MAHARSHI DAYANAND UNIVERSITY, ROHTAK

(Established under Haryana Act No. XXV of 1975)

'A+' Grade University accredited by NAAC

No. ACS-II/F-83/2020/ 5489-5519
Dated: 20-6-20

To

1. The Director UIET, M.D.University, Rohtak
2. All the Principals of Engineering Colleges, affiliated to M.D.University, Rohtak

Sub:- **Schemes of Examinations and Syllabus of B.Tech programs from the session 2020-21.**

Sir/Madam

I am directed to inform you that the Vice-Chancellor in anticipation approval of the Academic Council, has approved the recommendations of Faculty of Engineering & Technology made vide Reso. No. 1, 2 & 3 in its meeting held on 28.05.2020, regarding change in the Scheme of Examinations of B.Tech programs from the session 2020-21 as under:-

B.Tech 3rd year

1. B.Tech (Civil Engineering)
2. B.Tech (Mechanical Engineering)
3. B.Tech (Electronics and Communication Engineering)
4. B.Tech (Electronics & Tele Communication)
5. B.Tech (Computer Science & Engineering)
6. B.Tech (Information Technology)
7. B.Tech (Computer Science & Information Technology)
8. B.Tech (Electrical Engineering)
9. B.Tech (Bio Technology)
10. B.Tech (Fashion & apparel Engineering)
11. B.Tech (Electrical & Electronics Engineering)
12. B.Tech (Textile Technology)
13. B.Tech (Textile Chemistry)
14. B.Tech (Fire Technology and Safety)
15. B.Tech (Printing Technology)
16. B.Tech (Electronics & Computer Engineering)

B.Tech. 2nd year

17. B.Tech. (Mining Engg.)
18. B.Tech. (Computer Sci. & Technology)
19. Minor Change in SOE of B.Tech (Computer Science & Engg.) common with B.Tech. (IT), B.Tech. (CSIT)

The Schemes of Examinations and Syllabi of all above courses duly approved are available on the University Website which may be downloaded and instructions to the students may be imparted accordingly.

Yours faithfully,

Assistant Registrar (Academic)
For Registrar

Endst.No. ACS-II/F-/83/2020/ 5520-24

Dated: 20-6-2020

Copy of the above is forwarded to the following for information and further necessary action.

1. The Controller of Examination, M.D.University, Rohtak.
2. The Director (UCC) M.D.University, Rohtak with the request to upload the same on the University Website.
3. The Deputy Registrar (Secrecy, Conduct), M.D.University, Rohtak.
4. The Assistant Registrar(Result-IV/), M.D.University, Rohtak.

Assistant Registrar (Academic)

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Civil Engineering)

SEMESTER 5^{th} AND 6^{th}

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of $1/3^{rd}$ students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Civil Engineering) – 5th Semester
w.e.f. 2020-21

Sr. No.	Course Code	Course Title	Hours per Week	Contact Hours per Week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L-T-P			Internal Assessment	External Examination	Practical	Total	
1.	PCC-CE-301-G	Hydrology and Water Resource Engineering	2-1-0	3	3	25	75	-	100	3
2.	PCC-CE- 303-G	Highway Engineering-I	2-1-0	3	3	25	75	-	100	3
3.	PCC-CE-305-G	Soil Mechanics	3-1-0	4	4	25	75	-	100	3
4.	PCC-CE-307-G	Water Supply and Treatment	2-1-0	3	3	25	75	-	100	3
5.	PCC-CE-309-G	Design of Steel Structure	3-1-0	4	4	25	75	-	100	3
6.	PCC-CE-311-G	Engineering Geology	2-1-0	3	3	25	75	-	100	3
7.	LC-CE-313-G	Highway Engineering –I Lab	0-0-2	2	1	25	-	25	50	3
8.	LC -CE-315-G	Soil Mechanics Lab	0-0-2	2	1	25	-	25	50	3
9.	LC -CE-317-G	Design of Steel Structure Drawing Lab	0-0-2	2	1	25	-	25	50	3
10.	LC -CE-319-G	Engineering Geology Lab	0-0-2	2	1	25	-	25	50	3
11.	PT-CE-321-G	Survey camp	-	-	2	25	-	25	50	-
12.	PT-CE-323-G	Practical Training-I	-	-	-	-	-	-	* Refer note 1	
		TOTAL			**26**				**850**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.

   Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Scheme of Studies and Examination
B.TECH (Civil Engineering) – 6th Semester
w.e.f. 2020-21

Sr. No.	Course Code	Course Title	Hours per Week	Contact Hours per Week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L-T-P			Class work	Theory	Practical	Total	
1.	PCC-CE-302-G	Irrigation Engineering	3-1-0	4	4	25	75	-	100	3
2.	PCC-CE- 304-G	Foundation Engineering	3-1-0	4	4	25	75	-	100	3
3.	PCC-CE-306-G	Highway Engineering-II	3-1-0	4	4	25	75	-	100	3
4.	-	*Elective-I	2-1-0	3	3	25	75	-	100	3
5.	-	**Elective-II	3-1-0	4	4	25	75	-	100	3
6.	LC-CE-308-G	Environmental Engineering Lab.	0-0-2	2	1	25	-	25	50	3
7.	LC -CE-310-G	Foundation Engineering lab	0-0-2	2	1	25	-	25	50	3
8.	LC -CE-312-G	Highway Engineering-II Lab.	0-0-2	2	1	25	-	25	50	3
9.	LC-ESC-314-G	Computer aided Civil Engineering Design	1-0-2	3	2	25	-	25	50	3
		TOTAL			**24**			**700**		

	Course Code	Course Title
***Elective -I**	PEC-CEEL -302 G	1. Waste Water Treatment
	PEC-CEEL -304 G	2. Air & Noise Pollution Control
	PEC-CEEL -306 G	3. Environmental Impact Assessment
****Elective –II**	PEC-CEEL -308 G	1. Advanced Concrete Structure
	PEC-CEEL -310 G	2. Pre-Stressed Concrete
	PEC-CEEL -312 G	3. Repair & Rehabilitation Of Structure

Note:

1. Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

HYDROLOGY AND WATER RESOURCE ENGINEERING			
Course Code	**PCC-CE-301-G**	**External marks:**	**75**
Credits	**3**	**Internal marks:**	**25**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To provide knowledge in the hydrological cycle, precipitation, evapotranspiration, infiltration and its measurements.
- To understand the physics of translate of rainfall into runoff modelling of various runoff techniques.
- To estimate the floods.
- To develop ability to apply the analytical and numerical techniques to ground and surface water models.
- To understand hydrographs and its methods.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Hydrologic Cycle, Water-Budget Equation, History of Hydrology and its Application in Engineering, World Water Balance, Sources of Hydrological Data.

Module 2: Precipitation

Forms of Precipitation, Characteristics of Precipitation in India, Measurement of Precipitation, Rain Gauge Network, Mean Precipitation over an Area, Depth Area-Duration Relationships, Frequency of Point Rainfall, Intensity-Duration-Frequency Curves, Probable Maximum Precipitation (PMP), Rainfall Data in India.

Unit-II

Module 3: Hydrological Abstractions

Evaporation Process, Evaporimeters, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and Methods for its Reduction, Evapotranspiration and its Measurement, Evapotranspiration Equations, Potential Evapotranspiration over India, Actual Evapotranspiration, Interception, Depression Storage, Infiltration Process, Initial Loss, Infiltration Capacity, Factors Affecting Infiltration, Measurement of Infiltration, Infiltration Indices.

Module 4: **Runoff**

Types of Runoff, Runoff Characteristics of Streams, Runoff Volume , Factor Affecting Runoff, Rainfall-Run off Relationships, Estimation of Runoff, SCS-CN Method of Estimating Runoff Volume, Flow Duration Curve, Flow-Mass Curve, Measurement of Stage of Runoff by-Staff Gauge, Wire Gauge, Automatic Stage Recorder and Stage Hydrograph; Stream Flow Measurement by Direct and Indirect Methods.

Unit-III

Module 5: Hydrograph

Discharge Hydrograph, Components and Factors Affecting Shape of Hydrograph, Effective Rainfall, Base Flow Separation, Unit Hydrograph(UH)-Definition, Assumptions and its Derivation; Unit Hydrograph of Different Durations, Use and Limitations of UH, Snyder`S Synthetic UH

Module6: Floods and its Estimation

Introduction to Floods, Estimation of Floods by: Rational Methods, Empirical Formulae, Unit Hydrograph Technique, Flood Frequency Studies- Gumbel`s Method, Graphical Method.

Unit-IV

Module 7: Water Resource Planning-I

Role of Water in National Development, Water Resources and their Assessment , Planning Process, Environmental Consideration in Planning, System Analysis in Water Planning, Common Issues in Project Planning.

Module 8: Water Resource Planning-II

Functional Requirements in Multipurpose Projects, Multipurpose Planning, Basin Wise Planning, Long Term Planning, Reservoir Planning-Dependable Yield, Sedimentation in Reservoir, Reservoir Capacity, Empirical-Area Reduction Method.

Course outcomes

At the end of the course, the students will be able to:

- Demonstrate the concepts of hydrograph, unit hydrograph and flood estimation.
- Estimate the hydrological parameters.
- Carry out statistical and probability analysis of hydrological data.
- Demonstrate the concepts of hydrological systems.
- Gain the basic knowledge of water resource planning.

References:

- Engineering Hydrology by K.Subramanya.
- Hydrology by H.M.Raghunath.
- Water Resources Engineering by Linseley and Franzini
- Optimisation Theory and Applications by S.S.Roy
- Water Resources Systems Planning & Economics by R.S.Varshney.

HIGHWAY ENGINEERING-I			
Course Code	**PCC-CE-303-G**	**External marks:**	**75**
Credits	**3**	**Internal marks:**	**25**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To understand the importance of transportation and characteristics of road transport.
- To know about the history of highway development, surveys and classification of roads.
- To study the geometric design of highways.
- To study about traffic characteristics and design of intersections.
- To know about the pavement materials and design.
- To know about the different type of bituminous material and design.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Urban, Rural Roads and their Cross-Sections, Design of Cross Section Elements- Right of Way, Width Considerations, Roadway, Shoulders, Kerbs Traffic Barriers, Medians, Frontage Roads; Facilities for Pedestrians, Bicycles, Buses and Trucks, Traffic Separators and Road Margin, Design of Sight Distances, IRC Recommended Values.

Module 1: Introduction

Modes of Transportation, History of Road Development, Scope of Highway Engineering, Road Development Plans in India, PMGSY and other Highway Projects, Classification of Highways, Locations and Functions, Road Patterns.

Module 2: Highway Development and Planning

Necessity and Significance of Highway Planning, Highway Alignment and Surveys, Factors Influencing Highway Alignment, Engineering Surveys for Alignment, Conventional and Modern Methods of Highway Alignments.

Unit-II

Module 3: **Highway Geometric Design**

Urban, Rural Roads and their Cross-Sections, Design of Cross Section Elements- Right of Way and Width Considerations, Roadway, Shoulders, Kerbs Traffic Barriers, Medians, Frontage Roads; Facilities for Pedestrians, Bicycles, Buses and Trucks, Traffic Separators and Road Margin, Design of Sight Distances, IRC Recommended Values.

Module 4: Design of Horizontal and Vertical Alignment

Super-Elevation and its Design, Extra-Widening, Radius of Circular Curves, Length of Transition Curves, Gradient, Summit and Valley Curves, Introduction to Software like MXROAD.

Unit-III

Module 5: Highway Material: Soil and Aggregate

Subgrade Soil and its Characteristics, Compaction Methods, Evaluation of Soil Strength by Different Tests, Aggregates and their Characteristics, Various Tests on Aggregates, IRC/IS Specifications for Suitability of Aggregates.

Module 6: Highway Material: Bituminous Materials and Bituminous Mixes

Bitumen: Origin, Preparation, Properties and their Testing Methods, Bituminous Road Binders: Requirements Constitution, Selection Criterion for Different Binders, Bituminous Emulsions and Cutbacks: Preparation, Characteristics, uses and their Tests. Bituminous Mixes: Mechanical Properties and Characteristics, Bituminous Mix Design: Methods, Performance-Based Bitumen Specifications, Polymers and Rubber Modified Bitumen in Bituminous Mixes, Waste Plastic in Bituminous Mixes.

Unit-IV

Module 7: Traffic Engineering and Control

Traffic Characteristics, Traffic Studies and their Presentation, Traffic Capacity Studies, PCU and Axle Load Survey, Intersections Design, Design of Sign and Signals, Parking and Accident Studies, Highway Safety Measures.

Module 8: Intelligent Transportation Systems (ITS)

Objectives of Intelligent Transportation Systems, Historical Background, Benefits of ITS, Data Collection Techniques for ITS-Detectors, Automatic Vehicle Location, Automatic Vehicle Identification, Geographic Information Systems and Video Data Collection.

Course Outcomes

At the end of the course, the students will be able to:

- Carry out surveys involved in planning and highway alignment.
- Design cross-section elements, sight distance, horizontal and vertical alignment.
- Implement traffic studies, traffic regulations and control, and intersection design.
- Determine the characteristics of pavement materials.

References:

- Khanna, S.K. and Justo, C.E.G., Veeraragavan A., “Highway Engineering”, Nem Chand & Bros.
- Khanna, S.K. and Justo, C.E.G., “Highway Material Testing Manual”, Nem Chand & Bros.
- Kadiyali, L.R., “Traffic Engineering and Transportation Planning”, Khanna Publishers.
- G.V.Rao, Principles of Transportation and Highway Engg, Tata McGraw Hill Pub.

SOIL MECHANICS			
Course Code	**PCC-CE-305-G**	**External marks:**	**75**
Credits	**4**	**Internal marks:**	**25**
L-T-P	**3-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives:

- To provide Civil Engineering students with the basic knowledge regarding soil formation and composition.
- To explain the importance of three phase system of soil and how soil is properties estimated using three phase system.
- To impart knowledge on the various factors governing the Engineering behaviour of soils and carry out soil classification.
- To explain role of water in soil behaviour and how soil stresses, permeability and quantity of seepage are estimated.
- To determine shear parameters and stress changes in soil due to foundation loads.
- To estimate the magnitude and time-rate of settlement due to consolidation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Soil Formation and its Basic Soil Properties

Scope of Soil Mechanics, Types of Soil, Origin of Soil and its Formation, Inter-Particle Forces, Soil Structure and Fabric, Major Soil Deposits of India, Three Phase System, Weight-Volume Relationships, Index Properties, Particle Shape and Size, Grain Size Analysis: Sieve Analysis and Hydrometer Analysis; Grain Size Distribution Curves, Consistency of Soils: Sensitivity, Thixotropy, Activity; Consistency Limits and their Determination.

Module 2: Classification and Permeability of Soils

Necessity of Classification, Classification on the Basis of Grain Size and on the Basis of Plasticity, Plasticity Chart, Textural Classification, Unified Soil Classification, IS Classification System Soil. Permeability, Darcy`s Law and its Validity, Discharge Velocity and Seepage Velocity, One Dimensional Flow, Factors Affecting Permeability, Laboratory and Field Determination of Permeability, Indirect Methods, Permeability of Stratified Deposits.

Unit-II

Module 3: Effective Stress Concept

Principle of Effective Stress, Effective Stress under Hydrostatic Conditions and Under Hydro-Dynamic Conditions, Effective Stress in The Zone of Capillary Rise, Seepage Pressure, Quicksand Condition, Seepage Through Soil: Two Dimensional Flow, Flownets, Properties and Utilities of Flownet, Uplift Pressure, Piping, Protective Filter.

Module 4: Compressibility and Compaction

Definitions, Role of Moisture and Compactive Effort in Compaction, Moisture Density Relationship, Compaction in Laboratory and Field Conditions, Compactive Effect on Soil Properties, Compaction of Cohesionless Soils, Moderately Cohesive Soils and Clays, Field Control of Compaction.

Unit-III

Module 5: Vertical Stress below Applied Loads

Boussinesq`s Equation, Vertical Stress Distribution Diagrams, Pressure Bulb, Vertical Stress Beneath Loaded Areas, Newmark`s Influence Chart, Westergaard`s Analysis, Contact Pressure, Approximate Stress Distribution Methods for Loaded Areas.

Module 6: Consolidation

Consolidation Process and its Types, Components of Total Settlement, One-Dimensional Consolidation Test, Typical Void Ratio-Pressure Relationships for Sands and Clays, Consolidation Parameters, Normally Consolidated and Over Consolidated Clays, Casagrande`s Graphical Method of Estimating Pre-Consolidation Pressure, Terzaghi`s Theory of One- Dimensional Consolidation, Determination of Coefficients of Consolidation, Time Rate of Consolidation.

Unit-IV

Module 7: Shear Strength

Mohr Stress Circle, Mohr-Coulomb Failure-Criterion, Relationship Between Principal Stresses at Failure, Drainage Conditions, Shear Strength Parameters and their Determination, Advantages and Disadvantages of Different Shear Tests, Shear Strength Characteristics of Clay and Sand, Partially Saturated Soils.

Module 8: Earth Pressure

Types of Lateral Earth Pressure, Rankine`s Active, Passive States of Plastic Equilibrium and Rankine`s Theory, Coulomb's Wedge Theory, Coulomb`s Active and Passive Earth Pressure Theory, Culmann`s Graphical Construction.

Course Outcomes

At the end of the course, the students will be able to:

- Solve three phase system problems.
- Able to carry out soil classification.
- Solve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram.
- Estimate the stresses under any system of foundation loads.
- Solve practical problems related to consolidation settlement and time rate of settlement.

References:

- Soil Mechanics and Foundation Engineering by K. R. Arora, Standard Publishers Distributors, N. Delhi
- Soil Mechanics and Foundations by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain; Laxshmi Publications (P) Ltd, N. Delhi.
- Basic and Applied Soil Mechanics by Gopal Ranjan, ASR Rao, New Age International (P) Ltd., N. Delhi.

- Soil Engineering. in Theory and Practice, Vol .I, Fundamentals and General Principles by Alam Singh, CBS Publications, N.Delhi.
- Engineering Properties of Soils by S.K.Gulati, Tata-Mcgraw Hill,N.Delhi.
- Geotechnical Engineering. by P. Purshotam Raj, Tata Mcgraw Hill.
- Principles of Geotechnical Engineering by B.M. Das, PWS KENT, Boston.

WATER SUPPLY AND TREATMENT			
Course Code	**PCC-CE-307-G**	**External marks:**	**75**
Credits	**3**	**Internal marks:**	**25**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To quantify the water demands and its variations.
- To analyze the different characteristics of water.
- To study the different units of treatment.
- To deal with water supply and water distribution to consumers.
- To develop basic knowledge about the water pollution and its control.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Water Supply System – Planning, Objectives, Design Period, Population Forecasting, Water Demands and its Variations, Sources of Water and their Characteristics, Development and Selection of Source, Intakes and their Types.

Module 2: Water Characteristics

Sources of Impurities, Type of Impurities in Water and their Sanitary Significance, Physical, Chemical and Bacteriological Analysis of Water, Indian and Global Standards of Water Quality, Effluent Standards.

Unit-II

Module 3: Water Treatment

Necessity of Water Treatment , Flow Diagram of Different Treatment Units; Constructional Details, Working and Operation of Preliminary Units, Aeration Units, Sedimentation Units and their Types, Features and Design Aspects; Mixing Basins, Flocculation; Filtration – Mechanisms, Characteristics and Design of Slow and Rapid Sand Filtration Unit; Disinfection - Theory, Methods and Practices.

Module 4: Advanced Water Treatment

Water Softening, Desalination- R.O. Plant, Demineralization, Adsorption, Ion Exchange, Membrane Systems; Iron and Manganese Removal, Defluoridation, Dissolved Solids Removal.

Unit-III

Module 5: Water Conveyance System

Methods of Supply - Intermittent and Continuous, Pipes and Conduits for Water- Pipe Materials, Laying, Jointing and Testing of Pipes, Valves and Appurtenances

Module 6: Pumps and Pumping Stations

Need of Pumping, Terminology used, Classification of Pumps, Different Type of Pumps used in Water Supply, Power of Pumping, Total Lift of Pump, Location of Pumping Station, and Site Selection.

Unit-IV

Module 7: Water Distribution System

Requirements of Water Distribution, Type of Distribution System, Layout of Distribution System – Dead End System, Grid Iron System, Ring System, Radial System and their Merits and Demerits; Distribution Reservoir-Functions and Determination of Storage Capacity, Water Distribution Network- Layout, Capacity, Pressure Requirements, Analysis; Leak Detection and Maintenance of Water Distribution Network.

Module 8: Water Pollution and Control

Sources of Water Pollution, Types and their Effects, Preventive Measures and Control of Water Pollution, Description of Legislation Related to Water Pollution Control.

Course Outcomes

At the end of the course, the students will be able to

- Understand the sources of water and characterization of water including physical, chemical and biological water quality parameters.
- Develop basic knowledge about the transmission, storage and distribution of water.
- Knowledge of water pollution and its control.
- Recommend the degree of treatment required for the water.

References:

- Water Supply Engineering: S.R. Kshirsagar.
- Water Supply Engineering: S.K. Garg.
- Water Supply Engineering: B.C. Punmia.
- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie 8. Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi.

DESIGN OF STEEL STRUCTURE			
Course Code	**PCC-CE-309-G**	**External marks:**	**75**
Credits	**4**	**Internal marks:**	**25**
L-T-P	**3-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To learn IS 800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections.
- To study and design of various connections.
- To understand behaviour of flexural members and the design laterally restrained and unrestrained beams.
- To impart practical knowledge of steel structures and their application.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Stress Strain Curve for Steel, Composition and Properties of Structural Steel, Types of Steel Structures, Types of Sections, Stresses in Structural in Steel, Design Consideration, Codes and Specification, Introduction of Design Philosophies, Different Kind of Loads and their Combination.

Module 2: Connections

Terminology, Various Types of Connections and their Joints-Riveted, Bolted, Pin, Welded Connections; their Design for Different Loads, Modes of Failure

Unit-II

Module 3: Design of Tension Member

Types of Tension Members, Factors Affecting Strength of Tension Member, Design of Tension Members, Lug Angles, Splices, Gussets as per Indian Codal Provision.

Module 4: Design of Compression Members

Behaviour of Compression Members, Types of Compression Member, Effective Length, Slenderness Ratio, Sections Used for Compression Member, Flexural-Torsional Buckling, Prevention of Buckling Failure, Design of Compression Members, Design of Built Up Columns- laced and battened columns including the design of lacing and battens, Design of Compression Members Composed of Two Components Back-To-Back.

Unit-III

Module 5: Design of Beams

Different Types of Sections in Beams, Lateral Stability of Beam and Factors Affecting Lateral Stability, Design of Laterally Supported and Unsupported Beams, Web Buckling, Web Crippling, Diagonal Buckling, Torsional Buckling, Effect Of Holes In Beams.

Module 6: Design Column Bases and Footings

Types of Column, Bases-Slab Bases, Gusset Base, Design of Base plate and Gusseted Base, Design of Bases for Eccentrically Loaded Columns, Anchor Bolts and Shear Connectors, Grillage Foundation

Unit-IV

Module 7: Plastic Analysis and Design

Plastic Analysis- Scope, Theory and General Requirement, Ultimate Load-Carrying Capacity of Tension Members, Compression Members, Flexural Members, Shape Factor, Load Factor, Mechanisms, Plastic Collapse, Condition in Plastic Analysis, Method of Analysis, Plastic Analysis And Design of Steel Beams and Simple Portal Frames.

Module 8: Design of Gantry Girder

Loading Consideration, Selection Criteria of Gantry Girder, Specification, Design of Gantry girder

Course Outcomes

At the end of the course, the students will be able to:

- Apply the IS code of practice for the basic design of steel structural elements.
- Design compression and tension members using simple and built-up sections.
- Analyze the behaviour of bolted connections and design them.
- Design welded connections for both axial and eccentric forces
- Students will be able to understand the basic of steel structure with practical aaplication.

References:

- Design of steel structures, A.S.Arya&J.L.Ajmani, Nemchand& Bros., Roorkee.
- Design of steel structures (LSM), N,.Subramanian, Oxford Publication.
- Design of steel structures, M.Raghupati, TMH Pub., New Delhi.
- Design of steel structures, S.M.A.Kazmi&S.K.Jindal, Prentice Hall, New Delhi.
- Design of steel structures, S.K.Duggal, TMH Pub, New Delhi.

ENGINEERING GEOLOGY			
Course Code	**PCC-CE-311-G**	**External marks:**	**75**
Credits	**3**	**Internal marks:**	**25**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To make the students familiar interior of Earth.
- To aware about different geological maps, different organizations related with geological study.
- To provide knowledge about geological forces and formation of Superficial Deposits.
- To make students study various minerals
- To aware about the basics of various types of rocks and their formation
- To provide adequate knowledge about geological considerations in civil engineering projects

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Scope, Subdivision of Geology, Interior of Earth, Importance of Geological Studies in Various Civil Engineering Projects, Department Dealing with this Subject in India and their Scope of Work- GSI, Granite Dimension Stone Cell, NIRM; Use of Geological Maps and Interpretation of Data.

Module 2: Physical Geology

External and Internal Geological Forces Causing Changes; Weathering, Erosion and Denudation of the Surface of the Earth; Factors Affecting Weathering and Product of Weathering; Superficial Deposits and its Geotechnical Importance: Water Fall and Gorges, River Meandering, Alluvium, Glacial Deposits, Desert Landform, Loess, Mudflows, Coastal Deposits.

Unit-II

Module 3: Mineralogy

Origin and Composition of Minerals, Physical Properties of Minerals, Susceptibility of Minerals to Alteration, Rock Forming Minerals, Megascopic Identification of Common Primary and Secondary Minerals.

Module 4: Petrology

Rock Formation Processes, Ternary Diagram, Igneous Petrology- Volcanic Phenomenon, Types of Volcanic Eruption, Chemical and Mineralogical Composition, Texture and its Types, Sedimentary Petrology- Mode of Formation, Mineralogical Composition, Texture and its Types; Metamorphic Petrology- Agents and Types of Metamorphism, Metamorphic Grades, Mineralogical Composition, Structures and Textures.

Unit-III

Module 5: Structural Geology

Forms and Structures of Rocks, Stress and Strain in Rocks, Deformation and Tectonics, Dip and Strike, Bedding Planes and Outcrops; Fold- Types and Nomenclature, Criteria for Their Recognition in Field; Faults: Classification, Recognition in Field.
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Module 6: Properties of Rock Masses

Sub Surface Investigations of Rocks and Engineering Characteristics of Rocks Masses; Field and Laboratory Tests on Rocks, Stress Deformation and Bearing Capacity of Rocks, Important Variables Influencing Rock Properties and Behaviour, Measurement of Velocity of Sound in Rock.

Unit-IV

Module 7: Geology of Dam and Reservoir Site

Geological Consideration for Selecting Dam and Reservoir Site, Causes of Failure of Reservoir, Favourable and Unfavourable Conditions in Different Types of Rocks in Presence of Various Structural Features, Precautions to Counteract Unsuitable Conditions.

Module 8: Geological Hazards

Rock Instability and Slope Movement; Concept of Sliding, Consequences of Land Sliding, Prevention by Surface Drainage, Slope Reinforcement by Rock Bolting and Rock Anchoring; Earthquake: Magnitude and Intensity of Earthquake, Seismic Waves; Seismic Zones in India.

Course Outcomes

At the end of the course, the students will be able to:

- To identify different minerals, their physical properties and rock forming minerals.
- To understand the basics of various types of rocks and their formations, texture, composition.
- To determine different geological forces and formation of Superficial Deposits.
- Conduct geological survey by knowing the interior of Earth.
- To study different geological maps with geological symbols.
- To acquire the knowledge about geological considerations in civil engineering projects.

References:

- A textbook of Geology by P.K Mukherjee
- Physical and General Geology by SK Garg
- Engineering and General Geology by Prabin Singh.
- Introduction of physical Geology by A.holmes

HIGHWAY ENGINEERING-I LAB			
Course Code	**LC-CE-313-G**	**External marks:**	**25**
Credits	**1**	**Internal marks:**	**25**
L-T-P	**0-0-2**	**Total marks:**	**50**

Course Objectives

- To understand the characterization of highway materials as per IRC/IS codes.
- To learn the mix designs of granular, bituminous and CC mixes
- To learn the use of modern equipment for traffic studies and pavement evaluation

List of Experiments

1. To determine the flakiness index and elongation index of aggregates.
2. To determine the California Bearing Ratio (CBR) value of soil and aggregate.
3. To determine the impact value of aggregate and composite material.
4. To determine the crushing strength of aggregate and composite material.
5. To determine the abrasion and attrition value of aggregate by using:
   a) Deval abrasion test.
   b) Los Angeles abrasion test
   c) Dory abrasion test.
6. To determine the water absorption of aggregate.
7. To find out the durability of aggregate.
8. To determine the mechanical and wear properties of tiles/blocks:-a) Flexural strength b) Abrasion value of tiles/blocks.
9. Traffic volume and speed study using videography technique.(Demonstration only)

Course Outcomes

At the end of the course, the students will be able to:

- Gain Engineering knowledge of the subject and apply it for judging the suitability of highway materials.
- Make investigations, use modern test tools and develop solutions to use highway materials for sustainable development that preserves the environment.
- Understand the norms of engineering practice and the need for life-long learning as per their exposure to relevant IS/IRC specifications.

References:

- Khanna,S.K. and Justo, C.E.G.,Veeraragavan A.,“Highway Engineering”,Nem Chand &Bros.
- Khanna,S.K. and Justo,C.E.G.,“HighwayMaterialTestingManual”,NemChand& Bros.
- Kadiyali,L.R.,“TrafficEngineeringandTransportationPlanning”,Khanna Publishers.

SOIL MECHANICS LAB			
Course Code	**LC-CE-315-G**	**External marks:**	**25**
Credits	**1**	**Internal marks:**	**25**
L-T-P	**0-0-2**	**Total marks:**	**50**

Course Objectives

- To estimate index properties of soil.
- To estimate consistency limit of fine grained.
- To estimate shear strength of soils by direct shear test & unconfined compressive test.
- To estimate the engineering properties of the soils by density test, permeability test and consolidation test

List of Experiments

1. Visually classify the soil and to determine the moisture content (water content) of a given soil sample.

2. Determination of specific gravity of given soil sample.

3. To classify the coarse grained soil by sieve analysis using particle size distribution curve.

4. To determine liquid limit and plastic limit.

5. To determine field density of soil by
   a. Sand replacement method
   b. Core cutter method
6. To determine the optimum moisture content and maximum dry density of soil by Standard Proctor Test.

7. To determine the coefficient of permeability of soil sample at desired density by suitable method.

8. To determine the Unconfined compressive strength of cohesive soil sample.

9. To determine the shear strength parameters of the given granular soil sample at known density and moisture content by Direct shear test.

10. To determine the shear strength parameters of fine grained soil sample by unconsolidated undrained (UU) Triaxial test.

Course Outcomes

At the end of the course, the students will be able to:

- Determine index properties of soils.
- Students will learn and acquire knowledge to classify soils.
- To understand the techniques, skills and modern engineering tools necessary for engineering practice.
- Determine engineering properties of soils solutions.
- Classify soil by physical observation of the soils.
- Carry out interpolation among the estimated soil design parameters.

References:

- Soil Testing for Engineers by S.Prakash, PK Jain, Nem Chand & Bros.,Roorkee.
- Engineering Soil Testing by Lambi, Wiley Eastern.
- Engineering Properties of Soils and their Measurement by J.P.Bowles, McGraw Hill.
- Soil Engineering in Theory and Practice, Vol.II,
- Geotechnical Testing and Instrumentation by Alam Singh, CBS Pub.

DESIGN OF STEEL STRUCTURES DRAWINGS			
Course Code	**LC-CE-317-G**	**External marks:**	**25**
Credits	**1**	**Internal marks:**	**25**
L-T-P	**0-0-2**	**Total marks:**	**50**

Course Objectives

- To draw various steel connection.
- To draw various beam and column connections.
- Drawing of girders, different trusses and joints.
- To draw various steel members i.e. tension and compression members.

List of Experiments

1. To Prepare Detailed Drawing for various types of Bolted Connection.
2. To Prepare Detailed Drawing for various types of Welded Connection.
3. To Prepare Detailed Drawings for Laced And Battened Columns.
4. To Prepare Detailed Drawings of Built Up Beams.
5. To Prepare Detailed Drawing of Column Bases–Slab Bases–Gusset Base.
6. To Prepare Detailed Drawings of Grillage Foundations.
7. To Prepare Detailed Drawing of Beam to Column Connections.
8. To Prepare Detailed Drawings of Gantry Girder.
9. To Prepare Drawing of Plate Girder.
10. To Prepare Drawing of Circular and Rectangular Water Tank.
11. To Prepare Drawing of various types of Roof Trusses.

Course Outcomes

At the end of the course, the students will be able to:

- Understand the study of drawing for various components like connection, trusses, girders, joints etc.
- Implementation of design in drawing forms with by laws.
- Apply relevant Indian Standard provisions to ensure safety and serviceability of structural steel elements.

References:

- Structural design & Drawing, S. Krishnamurthy, Volume-3.
- Design & Drawing of steel Structure, Sajjan V. Wagh.
- Structural design & Drawing, reinforced concrete & Steel, N. Krishna Raju.
- Steel Structures (Design & Drawing), A.K. Upadhayay.

ENGINEERING GEOLOGY LAB			
Course Code	**LC-CE-319-G**	**External marks:**	**25**
Credits	**1**	**Internal marks:**	**25**
L-T-P	**0-0-2**	**Total marks:**	**50**

Course Objectives

- To study and identify different minerals with their physical properties.
- To aware about different types of rocks and rock forming minerals.
- To study the different geological formations.

List of Experiments

1. To Study physical properties of minerals.
2. To study and identify different minerals: Silica group, Feldspar group, Carbonate group and Pyroxene group.
3. To study and identify rocks forming silicate and ore minerals.
4. Identification of Igneous Petrology: Acidic Igneous rock: Granite and its varieties, Pumice, Scoria, Pegmatite and Volcanic Tuff.
5. Identification of Sedimentary Petrology: Sandstone and its varieties, Laterite, Limestone and its varieties, Shales and its varieties.
6. Identification of Metamorphic Petrology: Marble, Slate etc.
7. To determine Dip and strike of formations using
    a) Clinometer
    b) Brunton compass
8. Geological cross sections and Study of topographical features from Geological maps with identification of symbols.
9. Study of models of Geological structures and outcrops patterns of different types of rocks and landforms.

Course Outcomes

At the end of the course, students would be able to:

- To identify different materials and their physical properties.
- To identify different types of rocks on the basis of their formation.
- To identify geological symbols and make geological maps.
- To measure geological formations of different types.

References:

- A textbook of Geology by P.K Mukherjee
- Engineering and General Geology by Prabin Singh.

SURVEY CAMP			
Course Code	**PT-CE-321-G**	**External marks:**	**25**
Credits	**2**	**Internal marks:**	**25**
L-T-P	**0-0-0**	**Total marks:**	**50**

Course Objectives

- Survey camp emphasizes on field application of basic survey task such as triangulation, base line measurement, leveling, contouring and topographic surveying of land using plane table methods.
- It imparts knowledge of projection of land features on a plane sheet on a chosen scale.
- To make the student capable of drawing survey site plans and maps independently of a chunk of land of hilly area.

COURSE CONTENT

The survey camp is to be carried out by the students at suitable site. Different group of students will be asked to survey a particular area by using appropriate instruments issued to them. They will use different methods of surveying i.e. leveling, base line measurement, contouring, triangulation, plane table method to locate different control points. The students will plot important objects and features of the area under consideration on plane table sheet and prepare topographic map of the area.

Course Outcomes

At the end of the course, the students will be able to:

- Use instruments like Auto level, Total station, Tachometer and other important survey instrument.
- They will gain experience of preparing site maps of the objects in the area under consideration with contours.
- Make significant survey decisions on survey works whenever necessary especially when facing problems at sites.
- To carry out engineering survey work confidently.

Reference Books

- Punmia B.C., Surveying, Volume 1, Laxmi Publications.
- Punmia B.C. Surveying, Volume 2, Laxmi Publications.
- N N Basak, Surveying and Levelling TMH Private Ltd.

IRRIGATION ENGINEERING			
Course Code	**PCC-CE-302-G**	**External marks:**	**75**
Credits	**4**	**Internal marks:**	**25**
L-T-P	**3-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To make the students conversant with introduction to irrigation and national policies.
- To understand the basic methods of irrigation and soil water relation.
- To expose the students to water logging and land reclamation.
- To provide adequate knowledge regarding river training and canal outlet.
- To have adequate knowledge of drainage work.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Scope and Necessity of Irrigation, Different Water Resources, Development of Irrigation in India, Irrigation Systems and its various types, Benefits of Irrigation, National Water Policy, Impacts of Irrigation

Module 2: Water Requirement of Crops

Crops and Crop Seasons in India, Field Capacity, Wilting Point, Duty and Delta, Soil-Water Relationship- root zone soil water, infiltration, frequency of irrigation; Methods of Irrigation: Flooding Methods, Border Strip Method, Check Basin and Furrow Method, Sprinkler and Drip Irrigation Methods and their Design.

Unit-II

Module 3: Canal Regulation Works

Canal Fall- Necessity and Location, Types of fall, Cross Regulator and Distributory Head Regulators, Silt Control Devices, Canal Escapes and its Types.

Module 4: Cross Drainage Works

Classification, Site Selection Criteria, Factors Affecting the Selection of Cross Drainage Works, Hydraulic Design of- aqueducts, syphon aqueducts, super passage, canal syphon and level crossing

Unit-III

Module 5: Canal Outlets

Essential Requirements for an Outlet, Classification and Types of Outlets, Salient Features and Design: Pipe Outlet, APM Outlet and Open Flume Outlet; Flexibility Proportionality, Setting and Sensitivity of Outlet.

Module 6: Spillways and Energy Dissipations

Essential Requirements of Spillway and Spillway's Capacity, Types of Spillways and their Suitability, Ogee Spillways, Chute, Side Channel, Shaft and Syphon Spillways, Energy Dissipaters and its types ; Stilling Basins, USBR and IS Stilling Basins.

Unit-IV

Module 7: River Training

Objectives and Classification of River Training Works, Methods and Planning of River Training, Marginal Embankments, Guide Banks, Spurs, Cut Offs, Bank Protection and Launching Apron.

Module 8: Water Logging and Drainage

Water Logging- Effects, Causes & Preventive Measures, Land Reclamation: Process and Methods, Land Drainage, Benefits of Drainage, Essential Requirements of a Drain, Classification of Drains, its Operation and Maintenance.

Course Outcomes

At the end of the course, the students will be able to:

- Learn historical development of irrigation in India and the policies framed
- Learn about various methods of irrigation
- Understand water logging effects and methods of land reclamation
- Know about river training, classification and requirement of canal outlets and cross drainage works.

References:

- Garg, S. K., "Irrigation Water Power & Water Resources Engg." Standard Publishers & Distributors, Delhi, latest edition
- Modi, P.N. "Irrigation, Water Resources and Water Power Engg." Standard Book House, N. Delhi latest edition
- Arora, K R "Irrigation Water Power & Water Resources Engg." Standard Publishers & Distributors, Delhi, latest edition
- Sharma, S.K., Principles and Practice of Irrigation Engineering, S.Chand & Co., latest edition
- Punmia, B.C., "Irrigation and Water Power Engg." Standard Publishers, latest edition

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FOUNDATION ENGINEERING			
Course Code	**PCC-CE-304-G**	**External marks:**	**75**
Credits	**4**	**Internal marks:**	**25**
L-T-P	**3-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To emphasize the importance of soil investigations.
- To provide the knowledge for carrying out field investigations and to indentify soils in geotechnical engineering practice.
- To identify factors controlling soil behaviour and methods of dewatering.
- To understand different types of foundations and their importance in field.
- To identify different parameters for determining the bearing capacity of soil.
- To explain under which conditions deep foundation is needed and how to estimate pile and pile group capacity.
- To understand dynamic loading on soil foundation system and provide knowledge to lay out caissons and well foundation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Sub-Surface Exploration

Scope and Objectives, Stages in Soil Exploration, Depth and Lateral Extent of Exploration, Guidelines for Various Types of Structures, Ground Water Observations, Methods of Bore Holes, Soil Sampling and Disturbance, Major Types of Samplers, Sounding Methods-SPT, SCPT, DCPT and their Interpretation, Geophysical Methods, Pressure-Meter Test, Exploration Logs.

Module2: Drainage and Dewatering

Ditches and Sumps, Well Point Systems, Shallow Well System, Deep Well Drainage, Vacuum Method, Electro-Osmosis, Consolidation by Sand Piles.

Unit-II

Module 3: Shallow Foundations

Types of Foundations, Depth of Foundation, Types of Shallow Foundations and their Relative Merits, Design Criteria for Structural Safety of Foundation: i) Location of Footing, ii) Shear Failure Criterion, iii) Settlement Criterion. Modes of Shear Failure, Rankine's Analysis Tergazi's Theory, Skempton's Formula, Meyerhoff's Bearing Capacity Theory, Effect of G.W.T. , Effect of Eccentricity on Bearing Capacity, Inclined Load, IS Code Recommendations.

Module 4: Settlement of Foundations

Various Causes of Settlement of Foundation, Allowable Bearing Pressure Based on Settlement, Elastic and Consolidation Settlement, Allowable Settlement According to IS Code Method, Plate Load Test and its Interpretation, Conventional Procedure of Proportioning of Footings, Situation Suitable for the Shallow Foundations.

Unit-III

Module 5: Bearing Capacity of foundations

Design Bearing Capacity, Bearing Capacity from Penetration Tests, Factors Affecting Bearing Capacity, Methods of Improving Bearing Capacity, Raft Foundations, Bearing Capacity of Raft in Sands and Clays, Various Methods of Designing Rafts, Seismic Considerations, Floating Foundations.

Module 6: Pile Foundations

Necessity of Pile Foundations, Classification of Piles, Selection Criteria, Load Capacity, Static Analysis, Analysis of Pile Capacity in Sands and Clays, Dynamic Analysis, Pile Load Tests, Negative Skin Friction, Batter Piles, Lateral Load Capacity, Uplift Capacity of Single Pile, Under-Reamed Pile, Batter Pile. Group Action in Piles, Pile Spacing, Pile Group Capacity, Stress on Lower Strata, Settlement Analysis, and Design of Pile Caps.

Unit-IV

Module 7: Drilled Piers and Caisson Foundations

Drilled Piers- Types, Uses, Bearing Capacity, Settlement and Construction Procedure; Caissons-Types, Bearing Capacity, Settlement and Construction Procedure

Module 8: Well Foundations

Shapes, Depth of Well Foundations, Components, Factors Affecting Well Foundation Design Lateral Stability, Construction Procedure, Sinking of Wells, Rectification of Tilts and Shifts, Recommended Values of Tilts & Shifts as per IS: 3955

Course Outcomes

At the end of the course, the students will be able to:

- To understand the importance of soil investigation and carry out sub-surface explorations for any civil engineering construction.
- To evaluate Bearing capacity factors and estimate bearing capacity using suitable methods.
- To do proper foundation proportioning for any kind of shallow foundation system.
- To estimate pile and pile group capacity for any kind of soils including group efficiency.
- To determine safe bearing capacity for various foundation system by considering shear and settlement criterion.

References:

- Murthy, V.N.S, A text book of Soil Mechanics and Foundation Engineering, UBS Publishers & Distributors Pvt. Ltd., New Delhi, latest edition
- Punmia, B.C., Soil Mechanics and Foundation Engineering, Laxmi Publications Pvt. Ltd., New Delhi, latest edition
- Gopal Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age Intetrnational Ltd. Publishers- N.Delhi, latest edition
- Nainan P Kurian, Design of foundation Systems Principles and Practices, Narosa, latest edition
- Braja M. Das, Principles of Foundation Engineering, Thomson Asia Pvt. Ltd., Singapore, latest edition
- Donald P. Coduto, Man-Chu Ronald Yeung and William A. Kitch, Geotechnical Engineering, Principles and Practices, PHI Learning Private limited, latest edition
- P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, latest edition

HIGHWAY ENGINEERING-II			
Course Code	**PCC-CE-306-G**	**External marks:**	**75**
Credits	**4**	**Internal marks:**	**25**
L-T-P	**3-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To understand the design of flexible and rigid pavements.
- To know the construction techniques of highways pavements.
- To understand the pavement failures and maintenance of pavements including strengthening.
- To learn economic evaluation of highway projects and sources of financing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module1: Design of Flexible Pavements

Types of Pavement, Components of a Pavement and their Functions, Factors Effecting Design of Pavements, Review of Design by Old Methods, Design of a Flexible Pavement by CBR Method (as per Latest IRC Guidelines).Pavement Performance and its Methods- AASHTO and Asphalt Institute.

Module 2: Design of Rigid Pavements

Westergaard's Theory and Assumption, Critical Locations of Loading, Load and Temperature Stresses, Critical Combination of Stresses, Joints: Types, Requirements and Patterns, Spacing of Expansion and Contraction Joints; Design and Functions of Dowel and Tie Bars, IRC and AASHTO Methods of Rigid Pavement Design.

Unit-II

Module 3: Construction of Bituminous Pavements

Various Types of Bituminous Constructions, Prime Coat, Tack Coat, Seal Coat and Surface Dressing; Construction of BUSG, Premix Carpet, BM, DBM and BC, Mastic Asphalt, Functions of Rollers, Paver and Hot Mix Plants, Introduction to Various IRC and MoRTH Specifications

Module 4: Highway Construction: Non-Bituminous Pavements

Subgrade and Embankment construction, Construction of GSB, WBM, WMM; Construction of DLC and PQC, Fixed Form and Slip-Form Paving Techniques

Unit-III

Module 5: Pavement Failure and Remedies

Classification of Distresses in Pavements (Functional and Structural); Different Types of Distresses in Flexible and Rigid Pavements along with the Causes and Remedial Measures; Various Types of Maintenance of Pavements; Evaluation of Pavements: Functional and Non- Destructive Evaluation

Module 6: Strengthening of Existing Pavement

Objective of Strengthening, Different Types of Overlay, Design of Flexible Overlays on Flexible Pavement using Effective Thickness Approach and Deflection Approach, Benkelman Beam Method, Design of Other Types of Overlays.

Unit-IV

Module 7: Highway Drainage and Hill Roads

Necessity and Significance of Drainage, Mode of Ingress of Water in Highway Structure, Surface Drainage: -Types and Brief Design, Types of Sub-Surface Drainage, Drainage Inkling for the Roads in Hilly Areas, Special Characteristics of Hill Roads: Geometrics and Hair Pin Bends.

Module 8: Highway Economics and Finance

Need of Economic Evaluation, Highway User Benefits and Costs, Methods of Economic Evaluation, Highway Finance, PPP Projects, Rate Analysis of MoRTH-Standard Data Book and Cost Estimation

Course Outcomes

At the end of the course, the students will be able to:

- Gain Engineering knowledge of the subject and apply it for the solution of problems related to pavement engineering.
- Design flexible and rigid pavements, make investigations, use modern tools and develop solutions to problems related to highway pavements.
- Understand the engineering solutions in societal context for sustainable development that preserve the environment and economical use of resources.
- Understand the norms of engineering practice and the need for life-long learning as per their exposure to relevant latest IS/IRC/MoRTH specifications.

Reference:

- Highway Engg by S.K.Khanna& C.E.G. Justo, Veeraragavan A., Nem Chand Bros., Roorkee, latest edition
- Principles and Practice of Highway Engg. By L.R.Kadiyali, N.B. Lal,Khanna Publishers, Delhi, latest edition
- Principles of Pavement Design by Yoder,E.J&Witczak,M.W., John Wiley and Sons, USA.
- Tunnel Engineering by S.C.Saxena, Dhanpat Rai Publications,N.Delhi.
- A text book of Tunnel, Bridges and Railway Engg. By S.P.Bindr,Dhanpat Rai Delhi

ENVIRONMENTAL ENGINEERING LAB			
Course Code	**LC-CE-308-G**	**External marks:**	**25**
Credits	**1**	**Internal marks:**	**25**
L-T-P	**0-0-2**	**Total marks:**	**50**

Course Objectives

- To quantify the water and wastewater pollutant.
- To analyze the physical characteristics of water and wastewater.
- To analyze the chemical characteristics of water and wastewater

List of Experiments

1. Determination of Turbidity of water by using suitable method
2. Determination of pH of given water sample.
3. Determination of Hardness of given water sample.
4. Determination of Residual Chlorine in given sample of water
5. Determination of Total Suspended and Dissolved Solids in given water sample.
6. Determination of Bio –chemical oxygen demand of waste water sample.
7. Determination of chemical oxygen demand of waste water sample.
8. Determination of Conductivity of given water sample.
9. Determination of Chlorides of given water sample
10. Determination of Alkalinity and Acidity of a given water sample.
11. Determination of Dissolved Oxygen of given waste water sample.

Course Outcomes

At the end of the course, the students will be able to:

- Quantify the water and wastewater pollutant.
- Estimate the physical characteristics of water and wastewater.
- Analyze the chemical characteristics of water and wastewater

References:

- Lab Manual, ISO 14001 Environmental Management, Regulatory Standards for Drinking Water and Sewage disposal.
- Clair Sawyer and Perry McCarty and Gene Parkin, “Chemistry for Environmental Engineering and Science”, McGraw-Hill Series in Civil and Environmental Engineering.
- Guide manual: Water & wastewater analysis, Central Pollution Control Board, Govt. of India.
- APHA standard methods for the examination of water and wastewater
- Water supply engineering, S.K. Garg

FOUNDATION ENGINEERING LAB			
Course Code	**LC-CE-310-G**	**External marks:**	**25**
Credits	**1**	**Internal marks:**	**25**
L-T-P	**0-0-2**	**Total marks:**	**50**

Course Objectives

- To aware the students about hydrometer method.
- To estimate the relative density and maximum dry density of soils.
- To aware the importance of SPT, consolidometer and Triaxial test for selection of foundation.
- To estimate shear strength parameters of soil by Triaxial shear test.
- To estimate consolidation parameters of clayey soil.
- To aware about the importance of sampling and aware about the significance of plate load test.

List of Experiments

1. To determine grain size analysis using Hydrometer method.
2. To determine relative density of granular Soils.
3. To determine shrinkage limit of fine grained soil
4. To determine shear strength properties for consolidated drained conditions using Triaxial test.
5. To determine shear strength properties for consolidated undrained condition using Triaxial test.
6. To determine consolidation parameters using consolidometer.
7. To determine bearing capacity parameters using Standard Penetration Test.
8. Demonstration of Undisturbed Sampling.
9. Demonstration of cone penetration test.
10. To study of Model Plate Load Test.

Course outcomes

At the end of the course, the students will be able to:

- Classify soil using hydrometer method and estimate relative density of soils.
- To perform Triaxial test under different conditions.
- To understand the procedure and calculations of SPT and prepare soil investigation report.
- Carry out interpolation tests to determine consolidation and estimate shear strength parameters.
- To obtain soil sampling by suitable method.
- Determine essential parameters of plate load test.

References:

- Gopal Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age International (P) Ltd. Publishers- N.Delhi, latest edition
- P. Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, latest edition

HIGHWAY ENGINEERING-II LAB			
Course Code	**LC-CE-312-G**	**External marks:**	**25**
Credits	**1**	**Internal marks:**	**25**
L-T-P	**0-0-2**	**Total marks:**	**50**

Course Objectives

- To understand the characterization of highway materials.
- To learn the mix designs of granular, bituminous, CC mixes and composite materials.
- To learn the use of modern equipment for traffic studies & pavement evaluation.
- To know the standard specifications of IS/IRC/MoRTH for judging suitability of these materials

List of Experiments

1. To determine the flash and fire point of bituminous material.
2. To determine the softening point of paving bitumen.
3. To determine the specific gravity of bituminous material.
4. To determine ductility of bitumen.
5. To determine the hardness of bitumen.
6. To determine the grade of a given binder.
7. To determine the viscosity of bituminous material.
8. To determine the granular mix design.
9. To determine the bituminous mix design by Marshall's method.
10. To determine the cement concrete mix design for pavements.
11. Demonstration of BBD & Bump Integrator.

Course Outcomes

At the end of the course, the students will be able to:

- Gain engineering knowledge of the subject and apply it for judging the suitability of highway materials.
- Make investigations, use modern test tools and develop solutions to use highway materials for sustainable development that preserves the environment.
- Understand the norms of engineering practice and the need for life-long learning as per their exposure to relevant IS/IRC specifications.

References:

- Highway Engg by S.K.Khanna & C.E.G. Justo, Veeraragavan A., Nem Chand Bros., Roorkee, latest edition
- Principles and Practice of Highway Engg. By L.R.Kadiyali, N.B. Lal,Khanna Publishers, Delhi, latest edition

COMPUTER-AIDED CIVIL ENGINEERING DESIGN			
Course Code	**LC-ESC-314-G**	**External marks:**	**25**
Credits	**2**	**Internal marks:**	**25**
L-T-P	**1-0-2**	**Total marks:**	**50**

Course Objectives

- To develop, analyze and design the various structural members in the fields of Civil Engineering using AutoCAD, STAAD Pro.
- To understand the design of structures using IS codes
- To provide the knowledge about methods of analysis and design of RCC and steel frames.

List of Experiments

1. To study the commands used in plans of buildings using AutoCAD.
2. To prepare 2 D architectural drawing
3. To prepare 3 D architectural drawing
4. To prepare the drawing of grillage foundation using Auto cad.
5. To study the commands used in modelling and design of structure using STAAD-Pro.
6. Analysis of 2D Frames.
7. Analysis of 3D Frames.
8. Design of 2D RCC frames and 2D Steel frames according to IS codes.
9. Design of 3D RCC frames and 3D Steel Frames according to IS codes.
10. Design of beams.
11. Analysis of truss frames.

Course Outcomes

At the end of the course, the students will be able to:

- To understand and learn the various codal provisions.
- Ability to prepare 2D and 3 D plans of buildings.
- To efficiently analyze and design of beams, truss frames and staircase.
- To perform various methods of analysis of 2D, 3D frames.

References:

- STAAD Pro Manual.
- IS 456, IS 1893, IS 800, IS 875.

WASTE WATER TREATMENT			
Course Code	**PEC-CEEL-302-G**	**External marks:**	**75**
Credits	**3**	**Internal marks:**	**25**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To learn basics of sewage collection and design of sewers
- To learn the basics of sewage composition and its characteristics
- To have adequate knowledge about various sewage treatment processes and its design
- To provide adequate information on various disposal standards for treated effluents

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Importance and Necessity of Sanitation, Terms used in sanitation- Sullage, Sewage, Sewer and Sewerage, Sewerage Systems and their Suitability, Dry Weather Flow, Factors Affecting Dry Weather Flow, Flow Variations and their Effects on Design of Sewerage System.

Module 2: Design of Sewers

Types of Sewers and their Hydraulic Design, Material used for Sewer Construction, Joints and Sewer Appurtenances, Layout, Construction and Testing of Sewer Lines, Velocity in Sewers, Storm Water Sewers

Unit-II

Module 3: House Drainage

Principles of House Drainage, Types of Pipes used for Drainage , Classification and Functions of Traps, Sanitary Fitting, System of Plumbing, House Drainage Plan and Ventilation of House Drainage.

Module 4: Wastewater Characteristics

Quality Parameters- Physical, Chemical and Biological Characteristics, Oxygen Demand, Indian Standards for Disposal of Effluents into Inland Surface Sources and on Land, Guidelines for Reuse of Treated Wastewater

Unit-III

Module 5: Primary Sewage Treatment

Objectives, Flow chart of Conventional Treatment Units and their Efficiencies, Preliminary Treatment, Screening and Grit Removal Units, Principle, Types and Design of Primary Sedimentation Tank, Coagulation Aided Sedimentation Tank, Flocculation,

Module 6: Secondary Sewage Treatment

Concept of Organic Matter Removal, Aerobic and Anaerobic Treatment Processes, Activated Sludge Process, Conventional and Extended Aeration Systems, Trickling Filters, Aerated Lagoons, septic tank, Waste Stabilization Ponds, Oxidation Ditches, Up-Flow Anaerobic Sludge Blanket Process.

Unit-IV

Module 7: Sludge Treatment

Objectives, Sludge Digestion, Digestion and Disposal of Primary and Secondary Sludge, Factors Affecting Sludge Digestion, Thickening of Sludge, Anaerobic Digestion of Sludge, Sludge Digestion Tank, Sludge Conditioning and Dewatering, Sludge Drying Bed

Module 8: Sludge Disposal

Standards of Wastewater Disposal, Modes of Disposal of Treated Sludge, Self-Purification of Streams, Oxygen Sag Curve, Sewage Farming, Sodium Hazards, Soil Dispersion System

Course Outcomes

At the end of the course, the students will be able to:

- Estimate quantity of sewage and design sewerage system
- Determine the various characteristics of sewage
- Design various sewage treatment units
- Plan reuse of treated effluent and select appropriate disposal option

References:

- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Wastewater Engineering, Collection, Treatment and Disposal: Metcalf and Eddy
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie
- Sewage and Sewage Treatment: S.K. Garg.
- Sewage and Sewage Treatment: S.R. Krishansagar.
- Waste Water Engineering: B.C. Punmia.
- Manual on Sewerage and Sewage Treatment: Ministry of Urban Dev., New Delhi.

AIR AND NOISE POLLUTION CONTROL			
Course Code	**PEC-CEEL-304-G**	**External marks:**	**75**
Credits	**3**	**Internal marks:**	**25**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- Understanding of basic concepts of air pollution.
- To understand the basic characteristics of air pollutants.
- To provide adequate knowledge about the noise pollution.
- To have adequate knowledge on various type of sounds.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Air Pollution

Composition and Structure of Atmosphere, Air Pollution and Global Climate, Air Quality Criteria, Emission Standards, National Ambient Air Quality Standards, Air Quality Management in India

Module 2: Sources, Classification and Effects

Sources and Classification of Air Pollutants, Type of Air Pollutants, Pollution due to Automobiles, Analysis of Air Pollutants – Chemical, Instrumental and Biological Methods; Air Pollution and its Effects on Human health, plants, animals and microbes, archaeological monuments and aesthetics,

Unit-II

Module 3: Pollutant Dispersion

Concept of Atmospheric Stability, Adiabatic and Environmental Lapse Rate, Plume Behaviour, Terrain and Structure on Pollutant Dispersion, factors affecting Pollutant Dispersion, Concept of Maximum Mixing Depth and Ventilation Coefficient, Plume Rise and Effective Stack Height.

Module 4: Air Quality

Objectives, Time and Space Variability in Air Quality; Air Sampling Design, Analysis and Interpretation of Air Pollution Data, Introduction to Air Quality Index and Comprehensive Environmental Pollution Index and its Application, Sampling and Measurement of Air Pollutants Guidelines of Network Design in Urban and Rural areas, Stack Monitoring.

Unit-III

Module 5: Dispersion Modelling and Impacts of Air Pollution

Dispersion modelling, it's Applications and Limitations, Gaussian Plume Model and GLC Determination, Global Environmental Issues: Acid Rain, Global Warming, Smog, Ozone layer depletion, Combustion of Fuel, Indoor Air Pollution, Various Treaties and Protocols: Kyoto Protocol and Montreal Protocol.

Module 6: Air Pollution Control

Introduction to Control Methods and Equipment for Particulate Matter and Gases, Design and Working of Scrubbers, Electrostatic Precipitator, Gravity Settlers, Cyclone Separator, Filter Bags , Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their Control

Unit-IV

Module 7: Noise Pollution

Sound and Noise, Sources of Noise Pollution – Environmental and Industrial, Characteristics of Sound and its Measurement, Levels of Noise, Noise Rating Systems, Noise Level Standards, Outdoor and Indoor Noise Propagation; Psychoacoustics and Noise Criteria Curves

Module 8: Effects of Noise and Control Methods

Effects on Human and Environment, Infra-Sound, Ultrasound, Impulsive Sound and Sonic Boom; Noise Standards and Permissible Values; Instrumentation and Monitoring Procedure, Noise Indices and Control Methods

Course Outcomes

At the end of the course, the students will be able to

- To understand various air pollutants
- Analyze various types of noises.
- To understand various methods of control of air pollution.
- To understand various methods of control of noise pollution.

References:

- Air and Noise Pollution Control : Lawrence K. Wang
- Advanced Air and Noise Pollution Control: Volume 2 : Lawrence K. Wang
- Environmental Pollution and Health : V. K Ahluwalia
- Atmospheric pollution: Mark Z. Jacobson

ENVIRONMENTAL IMPACT ASSESSMENT			
Course Code	**PEC-CEEL-306-G**	**External marks:**	**75**
Credits	**3**	**Internal marks:**	**25**
L-T-P	**2-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To know the various types of environmental pollution.
- To understand various EIA techniques.
- To provide adequate knowledge about the noise pollution.
- To have adequate knowledge on various type of sounds.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Introduction Environment: Definition, Scope, Components, Structure and Composition. Environmental Quality, Monitoring and Base Line Data.

Module 2: Sustainable Development

Present and Future Development Needs; Exploitation of Natural Resources, Environmental Harmony, Economic Efficiency and Social Justice, Symbiotic Relationship, Concept of Carrying Capacity

Unit-II

Module 3: Environmental pollution

Environmental pollution due to increasing growth rate, population and human interaction; Air Pollution: Sources, Effects and its Control Measures; Water Pollution: Point and Non-point Source of Pollution, Major Pollutants of Water, Impact of pollutants and its Control Measures; Noise Pollution: Sources, Effects and its Control Measures

Module 4: Evolution of EIA

Scope, Preliminary Screening Requiring EIA of projects, Impact identification, Assessment of Impact; Impact Evaluation, Types of EIA, rapid and comprehensive, Plan for mitigation of adverse impact on environment – Options for mitigation of impact on water, air and land, energy, flora and fauna; addressing the issues related to the project affected people

Unit-III

Module 5: EIA Methodology

Impact Analysis: identification, predication, evaluation; Impact Identification Methods: overlays method, ad-hoc method, Checklist method, Matrices method, Fault Tree Analysis, Event Tree Analysis, Role of an Environmental Engineer,

Module 6: Environmental Audit

Cost Benefit Analysis; Life Cycle Assessment; Resource Balance, Energy Balance, management Review of Environmental Audit; Operational Control;

Unit-IV

Module 7: Case Studies of EIA

Standards for Water, Air and Noise Quality and their indices - Environmental Management Plan, EIA case studies for new and expansion projects: township projects, river valley projects, thermal power plants and industrial plants.

Module 8: Environmental Management

Preventive Policy of Environment, Waste Minimisation, Conservation of Water and Energy, Use of Renewable Sources, Pollution Control Strategy, Disposal of Treated Effluents, Solid Waste Disposal, Concept of Green Cities, Green Belt Development – Case History, Environment Management Plan – ISO 14000

Course Outcomes

At the end of the course, the students will be able to

- Analyze various EIA techniques
- Analyze various types of pollutions.

References:

- Environmental Impact Assessment: Cutting Edge for the 21st Century : Alan Gilpin
- Environmental Impact Assessment : Larry W Canter
- Environmental Impact Assessment: A Methodological Approach : Richard K. Morgan

ADVANCED CONCRETE STRUCTURE			
Course Code	**PEC-CEEL -308-G**	**External marks:**	**75**
Credits	**4**	**Internal marks:**	**25**
L-T-P	**3-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

At the end of this course, the student should be able to impart understanding of designing specialized RCC structures. To prepare the detailed structural drawings for execution purpose

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module1: Continuous Beams

Basic Assumptions, Moment of inertia, Settlements, Modification of Moments, Maximum Moments and Shear, Design Examples.

Module2: Curved Beams

Analysis for Torsion, Redistribution of Moments for Single and Multi-Span Beams, Design of Circular Beams Supported on Symmetrically Placed Columns, Semi-Circular Beams Supported on Equally Spaced Column , Design examples.

Unit-II

Module 3: Flat Slab

Advantages of Flat Slab, General Design Considerations, Indian Code Recommendations, Approximate Direct Design Method, Equivalent Frame method, Design of Flat Slabs, Openings in Flat Slab

Module 4: Yield Line Theory

Basic Assumptions, Yield Line Patterns and Failure Mechanisms, Ultimate Load on Slab, Design Example.

Unit-III

Module 5: Liquid Retaining Structure

Design Concepts of Liquid Retaining Structures, Design of Tanks Resting on Ground, Underground Tanks and Overhead Service Reservoirs, Staging and Foundation Design.

Module 6: Stair Case

Various Types of Staircases, General Notes on Design of Stair, Design Examples.

Unit-IV

Module 7: Design of Joints

Types of Joints, Joints in Multi-Storied Buildings, Forces Acting on Joints, Design of Joints for Strength, Anchorage Requirement in Joints, Detailing of Reinforcement in Joints.

Module 8: Building Frames

Introduction, Members Stiffness, Torsion in Buildings, Design Loads on Building Frames Including Wind and Earthquake Loads, Earthquake Resistant Design using Software, Introduction to IS: 13920 and Concepts of Ductile Detailing in Building Frames, Design and Detailing for Ductility, Design Examples.

Course Outcomes

At the end of the course, the students will be able to:

- Design advanced RCC structures.
- Prepare detailed structural drawings for the designed RCC structures using software.

References:

- “Advanced Reinforced Concrete Design”, P.C. Varghese, Prentice Hall of India Pvt. Ltd.
- “Plain & Reinforced Concrete,”Jain& Jai Krishan (Vol. I & Vol-II), Nem Chand and Bros.
- “Reinforced Concrete Structures”, Syal and Goel, S. Chand & Company Pvt. Ltd.
- “Reinforced Concrete Design”, S.U. Pillai&Devdas Menon, Tata McGraw Hill.
- "Reinforced Concrete Limit State Design"' A.K. Jain, Nem Chand and Bros.

PRE-STRESSED CONCRETE			
Course Code	**PEC-CEEL-310-G**	**External marks:**	**75**
Credits	**4**	**Internal marks:**	**25**
L-T-P	**3-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives

- To introduce the need for prestressing as well as the methods, types and advantages of prestressing to the students.
- Students will be introduced to the design of pre-stressed concrete structures subjected to flexure and shear.
- To make them familiar with design of typical pre-stressed concrete structural elements and to have a knowledge of the codal provisions.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Material Properties and Prestressing Systems

Introduction of Prestressing system- history, types, source, advantages and its limitations, Prestressing Systems and Devices
Materials properties- Constituents of Concrete and their Properties, Stress-Strain Curves for Concrete, Constituents of Prestressing Steel and their Properties, Types of Prestressing Steel, Stress-Strain Curves for Prestressing Steel, Relaxation of Steel, Fatigue, Codal Provisions.

Module 2: Losses in Prestress

Elastic Shortening, Pre-Tensioned & Post-Tensioned - Axial & Bending Members, Losses in Prestress - Friction, Anchorage Slip, Creep of Concrete, Shrinkage of Concrete, Relaxation of Steel, Total Time-Dependent Loss, Force Variation Diagram.

Unit-II

Module 3: Analysis and Design for Shear and Torsion

Analysis for Shear- Introduction, Types of Cracks, Components of Shear Resistance, Modes of Failure, Effect of Prestressing Force, Stress in an Uncracked Beam, Design and Detailing Requirement for Shear, Design of Transverse Reinforcement.
Analysis for Torsion-Introduction, Crack Pattern Under Pure Torsion, Components of Resistance for Pure Torsion, Modes of Failure, Effect of Prestressing Force for Torsion, Stresses in an Uncracked Beam, Design and Detailing Requirement for Torsion, Design of Longitudinal Reinforcement and Transverse Reinforcement.

Module 4: Calculations of Deflection and Crack Width

Factors Influencing Deflections, Short Term Deflections of Uncracked Members, Prediction of Long Term Deflections due to Creep and Shrinkage, Check for Serviceability Limit State of Deflection. Deflection due to Gravity Loads and Prestressing Force, Total Deflection, Determination of Moment of Inertia, Calculation of Crack Width, Method of Calculation, Limits of Crack Width.

Unit-III

Module 5: Analysis of Members

Analysis of Members under Axial and Flexural Load- Based on Stress, Force and Load Balancing Concept. Cracking Moment, Kern Point, Pressure Line, Analysis for Ultimate Strength, Variation of Stress in Steel Condition at Ultimate Limit State, Analysis of Rectangular Sections, Flanged Sections, Partially Pre-Stressed Sections, Un-Bonded Post-Tensioned Beams.

Module 6: Design of Members

Design of Members for Axial Tension, Flexure Type I and Type II, Choice of Sections, Determination of Limiting Zone, Post-Tensioning in Stages, Magnel's Graphical Method, Guyon's Method

Unit-IV

Module 7: Composite and Continuous Beams

Analysis and Design of Composite Beams – Methods of Achieving Continuity in Continuous Beams, Analysis for Secondary Moments, Concordant Cable and Linear Transformation, Calculation of Stresses, Principles of Design.

Module 8: Miscellaneous Structures

Design of Tension and Compression Members, Tanks, Pipes and Poles, Partial prestressing – definition, methods of achieving partial prestressing, merits and demerits of partial prestressing.

Course Outcomes

At the end of the course, the students will be able to:

- Analyse prestressed concrete members
- Design prestressed concrete members using codal provisions
- Design for shear and torsion of prestressed concrete members
- Design end blocks and provide detailing of reinforcements
- Design composite members and other applications
- Design continuous members

References:

- Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, latest edition
- Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, latest edition
- Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, latest edition
- IS1343:1980, Code of Practice for Prestressed Concrete, Bureau of Indian Standards,

REPAIR & REHABILITATION OF STRUCTURE			
Course Code	**PEC-CEEL-312 G**	**External marks:**	**75**
Credits	**4**	**Internal marks:**	**25**
L-T-P	**3-1-0**	**Total marks:**	**100**
		Duration of Examination:	**3 hrs**

Course Objectives:

This course has been designed with an aim to give the students an insight into the subject of concrete repair, its protection and strengthening

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE CONTENT

Unit-I

Module 1: Introduction

Overview of Distress, Deterioration in Concrete Structures, Global Scenario of Distressed Structures, Need for Repairs and Upgrading of Structures, Process for Durable Concrete Repair

Module 2: Deterioration of concrete structures

Types of Deterioration - causes & symptoms, mechanism & micro-structure of concrete, Physical and Chemical Deterioration and its factors, Deterioration due to Water Leakage, Fire – detection & mitigation, Deterioration due to Ageing and Inadequate Maintenance, Design & Construction Deficiencies like Overloading.

Unit-II

Module 3: Visual deterioration of structures

Types of Cracks, Causes & Characteristic of Cracking in Various Structural Components, Measurement of Cracks and Interpretation of the Cracking Phenomena

Module 4: Conditional/damage assessment & Evaluation of structures

Structural Assessment- importance, objective, various stages, conditional evaluation of the structure, Damage Assessment Procedure, Preliminary & Detailed Investigation – scope, objectives, methodology & rapid visual inspection of structures , Damage Assessment Allied Tests (Destructive, Semi-Destructive and Non-Destructive), Field & Laboratory Testing Procedures- strength, corrosion activity, performance & Integrity, Durability.

Unit-III

Module 5: Repairs of concrete structures

Repairing Materials- criteria, selection of repair materials, methodology, performance requirements, preparatory stage of repairs, different types of repair materials & their application and repair techniques

Module 6: Retrofitting/Strengthening

Need for Retrofitting, Design Philosophy of Strengthening Structures, Conventional and Advanced Techniques Available for Strengthening, Seismic Retrofit of Concrete Structures- deficiencies in structure requiring seismic retrofit and its design philosophy, Latest Techniques to Enhance the Seismic Resistance of Structures.

Unit-IV

Module 7: Protection & maintenance of structures

Importance of Protection & Maintenance, Categories of Maintenance, Building Maintenance, Corrosion Mitigation Techniques

Module 8: Structural health monitoring (SHM)

Definition and Motivation for SHM, Basic Components of SHM and its Working Mechanism, SHM as a Tool for Proactive Maintenance of Structures

Course Outcomes

At the end of the course, the students will be able to:

- Identify and define all the terms and concepts associated with deterioration of concrete structures.
- Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration.
- Develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques.
- Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.

References:

- Concrete microstructure, Properties and materials – P Kumar Mehta and Paulo J.M.Monterio.
- Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India.
- Concrete Technology by M.L.Gambhir, Tata McGraw-Hill Education, Third Edition
- V. M. Malhotra, Nicholas J. Carino 2004 "Handbook on Nondestructive Testing of Concrete"
- "Repair and Strengthening of Concrete structures" , FIP guide, Thomas Telford, London.
- Concrete Structures, Protection, Repair and Rehabilitation by R.Dodge Woodson.
- Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Mechanical Engineering)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Mechanical Engineering) – 5th Semester
w.e.f. 2020-21

S. N.	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Internal Assessment	External Examination	Practical	Total	
1	PCC-ME-301G	Computer Aided Design & Manufacturing	3	0	0	0	3	25	75		100	3
2	PCC- ME-303G	Solid Mechanics	3	1	0	4	4	25	75		100	3
3	PCC- ME-305G	Manufacturing Technology-I	3	0	0	3	3	25	75		100	3
4	PCC- ME-307G	Kinematics of Machine	3	0	0	3	3	25	75		100	3
5	PCC- ME-309G	Fluid Machines	3	0	0	3	3	25	75		100	3
6	**OEC/HSMC-I**	Refer List -I	2	0	0	2	2	25	75		100	3
7	LC-ME-311G	Computer Aided Design & Manufacturing Lab	0	0	2	2	1	25		25	50	3
8	LC-ME-313G	Fluid Machines Lab	0	0	2	2	1	25		25	50	3
9	LC-ME-315G	Kinematics of Machine Lab	0	0	2	2	1	25		25	50	3
10	PT-ME-317G	Practical Training-I	0	0	2	2	0					3
11	MC-315G	Essence of Indian Traditional knowledge										
	TOTAL						**21**				**750**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded ‘F’ grade is required to repeat Practical Training.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

OPEN ELECTIVE COURSES (OEC)/ HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)-LIST-I

LIST-I (Semester -V)

S. No.	Code	Name of Course	No. of Contact Hours	Credits
1.	HSMC-01G	Economics For Engineers	2	2
2.	HSMC-03G	Finance and Accounting	2	2
3.	OEC –ME-301G	Air and Noise Pollution and Control	2	2
4.	OEC –ME-303G	Installation Testing & Maintenance of Electrical Equipments	2	2
5.	OEC –ME-305G	Microprocessor and Interfacing	2	2

Note: Students have to select any one subject from the above list of courses.

Scheme of Studies and Examination
B.TECH (Mechanical Engineering) – 6th Semester
w.e.f. 2020-21

S. N.	Course Code	Course Title	Hours per week L	Hours per week T	Hours per week P	Total Contact hrs/week	Credit	Examination Schedule (Marks) Internal Assessment	External Examination	Practical	Total	Duration of Exam (Hours)
1	PCC-ME-302G	Manufacturing Technology-II	3	0	0	3	3	25	75		100	
2	PCC- ME-304G	Design of machine element-I	3	0	0	3	3	25	75		100	
3	PCC- ME-306G	Heat Transfer	3	1	0	4	4	25	75		100	
4	PCC- ME-308G	Dynamics of Machines	3	0	0	3	3	25	75		100	
5	LC-ME-310G	Workshop Lab-I	0	0	3	3	1.5	25		25	50	
6	LC-ME-312G	Workshop Lab-II	0	0	2	2	1	25		25	50	
7	LC-ME-314G	Heat Transfer Lab	0	0	2	2	1	25		25	50	
8	LC-ME-316G	Dynamics of Machines Lab	0	0	2	2	1	25		25	50	
9	PCC-ME-318G	Seminar	0	0	2	2	1	50			50	
10	PEC	Professional Elective Courses(PEC): Refer List -I	3	0	0	3	3	25	75		100	
11	**HSMC-II**	Refer List -II	2	0	0	2	2	25	75		100	
	TOTAL						**23.5**				**850**	

NOTE:

1. Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the VII semester.

2. Assessment of Practical Training-II, undergone at the end of VI semester, will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the industry/ Professional organization/ Research Laboratory etc. According to performance letter grades A, B, C, F are to be awarded:

   Excellent: A; Good : B; Satisfactory:C; notsatisfactory: F.

A student who has been awarded ‘F’ grade will be required to repeat the practical training.

PROFESSIONAL ELECTIVE COURSES (PEC) (Semester-VI) LIST-I

S. No.	Code	Name of Course	No. of Contact Hours	Credits
1.	PEC-ME-320G	Internal Combustion Engines & Gas Turbines	3	3
2.	PEC-ME-322G	Welding Technology	3	3
3.	PEC-ME-324G	Air Craft Technology	3	3
4.	PEC-ME-326G	Reliability, Availability & Maintainability	3	3

Note: Students will have to select any one out of the list.

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)-LIST-II.

List-II (Semester-VI)

S. No.	Code	Name of Course	No. of Contact Hours	Credits
1.	HSMC -02G	Organizational Behaviour	2	2
2.	HSMC -04G	Human Resource Management	2	2
3.	HSMC -06G	Industrial Psychology	2	2
4.	HSMC -08G	Fundamentals of Management	2	2

Note: Students have to select any one subject from the above list of courses.

<table>
<tr><td>Course code</td><td colspan="5">PCC-ME -301G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">COMPUTER AIDED DESIGN & MANUFACTURING</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Objectives:</td><td colspan="5">Understand the fundamentals of various Computer Aided Design, basics of geometric modeling, curves surfaces, solids and Additive Manufacturing Technologies for application to various industrial needs.
Learn what Advanced/Additive manufacturing (AM) is and understand why it has become one of the most important technology trends in decades for product development and innovation.
Differentiate between subtractive and Additive manufacturing.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Introduction to CAD/CAM/CAE, Design Process, Importance and Necessity of CAD, Applications of CAD, Hardware and Software requirement of CAD.
Fundamentals of Additive Manufacturing (AM), Basic steps to perform AM, Classification of AM, Applications of AM: Aerospace, Biomedical, Automotive, Bio-printing, Tissue & Organ Engineering, Architectural Engineering, Surgical simulation, Art, Health care.

UNIT-II

Basics of geometric and solid modeling, coordinate systems. Transformations: Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations. Curves: Algebraic and geometric forms, reparametrization, Analytical and Synthetic curves, cubic splines, Bezier curves and B-spline curves.
Surfaces and Solids: Plane surface, ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, Bezier surface, B-spline surface, Solid models and representation scheme, boundary representation, constructive solid geometry, sweep representation, cell decomposition.

UNIT-III

Finite Element Method: Introduction, Procedure, Finite Element Analysis, Finite Element Modeling, Analysis of 1D, 2D structural problems.

Design for Additive Manufacturing, Software issues for AM, Direct Digital Manufacturing.

Difference between machining and additive manufacturing. Photo polymerization Processes, Powder bed fusion processes, Extrusion Based systems, Printing Processes, Effects of significant parameters.

UNIT-IV

Flexible Manufacturing Systems & Computer aided process planning: Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications Conventional process planning, types of CAPP, Steps in variant process planning, planning for CAPP.

COURSE OUTCOMES: Upon completion of this course the student will be able to:
1. Demonstrate the knowledge of Computer Aided design and Additive Manufacturing.
2. Able to understand the concept of wireframe modeling, surface modeling and solid modeling.
3. Able to understand the method of manufacturing of liquid based, powder based and solid based techniques

References:

1. CAD/ CAM by Groover and Zimmer, Prantice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill
3. Numerical Control and Computer Aided Manufacturing by Kundra, Rao & Tiwari, TMH.
4. Ian Gibson, Davin Rosen, Brent Stucker "Additive Manufacturing Technologies, Springer, 2nd Ed, 2014.

Course code	**PCC-ME -303G**				
Category	Professional Core Courses				
Course title	**SOLID MECHANICS**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	3	1	0	4	
Objectives:	The objective is to present the mathematical and physical principles in understanding the linear continuum behavior of solids.Apply and use energy methods to find force, stress and displacement in simple structures and springs.Understand and determine the stresses and strains in pressure vessels. Knowledge of stress functions, and calculate stresses in rotating rings, discs, and curved beams.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's & Maxwell's theorems, Numericals.

Theories of Elastic Failure: Various theories of elastic failures with derivations and graphical representations, applications to problems of 2- dimensional stress system with (i) Combined direct loading and bending, and (ii) combined torsional and direct loading, Numericals.

UNIT-II

Unsymmetrical Bending: Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis Numericals.

Springs: Stresses in open coiled helical spring subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numericals.

UNIT-III

Derivation of Lame's equations, Radial & Hoop Stresses in compound spherical shells subjected to internal fluid pressure only, wire wound cylinders, hub shrunk on solid shaft, Numericals.

Rotating Rims & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in (I) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solids cylinders. Numericals.

UNIT-IV

Bending of Curved Bars : Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, deflection of rings by Castigliano's theorem stresses in simple chain link, deflection of simple chain links, Problems.

Course Outcomes (COs): After studying this course, students will be able:

CO 1- Apply and use energy methods to find force, stress and displacement in simple structures and springs.

CO 2- Understand and determine the stresses and strains in pressure vessels.

CO 3- Knowledge of stress functions, and calculate stresses in rotating rings, discs, and curved beams.

CO 4- Evaluate the behaviour and strength of structural elements subjected to three dimensional stress system.

Text Books:

1. Strength of Materials – G.H.Ryder, Third Edition in SI Units 1969 Macmillan, India.
2. Strength of Materials – Sadhu Singh, Khanna Publishers

ReferenceS:

1. Book of Solid Mechanics – Kazmi, Tata Mc Graw Hill
2. Strength of Materials – D.S. Bedi - S. Chand & Co. Ltd.
3. Strength of Materials – U.C Jindal - Pearson India Ltd.

<table>
<tr><td>Course code</td><td colspan="5">PCC-ME -305G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">MANUFACTURING TECHNOLOGY-I</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Objectives:</td><td colspan="5">To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Metal Cutting & Tool Life: Introduction, basic tool geometry, single point tool nomenclature, chips types and their characters tics, mechanics of chips formation, theoretical and experimental determination of shear angle, orthogonal and oblique metal cutting, metal cutting theories, relationship of velocity, forces, and power consumption, cutting speed, feed and depth of cut, coolant, temperature profile in cutting, tool life relationship, tailor equation of tool life, tool material and mechanism

Economics of Metal Machining: Introduction, elements of machining cost, tooling economics, machining, economics and optimization, geometry of twist, drills and power calculation in drills.

UNIT-II

Metal forming Jigs and Fixtures: Introduction, Metal blow condition, theories of plasticity, conditions of plane strains, friction, conditions in metal working, wire drawing, theory of forging, rolling theory, no slip angle, and foreword slip, types of tools, principles of locations, locating and clamping devices, jigs bushes, drilling jigs, milling fixtures, turning fixtures, boring and broaching fixtures, welding fixtures, different materials, for jigs and fixtures, economics of jigs and fixtures.

Metrology: Measurement, linear and angular simple measuring instruments, various clampers, screw gauge, sine bar, auto-collimator, comparator- mechanical, electrical, optical, surface finish and its measurements, micro and macro deviation, factors influencing surface finish and evaluation of surface finish.

UNIT-III

Machine tools: Introduction, constructional features, specialization, operations and devices of basic machine tools such as lathe, shaper, planner, drilling machining, and milling machine, indexing in milling operation, working principles of capstan and turret lathes.

Metal Casting Process: Introduction, Foundry: Introduction to Casting Processes, Basic Steps in Casting Processes. Pattern: Types of Pattern and Allowances. Sand Casting: Sand Properties, Constituents and Preparation. Mould & Core making with assembly and its Types. Gating System. Melting of Metal, Furnaces and Cupola, Metal Pouring, Fettling. Casting Treatment, Inspection and Quality Control, Sand Casting Defects & Remedies.

UNIT-IV

Welding: Introduction to Welding, Classification of Welding Processes, Gas Welding: Oxy-Acetylene Welding, Resistance Welding; Spot and Seam Welding, Arc Welding: Metal Arc, TIG & MIG Welding, Submerged arc welding (SAW), resistance welding principles, electrode types and selection, thermit welding, electro slag welding, electron beam welding, laser beam welding, forge welding, friction welding, Welding Defects and remedies, brazing & soldering.

Forming Processes: Basic Principle of Hot & Cold Working, Hot & Cold Working Processes, Rolling, Extrusion, Forging, Drawing, Wire Drawing and Spinning. Sheet Metal Operations: Measuring, Layout marking, Shearing, Punching, Blanking, Piercing, Forming, Bending and Joining.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Demonstrate the knowledge about different sand moulding and metal casting processes.

CO 2- Understand the plastic deformation of metals under rolling, extrusion, forging and sheet metal working.

CO 3- Acquire knowledge about basic welding processes and their selection for fabrication of different components.

CO 4 **-** Learn about different gear manufacturing and gear finishing operations.

CO 5- Acquire the basics of powder metallurgy.

References:

1. Manufacturing Engineering Technology, K. Jain, Pearson Education
2. Manufacturing Technology: Foundry, Forming and Welding by P.N.Rao, TMH.
3. Principles of Manufacturing Materials and Processes, James S.Campbell, TMH.
4. Welding Metallurgy by G.E.Linnert, AWS.
5. Production Engineering Sciences by P.C.Pandey and C.K.Singh, Standard Publishers Ltd.
6. Manufacturing Science by A.Ghosh and A.K.Mallick, Wiley Eastern

Course code	**PCC-ME -307G**				
Category	Professional Core Courses				
Course title	**KINEMATICS OF MACHINE**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	3	0	0	3	
Objectives:	• To understand the kinematics and rigid- body dynamics of kinematically driven machine components. • To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link. • To be able to design some linkage mechanisms and cam systems to generate specified output motion. • To understand the kinematics of gear trains.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: mechanism and machines, kinematics links, kinematics pairs, kinematics chains, degree of freedom, Grubler's rule, kinematics inversion, equivalent linkages, four link planar mechanisms, straight line mechanisms, steering mechanisms, pantograph, problems.

Kinematics Analysis of Plane Mechanisms: displacement analysis, velocity diagram, velocity determination, relative velocity method, instantaneous center of velocity, Kennedy's theorem, graphical and analytical methods of velocity and acceleration analysis, problems.

UNIT-II

Cams: Classification of cams and followers, disc cam nomenclature, construction of displacement, velocity and acceleration diagrams for different types of follower motions, analysis of follower motions, determination of basic dimension, synthesis of cam profile by graphical methods, cams with specified contours, problems.

Gears: fundamental law of gearing, involute spur gears, characteristics of involute and cycloidal action, Interference and undercutting, center distance variation, path of contact, arc of contact, non standard gear teeth, helical, spiral bevel and worm gears, problems.

UNIT-III

Gear Trains: synthesis of simple, compound and reverted gear trains, analysis of epicylic gear trains, problems.

Kinematics synthesis of Mechanisms: function generation, path generation, Freudenstein's equation, two and three position synthesis of four bar and slider crank mechanisms by graphical and analytical methods, precision positions, structural error; Chebychev spacing, transmission angle, problems.

UNIT-IV

Friction : Types of friction, laws of friction, motion along inclined plane, screw threads, efficiency on inclined plane, friction in journal bearing, friction circle and friction axis, pivots and collar friction, uniform pressure and uniform wear.

Belts and pulleys: Open and cross belt drive, velocity ratio, slip, material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts, ratio of tension, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drives, chain length, classification of chains.

Course Outcomes : Students would be able :

CO1 - To understand about the applications of mechanism and machines.

CO2 - To understand about the basics Cams and Friction

CO3 - Students get familiarity about power transmitted with Belts and pulleys and also Gears and Gear Trains.

CO4 - Students having familiarization with calculate Kinematics Analysis of Plane Mechanisms

CO5 - Students would be able to know the Kinematics synthesis of Mechanisms.

TEXT BOOKS:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Malik, Third Edition Affiliated East-West Press.

2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.

References:

1. Mechanism and Machine Theory : J.S. Rao and R.V. Dukkipati Second Edition New age International.

2. Theory and Machines: S.S. Rattan, Tata McGraw Hill.

3. Theory of Machines, Beven, Pearson Indian Education Service Pvt. Ltd. India.

Course code	**PCC-ME -309G**				
Category	Professional Core Courses				
Course title	**FLUID MACHINES**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	3	0	0	3	
Objectives:	The students completing this course are expected to understand the theory of boundary layer, working and performance characteristics of various hydraulic machines like pumps and turbines.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Impact of free jets: Impulse – momentum principle, jet impingement - on a stationary flat plate, inclined plate and a hinged plate, at the center of a stationary vane, on a moving flat plate, inclined plate, a moving vane and a series of vanes, Jet striking tangentially at the tip of a stationary vane and moving vane(s), jet propulsion of ships, Problems.

Impulse Turbines: Classification – impulse and reaction turbines, water wheels, component parts, construction, operation and governing mechanism of a Pelton wheel, work done, effective head, available head and efficiency of a Pelton wheel, design aspects, speed ratio, flow ratio, jet ratio, number of jets, number of buckets and working proportions, Performance Characteristics, governing of impulse turbines, Problems.

UNIT-II

Francis Turbines: Component parts, construction and operation of a Francis turbine, governing mechanism, work done by the turbine runner, working proportions and design parameters, slow, medium and fast runners, degree of reaction, inward/outward flow reaction turbines, Performance Characteristics, Problems.

Propeller and Kaplan turbines: Component parts, construction and operation of a Propeller, Kaplan turbine, differences between the Francis and Kaplan turbines, draft tube - its function and different forms, Performance Characteristics, Governing of reaction turbine, Introduction to new types of turbine, Deriaz (Diagonal), Bulb, Tubular turbines, Problems.

UNIT-III

Dimensional Analysis and Model Similitude: Dimensional homogeneity, Rayleigh's method and Buckingham's πtheorem, model studies and similitude, dimensionless numbers and their significance. Unit quantities, specific speed and model relationships for turbines, scale effect, cavitations – its causes, harmful effects and prevention, Thomas cavitation factor, permissible installation height, Problems.

Centrifugal Pumps: Classification, velocity vector diagrams and work done, manometric efficiency, vane shape, head capacity relationship and pump losses, pressure rise in impeller, minimum starting speed, design considerations, multi-stage pumps. Similarity relations and specific speed, net positive suction head, cavitation and maximum suction lift, performance characteristics. Brief introduction to axial flow, mixed flow and submersible pumps, Problems.

UNIT-IV

Reciprocating Pumps: Construction and operational details, discharge coefficient, volumetric efficiency and slip, work and power input, effect of acceleration and friction on indicator diagram (pressure – stroke length plot), separation, air vessels and their utility, rate of flow into or from the air vessel, maximum speed of the rotating crank, characteristic curves, centrifugal vs reciprocating pumps, brief introduction to screw, gear, vane and radial piston pumps, Problems.

Hydraulic systems: Function, construction and operation of Hydraulic accumulator, hydraulic intensifier, hydraulic crane, hydraulic lift and hydraulic press, Fluid coupling and torque converter, Hydraulic ram, Problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Application of momentum equation and its application.

CO 2- Understand the construction, working principle and design analysis of hydraulic turbines.

CO 3- Expedite construction, working principle and design analysis of pumps.

CO 4- Knowledge of the design of a prototype on the basis of dimensional analysis.

Text Books:

1. Fluid Mechanics and Hydraulic Machines – Mahesh Kumar, Pearson Indian Education Service Pvt. Ltd. India.
2. Hydraulics & Fluid Mechanics – Modi & Seth, Pub. - Standard Book House, N.Delhi
3. Hydraulic Machines – Jagdish Lal, Metropolitan

References:

1. Fluid Mechanics and Hydraulic Machines – S S Rattan, Khanna Publishers
2. Introduction to Fluid Mechanics and Fluid Machines – S K Som and G Biswas, Tata McGraw Hill
3. Fluid Mechanics and Fluid Power Engineering – D S Kumar, S K Kataria and Sons.

Course code	**LC-ME -311G**				
Category	Engineering Science courses				
Course title	**COMPUTER AIDED DESIGN & MANUFACTURING LAB**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	0	0	2	1	
Objectives:	At the end of the course, the student shall be able to: Display of the basic fundamentals of modeling package. Explore the surface and solid modeling features. Learning the techniques of 3D modeling of various mechanical parts.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments:

The students will be required to carry out the following exercises using software packages (e.g. Solid works / Pro Engineer/AutoCAD/ I-Deas/ Solid Edge/CURA etc.)

1. CAD Modeling Assignments
   (i) Use and learn import/export techniques and customization of software.
   (ii) Construction of simple machine parts and components like Coupling, Crankshaft, Pulley, Piston , Connecting rod, nuts, bolts, gears and helical springs
   (iii) Assembly drawing with sectioning and bill of materials from given detailed drawings of assemblies: Lathe Tail stock, Machine vice, Pedestal bearing, Drill jigs and Milling fixture.
   (iv) Make the part family/family table of a bolt.

2. CAM Assignments Tool path generation, Part programming, G & M codes development for machining operations, Physical interpretation of machining features and tool geometries.

3. To perform reverse engineering of a product using 3D scanner.

4. To print coupling, crankshaft, pulley, piston, connecting rod, nuts, bolts with FDM 3D printer with suitable filament like Nylon, ABS etc.

5. To print a product with FDM 3D printer which is developed with reverse engineering.

6. To Draw Orthographic projection Drawings (Front, Top and side) of boiler safety valve giving name the various components of the valve.

7. Make an Isometric dimensioned drawing of a connecting Rod using isometric grid and snap.

8. Draw 3D models by extruding simple 2D objects, dimension and name the objects.

Course Outcomes (COs): At the end of the course, the student shall be able to:
CO 1- Display of the basic fundamentals of modeling package.
CO 2- Explore the surface and solid modeling features.
CO 3- Learning the techniques of 3D modeling of various mechanical parts.
CO 4- To expedite the procedure and benefits of FEA and CAE.

Note:-

1. At least Five experiments are to be performed in the semester.
2. At least five experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.
3. The students will be required to carry out the following exercises using educational software (AutoCAD, I-DEAS, Pro-Engineer etc).

<table>
<tr><td>Course code</td><td colspan="5">LC-ME -313G</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science courses</td></tr>
<tr><td>Course title</td><td colspan="5">FLUID MACHINES LAB</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Objectives:</td><td colspan="5">(i) To understand the principles and performance characteristics of flow and thermal devices.
(ii) To know about the measurement of the fluid properties.
(iii) To understand the theory, working and performance characteristics of various hydraulic machines like pumps and turbines.</td></tr>
<tr><td>Class work mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Practical mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Experiments:

1. To study the constructional details of a Pelton turbine and draw its fluid flow circuit.
2. To draw the following performance characteristics of Pelton turbine-constant head, constant-speed and constant efficiency curves.
3. To study the constructional details of a Francis turbine and draw its fluid flow circuit.
4. To draw the constant head, constant speed and constant efficiency performance characteristics of Francis turbine.
5. To study the construction details of a Kaplan turbine and drawits fluid flow circuit.
6. To drawthe constant head, speed and efficiency curves for a Kaplan turbine.
7. To study the constructional details of a Centrifugal Pump and draw its characteristic curves.
8. To study the constructional details of a Reciprocating Pump and draw its characteristics curves.
9. To study the construction details of a Gear oil pump and its performance curves.
10. To study the constructional details of a Hydraulic Ram and determine its various efficiencies..
11. To study the constructional details of a Centrifugal compressor.
12. To study the model of Hydro power plant and draw its layout.

Course Outcomes (COs): At the end of the course, the student shall be able to:
CO 1- Understand the concept of momentum equation.
CO 2- Knowledge of construction, working principle and performance of hydraulic turbines.
CO 3- Learn construction, working principle and performance of pumps.
CO4- Explore construction, working principle and performance of hydraulic ram.

NOTE:
1. At least ten experiments are to be performed in the Semester.
2. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as per the scope of the syllabus.

<table>
<tr><td>Course code</td><td colspan="5">LC-ME -315G</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science courses</td></tr>
<tr><td>Course title</td><td colspan="5">KINEMATICS OF MACHINES LAB</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Objectives:</td><td colspan="5">To understand the kinematics and rigid- body dynamics of kinematically driven machine components.
To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.
To be able to design some linkage mechanisms and cam systems to generate specified output motion.
To understand the kinematics of gear trains.</td></tr>
<tr><td>Class work mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Practical mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Experiments:

1. To study various types of Kinematic links, pairs, chains and Mechanisms.
2. To study inversions of 4 Bar Mechanisms, Single and double slider crank mechanisms.
3. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
4. To find coefficient of friction between belt and pulley.
5. To study various type of cam and follower arrangements.
6. To plot follower displacement vs cam rotation for various Cam Follower systems.
7. To generate spur gear involute tooth profile using simulated gear shaping process.
8. To study various types of gears – Helical, cross helical worm, bevel gear.
9. To study various types of gear trains – simple, compound, reverted, epicyclic and differential.
10. To find co-efficient of friction between belt and pulley.
11. To study the working of Screw Jack and determine its efficiency.
12. Create various types of linkage mechanism in CAD and simulate for motion outputs and study the relevant effects.
13. Creation of various joints like revolute, planes, spherical, cam follower and study the degree of freedom and motion patterns available.
14. To design a cam profile by using the requirement graph using on-line engineering handbook and verify the same using a 3D mechanism on CAD.

Course Outcomes (COs): After studying this course, students will be able:
CO 1- Understand the various practical demonstrations of mechanism.
CO 2- Knowledge of Motions in mechanism with practical demonstration.
CO 3- Learning the Special purpose machine members used in designing of a machine.
CO 4- Synthesis of working model using the various linkages.

Note:
1. At least ten experiments are to be performed in the Semester.
2. At least eight experiments should be performed from the above list. However these experiments should include experiments at Sr. No. 12, 13 and 14. Remaining two experiments may either be performed from the above list or as designed & set by the concerned institution as per the scope of the syllabus.

Course code	**PT-ME -317G**
Category	Engineering Science courses
Course title	**PRACTICAL TRAINING -I**
Scheme and Credits	L: 0, T: 0, P: 2, **Credits**: 1 — Semester-V
Objectives:	• Achieving the objectives of the University and its colleges and departments in practical training. • Providing students with practical skills, which match the requirements of the job market and allow them to directly enter the work community in a serious and constructive manner. • Providing students with experience to help them take decisions pertaining to their future career objectives. • Providing college students the full opportunity to apply theoretical knowledge (gained during their studies) in a real work environment at a later stage of their studies. • Developing the student's understanding of the needs of the job market and reaching this understanding successfully. .
Class work mark	25 Marks
Practical mark	25 Marks
Total	50 Marks
Duration of Exam	03 Hours

PRACTICAL TRAINING VIVA-VOCE:

1**) Assessment of Practical Training-I, undergone at the end of IV semester, will be based on seminar, viva-voce, report and certificate of practical training obtained by the student from the industry/** Professional organization/ Research Laboratory with the prior approval of the Director-Principal/ **Mechanical Software /Automobile Workshop. According to performance letter grades A, B, C, F are to be awarded:**

Excellent : A ; Good : B ; Satisfactory : C ; Not satisfactory : F.

A student who has been awarded 'F' grade will be required to repeat the practical training.

2) Each student has to undergo practical training of 4/6 weeks during summer vacation and its evaluation shall be carried out in the V semester.

Course code	MC-315G			
Category	Mandatory Course			
Course title	**Essence of Indian Traditional Knowledge**			
Scheme and credits	L	T	P	Credits
	2	0	0	0

Course Contents

- Basic structure of Indian knowledge System: अष्टादशविद्या – वेद, उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थाप्य आदि) वेदांग (शिक्षा, कल्प, निरूक्त, व्याकरण, ज्योतिष, छंद) उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र)
- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case studies

References

1. V. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
2. Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan
3. Swami Jitatmanand, *Holistic Science and Vedant*, Bharatiya Vidya Bhavan
4. Fritzof Capra, *Tao of Physics*
5. Fritzof Capra, *The Wave of life*
6. VN Jha (Eng. Trans.), *Tarkasangraha of Annam Bhatta*, International Chinmay Foundation, Velliarnad, Arnakulam
7. *Yoga Sutra of Patanjali*, Ramakrishna Mission, Kolkata
8. GN Jha (Eng. Trans.), Ed. RN Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakashan, Delhi 2016
9. RN Jha, *Science of Consciousness Psychotherapyand Yoga Practices*, Vidyanidhi Prakashan, Delhi 2016
10. P B Sharma (English translation), *Shodashang Hridayan*

<table>
<tr><td>Course code</td><td colspan="5">HSMC -01G</td></tr>
<tr><td>Category</td><td colspan="5">HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)</td></tr>
<tr><td>Course title</td><td colspan="5">ECONOMICS FOR ENGINEERS</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Objectives:</td><td colspan="5">• Acquaint the students to basic concepts of economics and their operational significance.
• To stimulate the students to think systematically and objectively about contemporary economic problems.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, Elasticity of Demand- meaning, factors affecting it, its practical application and importance.

UNIT-II

Production- Meaning of Production and factors of production, Law of variable proportions, Returns to scale, Internal and external economies and diseconomies of scale.

Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Real cost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-III

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT-IV

Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), Privatization - meaning, merits and demerits.
Globalization of Indian economy - merits and demerits.

Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions, Difference between Commercial & Central Bank.

COURSE OUTCOMES

Upon successful completion of this course, the student will be able to:

CO1 - The students will able to understand the basic concept of economics.
CO2 - The student will able to understand the concept of production and cost.
CO3 - The student will able to understand the concept of market.
CO4 - The student will able to understand the concept of privatization, globalization and banks.

REFERENCES:

1. Jain T.R., Economics for Engineers, VK Publication.
2. Chopra P. N., Principle of Economics, Kalyani Publishers.
3. Dewett K. K., Modern economic theory, S. Chand.
4. H. L. Ahuja., Modern economic theory, S. Chand.
5. Dutt Rudar & Sundhram K. P. M., Indian Economy.
6. Mishra S. K., Modern Micro Economics, Pragati Publications.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
8. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
9. Micro Economic Theory – M.L. Jhingan (S.Chand).
10. Micro Economic Theory - H.L. Ahuja (S.Chand).
11. Modern Micro Economics : S.K. Mishra (Pragati Publications).
12. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co).

Course code	**HSMC -03G**				
Category	**HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)**				
Course title	**FINANCIAL ACCOUNTING**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	2	0	0	2	
Objectives:	The role of accounting is to provide information to investors, policy-makers, regulators, and other decision-makers to facilitate the allocation of resources in society. The purpose of this course is to understand the accounting process and to develop skills necessary to evaluate an enterprise's financial position and its operating, investing and financing activities				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Theoretical Framework:Accounting as an information system, the users of financial accounting information and their needs. Qualitative characteristics of accounting, information. Functions, advantages and limitations of accounting. Branches of accounting. Bases of accounting; cash basis and accrual basis.

The nature of financial accounting principles – Basic concepts and conventions: entity, money measurement, going concern, cost, realization, accruals, periodicity, consistency, prudence (conservatism), materiality and full disclosures.

Financial accounting standards: Concept, benefits, procedure for issuing accounting standards in India. International Financial Reporting Standards (IFRS): - Need and procedures, Convergence to IFRS, Distinction between Indian Accounting Standards (Ind ASs) and Accounting Standards (ASs).

Accounting Process From recording of a business transaction to preparation of trial balance including adjustments: Capital and Revenue expenditure & receipts, Preparation trial balance, Profit and Loss Account and Balance Sheet(Sole Proprietorship only).

UNIT-II

Business Income: Measurement of business income-Net income: the accounting period, the continuity doctrine and matching concept. Objectives of measurement. Revenue: concept, revenue recognition principles, recognition of expenses.

The nature of depreciation. The accounting concept of depreciation. Factors in the measurement of depreciation. Methods of computing depreciation: straight line method and diminishing balance method; Disposal of depreciable assets-change of method

Inventories: Meaning. Significance of inventory valuation. Inventory Record Systems: periodic and perpetual. Methods: FIFO, LIFO and Weighted Average. Preparation of financial statements of not for profit organizations.

UNIT-III

Accounting for Hire Purchase and Installment System, Consignment, and Joint Venture:Accounting for Hire Purchase Transactions, Journal entries and ledger accounts in the books of Hire Vendors and Hire purchaser for large value items including default and repossession, stock and debtors system. Consignment: Features, Accounting treatment in the books of the consignor and consignee.

Joint Venture: Accounting procedures: Joint Bank Account, Records Maintained by Coventurer of all transactions and only his own transactions. (Memorandum joint venture account).

UNIT-IV

Accounting for Inland Branches Inland Branches; Dependent branches only and Ascertainment of Profit by Debtors Method & Stock and Debtors Method.

Accounting for Dissolution of Partnership Firm Dissolution of the Partnership Firm Including Insolvency of partners, sale to a limited company and piecemeal distribution.

Computerized Accounting System (using any popular accounting software); Creation of Vouchers; recording transactions; preparing reports, cash book, bank book, ledger accounts, trial balance, Profit and loss account, Balance Sheet.

Learning outcomes

After studying this course, you should be able to:

- define bookkeeping and accounting
- explain the general purposes and functions of accounting
- explain the differences between management and financial accounting
- describe the main elements of financial accounting information – assets, liabilities, revenue and expenses
- identify the main financial statements and their purposes.

References:

1. Lal, Jawahar and Seema Srivastava, Financial Accounting, Himalaya Publishing House.

2. Monga, J.R., Financial Accounting: Concepts and Applications, Mayoor Paper Backs, New Delhi.

3. Shukla, M.C., T.S. Grewal and S.C.Gupta. Advanced Accounts. Vol.-I. S. Chand & Co., New Delhi.

4. S. N. Maheshwari, Financial Accounting, Vikas Publication, New Delhi. T.S, Grewal, Introduction to Accounting, S. Chand and Co., New Delhi

5. P.C. Tulsian, Financial Accounting, Tata McGraw Hill, New Delhi.

6. Bhushan Kumar Goyal and HN Tiwari,Financial Accounting,Vikas publishing House, New Delhi.

7. Jain, S.P. and K.L. Narang. Financial Accounting. Kalyani Publishers, New Delhi.

Course code	**OEC –ME-301G**				
Category	**OPEN ELECTIVE COURSES(OEC)**				
Course title	**AIR AND NOISE POLLUTION AND CONTROL**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	2	0	0	2	
Objectives:	To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Atmosphere as a place of disposal of pollutants – Air Pollution – Definition – Air Pollution and Global Climate – Units of measurements of pollutants – Air quality criteria – emission standards – National ambient air quality standards – Air pollution indices – Air quality management in India.

UNIT-II

Sources and classification of air pollutants – Man made – Natural sources – Type of air pollutants – Pollution due to automobiles – Analysis of air pollutants – Chemical, Instrumental and biological methods. Air pollution and its effects on human beings, plants and animals – Economic effects of air pollution – Effect of air pollution on meteorological conditions – Changes on the Meso scale, Micro scale and Macro scale.

UNIT-III

Sampling and measurement of particulate and gaseous pollutants – Ambient air sampling – Stack sampling. Environmental factors – Meteorology – temperature lapse rate and stability – Adiabatic lapse rate – Wind Rose – Inversion – Wind velocity and turbulence –Plume behaviour – Dispersion of air pollutants- Air Quality Modeling.

Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydro carbons.Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

UNIT-IV

Noise Pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure, Noise indices.

OUTCOMES: The students completing the course will have

- an understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
- ability to identify, formulate and solve air and noise pollution problems
- ability to design stacks and particulate air pollution control devices to meet applicable laws.

TEXTBOOKS:

- C. S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Limited, 2000.
- M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 1993
- Dr. Y. Anjaneyulu, “Air Pollution and Control Technologies”, Allied publishers Pvt. Ltd., 2002.

REFERENCES:

- Noel De Nevers, “Air pollution control Engineering”, McGraw Hill International Edition, McGraw Hill Inc, New Delhi, latest edition
- Air Pollution act, India, latest edition
- Peterson and E.Gross Jr., “Hand Book of Noise Measurement”, latest edition
- Mukherjee, “Environmental Pollution and Health Hazards”, causes and effects, latest edition
- Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, latest edition
- Kenneth wark, Cecil F.Warner, “Air Pollution its Origin and Control”, Harper and Row Publishers, New York, latest edition
- Peavy, Rowe and Tchobanoglous: Environmental Engineering.
- Martin Crawford: Air Pollution Control Theory.
- Warkand Warner: Air Pollution: Its Origin and Control.
- Keshav Kant and Rajni Kant, “Air Pollution and Control Engineering”, Khanna Publishing House.
- Environmental Noise Pollution – PE Cunniff, McGraw Hill, New York, latest edition
- Nevers: Air Pollution Control Engineering.
- M. P. Poonia and S C Sharma,” Environmental Engineering, Khanna Publishing House.
- My cock, Mc Kenna and Theodore: Handbook of Air Pollution Control Engineering and
- Technology. Suess and Crax ford: W.H.O. Manualon Urban Air Quality Management
- OP Gupta,Elements of Environmental Polluton Control, Khanna Publishing House.

<table>
<tr><td>Course code</td><td colspan="5">OEC –ME-303G</td></tr>
<tr><td>Category</td><td colspan="5">OPEN ELECTIVE COURSES(OEC)</td></tr>
<tr><td>Course title</td><td colspan="5">INSTALLATION TESTING & MAINTENANCE OF ELECTRICAL EQUIPMENTS</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Objectives:</td><td colspan="5">The course content should be taught and implemented with the aim to develop required skills in the students so that they are able to acquire following competency: Undertake installation, commissioning and maintenance of various power system• components and equipment.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
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UNIT-I

Installation of Electrical Equipements: Introduction Unloading of electrical equipment at site Inspection Storage Foundation Alignment of electrical machines Tools/Instruments necessary for installation Inspection, storage and handling of transformer, switchgear and induction motor Preparation of technical report

Commissioning And Testing:Tests before commissioning of electrical equipment :Electrical and Mechanical test Specific tests on - transformer, induction motor, alternator, synchronous power and electrical power installation Need of gradually loading of Various Tests to be performed after commissioning and before starting the machine Various instruments required for testing Commissioning of switchgear Test report on commissioning and test certificate electrical equipment Preparations before commissioning of power transformer Commissioning- power transformer, three phase induction motor Transformer insulation oil: Properties as per IS, sampling, testing and filtering/purifying, standard tests as per IS Measurement of insulation resistance of different equipments/machines Methods of Drying the winding of electrical equipments and its record Classification and measurement of insulation resistance, Polarization Index Appropriate insulation test for specific purpose Factor affecting

UNIT-II

Maintenance Of Electrical Equipments: General aspect of maintenance, Classification Preventive maintenance-concept, classification, advantages, activities, functions of the Maintenance Department Breakdown maintenance-concept, advantages, activities Reasons of failure of electrical equipment due to poor maintenance Factors for preparing maintenance schedule Frequency of maintenance Maintenance schedule of transformer below and above 1000kVA Maintenance schedule - induction motor, circuit Breaker, overhead line, storage Battery Probable faults due to poor maintenance in transformer, induction motor, circuit breaker, overhead lines and battery

UNIT-III

Trouble Shooting:Causes of fault in electrical equipments- Internal and external Instruments and tools for trouble shooting Common troubles in electrical equipment – DC Machines, AC Machines, Transformers, Circuit- breaker, under-ground cable, electrical Installation Need of trouble shooting chart, advantages Trouble shooting chart – DC Motor, DC Generator, Transformer, Synchronous Motor, Induction Motor, Circuit-breaker Trouble shooting chart for Domestic appliances- electrical iron, ceiling fan, Washing machine, Air cooler, Vacuum cleaner Fluorescent tube light: Construction, working and troubleshooting chart

UNIT-IV

Earthing:Necessity of earthing System earthing : advantage of neutral earthing of generator in power station Equipment earthing: Objective Types of earth electrodesMethods of earthing : plate earthing,pipe earthing and coil earthing Earthing in extra high voltage and underground cable Earthing resistance- factor affecting Determination of maximum permissible resistance of the earthing system Measurement of earth resistance: voltmeterammeter method, earth tester method, ohm meter method and earth loop tester method Define: earthing , grounding and bonding Comparison between equipment earthing and system grounding Earthing procedure - Building installation, Domestic appliances, Industrial premises Earthing in substation, generating station and overhead line

Electrical Accidents And Safety: Causes of electrical accidents Factors affecting the severity of electrical shock Actions to be taken when a person gets attached to live part Safety regulations and safety measures Indian electricity supply act 1948- 1956 Factory act 1948 Procedure of shut down for sub- station and power lines Permit to work : certificate of (i)requisition for shut down(ii) Permit to work and (iii)Line clear certificate Instruction for the safety of persons working on a job with a permit to work Fire extinguishers- For fixed installation and portable devices

COURSE OUTCOMES (COs): The theory should be taught and practical should be undertaken in such a manner that students are able to acquire different learning outcomes in cognitive, psychomotor and affective domains to demonstrate the following course outcomes:

- Unload the electrical equipments/machines based on scientific procedure
- Commission various electrical equipment/machines
- Prepare maintenance schedule of different equipment and machines
- Prepare trouble shooting chart for various electrical equipment, machines and domestic appliances v. Carry out different types of earthing
- Apply electrical safety regulations and rules during maintenance.

REFERENCES:

1. Testing Commissioning operation and maintenance of Electrical Equipments by Rao S, Khanna Publication (Latest edition)

2. Installation, commissioning & maintenance of Electrical equipments by Singh TARLOK, S.K.Kataria & Sons, New Delhi, latest edition

3. Electrical power system by Wadhwa C.L., New Age international Publications.

<table>
<tr><td>Course code</td><td colspan="5">OEC –ME-305G</td></tr>
<tr><td>Category</td><td colspan="5">OPEN ELECTIVE COURSES(OEC)</td></tr>
<tr><td>Course title</td><td colspan="5">MICROPROCESSOR AND INTERFACING</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Objectives:</td><td colspan="5">This course deals with the systematic study of the Architecture and programming issues of 8086-microprocessor family and interfacing with other peripheral ICs and co-processor. In addition, various 32-bit and 64 bit microprocessors are introduced. The aim of this course is to give the students basic knowledge of the microprocessors needed to develop the systems using it.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

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UNIT-I

Architecture of 8085: Functional block diagram—Registers, ALU, Bus systems. Pin configuration, Timing and control signals, Machine cycle and timing diagrams. Interrupts—Types of interrupt, interrupt structure.

Programming of 8085: Instruction format, Addressing modes, Instruction set. Development of assembly language programs.

UNIT-II

Interfacing Devices:(a).The 8255 PPI chip: Architecture, pin configuration, control words, modes and Interfacing with 8085. (b). The 8254 PIC chip: Architecture, pin configuration, control words, modes and Interfacing with 8085.

UNIT-III

Interrupt and DMA controller: The 8259 Interrupt controller chip: Architecture, pin configuration, control words, modes.

Introduction to Microcontrollers, comparison with Microprocessor, Architecture and programming of 8051 microcontroller & brief introduction to PIC Microcontroller.

UNIT-IV

Architecture of 8086: Functional block diagram of 8086, details of sub-blocks such as EU, BIU,memory segmentation, physical address computations, pin configuration, program relocation, Minimum and Maximum modes of 8086— Block diagrams and machine cycles. UNIT6. Programming of 8086: Instruction format, Addressing modes, Instruction set and programs.

Course Outcomes: At the end of the course, a student will be able to:

- Explain the architecture, pin configuration of various microprocessors and Interfacing ICs
- Identify various addressing modes
- Perform various microprocessor based programs
- Apply the concepts of 8086 programming like interfacing, interrupts, stacks & subroutines.
- Interpret & Solve various automation based problems using microprocessor

TEXT BOOKS:

1. Microprocessor Architecture, Programming & Applications with 8085: Ramesh S Gaonkar; Wiley Eastern Ltd.

2. Microprocessor and applications – A.K.Ray. , TMH

REFERENCES:

1. Microprocessors and interfacing : Hall; TMH

2. The 8088 & 8086 Microprocessors-Programming, interfacing,Hardware& Applications :Triebel& Singh; PHI

3. Microcomputer systems: the 8086/8088 Family: architecture, Programming &Design : Yu-Chang Liu & Glenn A Gibson; PHI.

4. Advanced Microprocessors and Interfacing :Badri Ram; TMH.

Course code	**PCC-ME -302G**				
Category	Professional Core Courses				
Course title	**Manufacturing Technology-II**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	3	0	0	3	
Objectives:	(i)To provide knowledge onmachines and related tools for manufacturing various components. (ii) To understand the relationship between process and system in manufacturing domain. (iii) To identify the techniques for the quality assurance of the products and the optimality of the process in terms of resources and time management.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Mechanism of Metal Cutting: Deformation of metal during machining, nomenclature of lathe, milling tools, mechanics of chip formation, built-up edges, mechanics of orthogonal and oblique cutting, Merchant cutting force circle and shear angle relationship in orthogonal cutting, factors affecting tool forces. Cutting speed, feed and depth of cut, surface finish. Temperature distribution at tool chip interface. Numerical on cutting forces and Merchant circle.

Cutting Tool Materials & Cutting Fluids: Characteristics of tool materials, various types of cutting tool materials, coated tools, cutting tool selection, Types of tool wear, tool life, factors governing tool life, Purpose and types of cutting fluids, basic actions of cutting fluids, effect of cutting fluid on tool life, selections of cutting fluid.

UNIT-II

Unconventional Machining Processes: Abrasive jet machining: Principles, applications, process parameters. Ultrasonic machining: Principles, applications, analysis of process parameters. Electro-chemical machining and grinding: Principles, classifications, choice of electrolytes, applications. Electric discharge machining: Principles, selection of tools materials and dielectric fluid. Electron beam machining: Generation of electron beam, relative merits and demerits. Laser beam machining: Principles and applications.

Jigs & Fixtures: Introduction, location and location devices, clamping and clamping devises, Drill Jigs, Milling Fixtures.

UNIT-III

Numerical Control of Machine Tools; Introduction, Numerical Control & its growth, NC Machines tools, Axes of NC Machines, Classification of NC System, CNC, DNC and Machining Centre. Machine Control unit, NC tools & Tool changer.

Manual Part Programming; coordinate, Feed, Speed & Tool, Preparation & Miscellaneous functions, Examples of two axes part programming for Turning and Milling Operations, G & M Codes.

UNIT-IV

Group Technology; Definition and concept, Group and Family, working of group technology, Stages for Adopting Group Technology, Advantages of Group Technology.

Component Classification and Coding, Personnel and Group Technology, Planning the introduction of Group Technology, Group Technology layout.

Course Objectives (COs): At the end of the course, the student shall be able to:
CO 1- Acquire knowledge about mechanics of chip formation and to identify the factors related to tool wear and machinability.
CO 2- Learn about different gear manufacturing and gear finishing operations.
CO 3- Select the proper cutting tool material and components of jigs and fixtures.
CO 4- Understand the basics principles of non-conventional machining processes and their applications.
CO 5- Identify and select different measuring instruments for the inspection of different components.

Text Books

1. Manufacturing Technology – Vol. - 2, P.N. Rao, T.M.H, New Delhi
2. Computer Aided Manufacturing: S Kumar & B Kant Khan, Satya Prakashan, New Delhi .

References:

1. Principles of Machine Tools – G.C. Sen & A. Bhattacharya, Tata McGraw Hill, New Delhi
2. Manufacturing Engg.& Tech, Kalpakian, Serope Addison -Wisly Publishing Co. New York.
3. Modern Machining Processes: P.C. Pandey & H.S. Shan, T.M.H. Company, New Delhi
4. Text Book of Production Engineering: P.C. Sharma, S.Chand & Sons.
5. Production Engineering by KC Jain & AK Chilate, PHI, New Delhi

<table>
<tr><td>Course code</td><td colspan="5">PCC-ME -304G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">DESIGN OF MACHINE ELEMENT-I</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Objectives:</td><td colspan="5">This course seeks to provide an introduction to the design of machine elements commonly encountered in mechanical engineering practice, through
1. A strong background in mechanics of materials based failure criteria underpinning the safety-critical design of machine components.
2. An understanding of the origins, nature and applicability of empirical design principles, based on safety considerations.
3. An overview of codes, standards and design guidelines for different elements.
4. An appreciation of parameter optimization and design iteration. 5. An appreciation of the relationships between component level design and overall machine system design and performance.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
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UNIT-I

Design Philosophy: Problem identification- problem statement, specifications, constraints, Feasibility studytechnical feasibility, economic & financial feasibility, societal & environmental feasibility, Generation of solution field (solution variants), Brain storming, Preliminary design, Selection of best possible solution, Detailed design, Selection of Fits and tolerances and analysis of dimensional chains.

Selection of Materials: Classification of Engg. Materials, Mechanical properties of the commonly used engg. Materials, hardness, strength parameters with reference to stress-strain diagram, Factor of safety.

UNIT-II

Mechanical Joints: ISO Metric Screw Threads, Bolted joints in tension, Eccentrically loaded bolted joints in shear and under combined stresses, Design of power screws, Design of various types of welding joints under different static load conditions.

Riveted Joints, Cotter & Knuckle Joints: Design of various types of riveted joints under different static loading conditions, eccentrically loaded riveted joints, design of cotter and knuckle joints.

UNIT-III

Belt rope and chain drives: Design of belt drives, Flat & V-belt drives, Condition for Transmission of max. Power, Selection of belt, design of rope drives, design of chain drives with sprockets.

Keys, Couplings & Flywheel: Design of Keys – Flat, Kennedy Keys, Splines, Couplings design – Rigid & Flexible coupling, turning Moment diagram, coefficient of fluctuation of energy and speed, design of flywheel – solid disk & rimmed flywheels.

UNIT-IV

Clutches: Various types of clutches in use, Design of friction clutches – Disc. Multidisc, Cone & Centrifugal, Torque transmitting capacity.

Brakes: Various types of Brakes, Self energizing condition of brakes, Design of shoe brakes – Internal & external expanding, band brakes, Thermal Considerations in brake designing.

Course Outcomes: At the end of the course, the student shall be able to:
CO 1- Exploration of different concepts & considerations of machine design.
CO 2- Understanding design of different types of mechanical joints.
CO 3- Learning of design of different types of keys & couplings.
CO 4- Design procedure of transmission of shafts.
CO 5- Design of different types springs.

Note:

1. The paper setter will be required to mention in the note of the question paper that the use of following Design Data book is permitted:
2. Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan
3. Design Data Book PSG College of Technology Coimbatore

Text Books:

1. Mechanical Engg. Design - First Metric Editions: Joseph Edward Shigley-MGH, New York.
2. Design of Machine Elements – V.B. Bhandari – Tata McGraw Hill, New Delhi. 5. PSG Design Data Book

References:

1. Engineering design – George Dieter, MGH, New York.
2. Product Design and Manufacturing, A.K.Chitale and R.C.Gupta, PHI.
3. Machine Design An Integrated Approach: Robert L.Norton, Addison Wesley.
4. Machine Design : S.G. Kulkarini - Tata MacGraw Hill.
5. Design of machine elements-C S Sharma, Kamlesh Purohit, PHI.

<table>
<tr><td>Course code</td><td colspan="5">PCC-ME -306G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">HEAT TRANSFER</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Objectives:</td><td colspan="5">(1) The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation. (2) Rigorous treatment of governing equations and solution procedures for the three modes will be provided, along with solution of practical problems using empirical correlations. (3) The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Basics and Laws: Definition of Heat Transfer, Reversible and irreversible processes, Modes of heat flow, Combined heat transfer system and law of energy conservation.

Steady State Heat Conduction: Introduction, I-D heat conduction through a plane wall, long hollow cylinder, hollow sphere, Conduction equation in Cartesian, polar and spherical co-ordinate systems, Numericals.

UNIT-II

Steady State Conduction with Heat Generation: Introduction, 1 – D heat conduction with heat sources, Extended surfaces (fins), Fin effectiveness 2-D heat conduction , Numericals.

Transient Heat Conduction: Systems with negligible internal resistance, Transient heat conduction in plane walls, cylinders, spheres with convective boundary conditions, Chart solution, Relaxation Method, Numericals.

UNIT-III

Convection: Forced convection-Thermal and hydro-dynamic boundary layers, Equation of continuity, Momentum and energy equations, Some results for flow over a flat plate and flow through tube, Fluid friction and heat transfer (Colburn analogy), Free convection from a vertical flat plate, Empirical relations for free convection from vertical and horizontal o\planes & cylinders, Numericals.

Thermal Radiation: The Stephen-Boltzmann law, The black body radiation, Shape factors and their relationships, Heat exchange between non black bodies, Electrical network for radiative exchange in an enclosure of two or three gray bodies, Radiation shields, Numericals.

UNIT-IV

Heat Exchangers: Classification, Performance variables, Analysis of a parallel/counter flow heat exchanger, Heat exchanger effectiveness, Numericals.

Winglets, Types of Winglets, Heat Transfer Augmentation Process, effect of heat treatment augmentation, Application of heat treatment augmentation process, Heat transfer augmentation in a channel flow.

Heat Transfer with Change of Phase: Laminar film condensation on a vertical plate, Drop-wise condensation, Boiling regimes, Free convective, Nucleate and film boiling, Numericals.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Understand the basic concept of conduction, convection and radiation heat transfer.
CO 2- Formulation of one dimension conduction problems.
CO 3- Application of empirical correlations for both forced and free convection for determines the value of convection heat transfer coefficient.
CO 4- Expedite basic concept of the radiation heat transfer for black and grey body.
CO 5- Learning of thermal analysis and sizing of Heat exchangers.

Text Books:

1. Heat Transfer – J.P. Holman, John Wiley & Sons, New York.
2. Fundamentals of Heat & Mass Transfer–Incropera, F.P. & Dewill, D.P –John Willey New York.
3. Heat Transfer-Principles & Applications-Binay K. Dutta, PHI, New Delhi

References:

1. Conduction of Heat in Solids – Carslow, H.S. and J.C. Jaeger – Oxford Univ. Press.
2. Conduction Heat Transfer – Arpasi, V.S. – Addison – Wesley. 3. Compact Heat Exchangers – W.M. Keys & A.L. Landon, Mc. Graw Hill.
4. Thermal Radiation Heat Transfer – Siegel, R. and J.R. Howell, Mc. Graw Hill.
5. Heat Transmission – W.M., Mc.Adams, Mc Graw Hill.
6. Heat and Mass Transfer, Mohan, Pearson Indian Education Services, Pvt. Ltd. India

<table>
<tr><td>Course code</td><td colspan="5">PCC-ME -308G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">DYNAMICS OF MACHINES</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Objectives:</td><td colspan="5">1) To understand the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations.
2) Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.
3) To understand the Special purpose mechanism (governor, Gyroscope Cam and followers etc) used in designing of a machine.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Static and Dynamic Force Analysis: Static force analysis of planer mechanisms, dynamic force analysis including inertia and frictional forces of planer mechanisms.

Dynamics of Reciprocating Engines: engine types, indicator diagrams, gas forces, equivalent masses, inertia forces, bearing loads in a single cylinder engine, crankshaft torque, engine shaking forces.

UNIT-II

Balancing of Rotating Components: static balance, dynamic balance, balancing of rotating masses, two plane balancing, graphical and analytical methods, balancing of rotors, balancing machines, field balancing.

Balancing of Reciprocating Parts: Balancing of single cylinder engine, balancing of multi cylinder; inline, radial and V type engines, firing order.

UNIT-III

Governors: introduction, types of governors, characteristics of centrifugal governors, gravity controlled and spring controlled centrifugal governors, hunting of centrifugal governors, inertia governors.

Dynamometers: types of dynamometers, Prony brake, rope brake and band brake dynamometers, belt transmission dynamometer, torsion dynamometer, hydraulic dynamometer.

UNIT-IV

Gyroscope: gyroscopes, gyroscopic forces and couples, gyroscopic stabilization, ship stabilization, stability of four wheel and two wheel vehicles moving on curved paths.

Course Outcomes (COs): At the end of the course, the student shall be able to:
CO 1- Understand the Static and Inertia Force Analysis.
CO 2- Explore the concept of Balancing of rotating and reciprocating masses.
CO 3- Knowledge of concept of Mechanical Governor.
CO 4- Develop the concept of Gyroscope and its application.
CO 5- explore the concept of Mechanical Vibration.

Text Books:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok kumar Mallik, Third Edition Affiliated East-West Press.
2. Theory of Machine: S.S. Rattan, McGraw Hill Higher Education.

References:

1. Mechanism and Machine Theory: J.S. Rao and R.V. Dukkipati, New age International.
2. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition Mc Graw Hill, Inc .
3. Theory of Machines, Beven, Pearson Indian Education Services, Pvt. Ltd.

<table>
<tr><td>Course code</td><td colspan="5">LC-ME -310G</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science courses</td></tr>
<tr><td>Course title</td><td colspan="5">WORKSHOP LAB -I</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Objectives:</td><td colspan="5">To study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines,NC,CNC machine etc.
To understanding with the practical knowledge required in the core industries and different types of components using the machine tools.</td></tr>
<tr><td>Class work mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Practical mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Experiments: (MANUFACTURING TECHNOLOGY –II LAB)

1. Study and Practice of Orthogonal & Oblique Cutting on a Lathe.
2. Machining time calculation and comparison with actual machining time while cylindrical turning on a Lathe and finding out cutting efficiency.
3. Study of Tool Life while Milling a component on the Milling Machine.
4. Study of Tool Wear of a cutting tool while Drilling on a Drilling Machine.
5. Study of Speed, Feed, Tool, Preparatory (Geometric) and miscellaneous functions for N. C part programming.
6. Part Programming and proving on a NC lathe for:- a. Outside Turning b. Facing and Step Turning c. Taper Turning d. Drilling e. Outside Threading
7. Part Programming and Proving on a NC Milling Machine:-
   a. Point to Point Programming
   b. Absolute Programming
   c. Incremental Programming
8. Part Programming and Proving for Milling a Rectangular Slot.

Course Outcome (COs): At the end of the course, the student shall have practical exposure of:
CO 1- vapour power cycles and find and compare different cycles based on their performance parameters and efficiencies.
CO 2- steam boilers, their types and components.
CO 3- fundamentals of flow of steam through a nozzle.
CO 4- steam turbines and can calculate their work done and efficiencies.
CO 5- types and working of condensers and compressors and define their different types of efficiencies

NOTE:

1. At least Six experiments are to be performed in the Semester.

Course code	**LC-ME -312G**				
Category	Engineering Science courses				
Course title	**WORKSHOP LAB -II**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	0	0	2	1	
Objectives:	After studying this course, students will be able: Understand the how to prepare the graph between bhp, ihp, fhp vs speed by using variable compression test rig. Knowledge of functions of 4 stroke and two stroke engines and Combustion System of IC Engines with Lubrication and Cooling system.				
Class work mark	25 Marks				
Practical mark	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments: (I.C. ENGINES & GAS TURBINES LAB)

1. To study the constructional details & working principles of two-stroke/ four stroke petrol engine.
2. To study the constructional detail & working of two-stroke/ four stroke diesel engine.
3. Analysis of exhaust gases from single cylinder/multi cylinder diesel/petrol engine by Orsat Apparatus.
4. To prepare heat balance sheet on multi-cylinder diesel engine/petrol engine.
5. To find the indicated horse power (IHP) on multi-cylinder petrol engine/diesel engine by Morse Test.
6. To prepare variable speed performance test of a multi-cylinder/single cylinder petrol engine/diesel engine and prepare the curves (i) bhp, ihp,fhp, vs speed (ii) volumetric efficiency & indicated specific specific fuel consumption vs speed.
7. To find fhp of a multi-cylinder diesel engine/petrol engine by Willian's line method & by motoring method.
8. To perform constant speed performance test on a single cylinder/multi-cylinder diesel engine & draw curves of (i) bhp vs fuel rate, air rate and A/F and (ii) bhp vs mep, mech efficiency & sfc.
9. To measure CO & Hydrocarbons in the exhaust of 2- stroke / 4-stroke petrol engine.
10. To find intensity of smoke from a single cylinder / multi-cylinder diesel engine.
11. To draw the scavenging characteristic curves of single cylinder petrol engine.
12. To study the effects of secondary air flow on bhp, sfc, Mech. Efficiency & emission of a two-stroke petrol engine.

Course Outcomes (COs): After studying this course, students will be able:
CO 1- Understand the how to prepare the graph between bhp, ihp, fhp vs speed by using variable compression test rig.
CO 2- Knowledge of functions of 4 stroke and two stroke engines.
CO 3- Learn Combustion System of IC Engines with Lubrication and Cooling system.
CO 4- Familiarization of the pollution control system.

NOTE:

2. At least ten experimentsare tobe performed in the Semester.

3. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institution as perthe scope of the syllabus.

<table>
<tr><td>Course code</td><td colspan="5">LC-ME-314G</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science courses</td></tr>
<tr><td>Course title</td><td colspan="5">HEAT TRANSFER LAB</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Objectives:</td><td colspan="5">(1) The aim of the course is to build a solid foundation in heat transfer exposing students to the three basic modes namely conduction, convection and radiation.
(2) The course will also briefly cover boiling and condensation heat transfer, and the analysis and design of heat exchangers.</td></tr>
<tr><td>Class work mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Practical mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Experiments:

1. To determine the thermal conductivity of a metallic rod.
2. To determine the thermal conductivity of an insulating power.
3. Measurement of heat transfer rate in a channel flow using winglets.
4. To determine the thermal conductivity of a solid by the guarded hot plate method.
5. To find the effectiveness of a pin fin in a rectangular duct natural convective condition and plot temperature distribution along its length.
6. To find the effectiveness of a pin fin in a rectangular duct under forced convective and plot temperature distribution along its length.
7. To determine the surface heat transfer coefficient for a heated vertical tube under natural convection and plot the variation of local heat transfer coefficient along the length of the tube. Also compare the results with those of the correlation.
8. To determine average heat transfer coefficient for a externally heated horizontal pipe under forced convection & plot Reynolds and Nusselt numbers along the length of pipe. Also compare the results with those of the correlations.
9. To measure the emmisivity of the gray body (plate) at different temperature and plot the variation of emmisivity with surface temperature.
10. To find overall heat transfer coefficient and effectiveness of a heat exchange under parallel and counter flow conditions. Also plot the temperature distribution in both the cases along the length of heat of heat exchanger.
11. To verify the Stefen-Boltzmann constant for thermal radiation.
12. To demonstrate the super thermal conducting heat pipe and compare its working with that of the best conductor i.e. copper pipe. Also plot temperature variation along the length with time or three pipes.
13. To study the two phases heat transfer unit.
14. To determine the water side overall heat transfer coefficient on a cross-flow heat exchanger.
15. Design of Heat exchanger using CAD and verification using thermal analysis package eg. I-Deas etc.

Course Outcomes (COs): At the end of the course, the student shall be able to:
CO 1- Understanding the conduction heat transfer coefficient.
CO 2- Design and analyze heat transfer system with practical demonstration.
CO 3- Selection of equipments and their practical demonstration in heat transfer design.
CO 4- Knowledge of development about mass transfer

Note:

1. At least ten experiments are to be performed in the semester.
2. At least seven experiments should be performed from the above list. Remaining three experiments may either be performed from the above list or designed & set by the concerned institute as per the scope of the syllabus.

<table>
<tr><td>Course code</td><td colspan="5">LC-ME-316G</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science courses</td></tr>
<tr><td>Course title</td><td colspan="5">DYNAMICS OF MACHINE LAB</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Objectives:</td><td colspan="5">1. To understand the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems, vibrations.
2. Develop knowledge of analytical and graphical methods for calculating balancing of rotary and reciprocating masses.</td></tr>
<tr><td>Class work mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Practical mark</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Experiments:

1. To perform experiment on Watt and Porter Governors to prepare performance characteristic Curves, and to find stability & sensitivity.
2. To perform experiment on Proell Governor to prepare performance characteristic curves, and to find stability & sensitivity.
3. To perform experiment on Hartnell Governor to prepare performance characteristic Curves, and to find stability & sensitivity.
4. To study gyroscopic effects through models.
5. To determine gyroscopic couple on Motorized Gyroscope.
6. To perform the experiment for static balancing on static balancing machine.
7. To perform the experiment for dynamic balancing on dynamic balancing machine.
8. Determine the moment of inertial of connecting rod by compound pendulum method and tri-flair suspension pendulum.

Course Outcomes: At the end of the course, the student shall be able to:
CO 1- Understand the various practical demonstrations of forces in mechanism.
CO 2- Knowledge of various Design features of mechanism with practical demonstration.
CO 3- Learning the Special purpose mechanism (governor, Gyroscope Cam and followers etc) used in designing of a machine
CO 4- Prepare practical model using the various linkages.

Note :

1. Ten experiments are to be performed in the Semester.
2. At least seven experiments should be performed from the above list. Remaining three experiments should be performed as designed & set by the concerned Institution as per the scope of the syllabus.

Course code	**PCC-ME -318 G**				
Category	Professional Core Courses				
Course title	**SEMINAR**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	0	0	2	1	
Objectives:	1. To teach the student how to face interview and presentation given and remove their hesitation and improve their communications skills and overall personal developments.				
Practical Class mark	25 Marks				
Total	25Marks				
Duration of Exam	03 Hours				

Selecting of Seminar Topics by Teacher or concerned to teacher by students. A seminar topic given by students in semester.

<table>
<tr><td>Course code</td><td colspan="5">PEC-ME -320G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">INTERNAL COMBUSTION ENGINES & GAS TURBINES</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Objectives:</td><td colspan="5">1. To familiarize with the terminology associated with IC engines.
2. To understand the basics of IC engines.
3. To understand combustion, and various parameters and variables affecting it in various types of IC engines.
4. To learn about various systems used in IC engines and the type of IC engine required for various applications</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Air Standard Cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Wankel Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle. Problems.

Carburetion, fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of inject systems; petrol injection, Requirements of ignition system; types of ignition systems ignition timing; spark plugs. Problems.

UNIT-II

Combustion in I.C. Engines: S.I. engines; Ignition limits; stages of combustion in S.I. Engines; Ignition lag; velocity of flame propagation; detonation; effects of engine variables on detonation; theories of detonation; octane rating of fuels; pre-ignition; S.I. engine combustion chambers, Stages of combustion in C.I. Engines; delay period; variables affecting delay period; knock in C.I. engines, Cetane rating; C.I. engine combustion chambers.

Lubrication and Cooling Systems: Functions of a lubricating system, Types of lubrication system; mist, wet sump and dry sump systems; properties of lubricating oil; SAE rating of lubricants, engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators.

UNIT-III

Engine Testing and Performance: Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements; fuel and air consumption, brake power, indicated power and friction power, heat lost to coolant and exhaust gases; performance curves. Problems.

Air pollution from I.C. Engine and Its remedies: Pollutants from S.I. and C.I. Engines, Methods of emission control; alternative fuels for I.C. Engines; the current scenario on the pollution front.

UNIT-IV

Rotary Compressors: Root and vane blowers; Static and total head values; Centrifugal compressors- Velocity diagrams, slip factor, ratio of compression, pressure coefficient, pre-whirl; Axial flow compressor- Degree of reaction, polytropic efficincy, surging, choking and stalling, performance characteristics, Problems.

Gas Turbines: Brayton cycle; Components of a gas turbine plant; open and closed types of gas turbine plants; Optimum pressure ratio; Improvements of the basic gas turbine cycle; multi stage compression with intercooling; multi stage expansion with reheating between stages; exhaust gas heat exchanger, Applications of gas turbines. Problems.

Course Outcomes (COs): At the end of the course, the student shall be able to:
CO 1- Understand the Air Standard Cycles with their applications.
CO 2- Analyze carburetion, injection and ignition systems with new technologies.
CO 3- Conceptualize Combustion System of IC Engines.
CO 4- Knowledge of Lubrication and Cooling systems and fuel cells.
CO 5- Analyses the gas turbines.

Text Books:

1. Internal Combustion Engines –V. Ganesan, Pub.-Tata McGraw-Hill.
2. Gas Turbines - V. Ganesan, Pub.- Tata McGraw Hill.
3. Engineering fundamental of the I.C.Engine – Willard W. Pulkrabek Pub.-PHI,India

References:

1. Internal Combustion Engines & Air pollution- Obert E.F, Pub.-Hopper & Row Pub., New York
2. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGraw Hill, New York
3. Fundamentals of Internal Combustion Engines-H.N. Gupta, PHI, New Delhi

Course code	**PEC-ME -322G**				
Category	Professional Elective Courses				
Course title	**WELDING TECHNOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	3	0	0	3	
Objectives:	1.To study essential concepts for welding processes. 2.To study various techniques for weld testing. 3. To study the concept special welding processes and welding automation.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Oxy-Acetylene Welding: Introduction: Welding processes and their principles, Industrial Applications, Principles of Oxy- Acetylene Welding, Procedure, Types of flames, Poping, Flash Back and Fire. Equipment and Accessories: Torches, Regulators, Pressure Gauges, Gas Cylinders, Filler Rods and Welding Fluxes. Welded Joints and their Defects: Types of Joints and Welding Positions, Common Welding Defects and their control.

Automation in Welding: Introduction, Manual Welding, Semi-Automatic Welding, Automatic Welding, Welding Mechanization, Flexible Automated Welding, Robotic Welding, Types of Welding Robots, Robot Selection Mechanics, Joint tracking system.

UNIT-II

Electric Arc Welding: Principle of Electric Arc Welding: Principle, Welding Procedure, Arc Length, Arc Force and Arc Blow. Equipment and Accessories: Welding Machines, A.C. and D.C. Transformers, Motor Generators, Rectifiers, Use of Tong Tester for measuring welding currents, Types of Electrodes and Indian system of classification and coding of covered Electrodes for Mild Steels.

UNIT-III

Special and Allied Welding Processes: Resistance Welding: Principle, Types and Applications, Equipment and Machinery required. Metal Inert Gas Arc Welding (MIG): Principle, Advantage of Gas Shielded Arc Welding, Types of Metal Transfer, Welding Equipment and Shielding Gases, MIG Welding and its components.CO_2 Welding: Difference from MIG Welding, Principle of operation, Welding Equipments, Welding Parameters, Joint Design, Welding Procedure, Advantages, Disadvantages and Applications. Tungsten Inert Gas Arc Welding: Welding Equipment-Electrodes, Inert gases and Torches, Inert gas shielded, Spot welding Processes. Submerged Arc Welding: Principle of the Process and its Applications, Fluxes and Welding Rods. Soldering and Brazing: Soft and Hard Solders, Fluxes, Soldering Iron, Soldering procedure, principle of Brazing and different methods of Brazing, Comparison between Brazing and Soldering.

UNIT-IV

Destructive Testing of Welds: Destructive tests: their advantage and Types such as Tensile Test, Bend Test, Impact Test, Hardness Test, Fatigue Tests, Equipment required and the test piece Geometry. Computer systems for Welding Engineering: Introduction, computer systems, software for welding engineers, magdata, weld cost, weld vol, distortcalc, cut best, weld best, ferrite predictor and weld selector.

Non Destructive Testing of Welds: Non Destructive Tests: their Advantages and Limitations, Comparison with Destructive Tests, Visual Examination, Dye Penetrant Inspection, Magnetic Particle Inspection, X-Rays and Gamma Rays Inspection and Ultrasonic Inspection of Welds. Standards/ codes for welding.

Course Outcome (COs): At the end of the course, the student shall be able to:

CO 1- Lay down Principles and applications of oxyacetylene and electric arc welding.

CO 2- Understand various types of weld testing.

CO 3- Have Knowledge of techniques of welding automation.

CO 4- Describe methods of advanced and special welding processes. Course Contents:

Text Books: 1. Welding and Welding Technology by R. Little- Tata McGraw Hill Publication.

2. Welding Processes and Technology by R. S. Parmar- Khanna Publication.

References:

1. Welding Technology by Koeingsberger, J. R. Adair- Macmillan.

2. Welding Technology by Rossi- Mc Graw Hill Publications.

3. Welding Handbook, Eighth Edition, Vol. 1 & 2- American Welding Society.

4. Welding, Hoffman, Pearson Indian Education Services, Pvt. Ltd. India

Course code	**PEC-ME -324G**				
Category	Professional Elective Courses				
Course title	**AIRCRAFT TECHNOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	3	0	0	3	
Objectives:	To understand the principles of operation of aircrafts, aerodynamics, general familiarization of aircraft engine systems, maintenance procedures and standard practices.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Principles of Flight: History of flights, Aircraft configurations, Flight control systems; Mechanical control, Powered control, Fly-By-Wire and digital Fly-By-Wire control systems, flying limits, Airframe & engine manufacturers.

Aircraft Thermodynamics: First law of thermodynamics, Second law of thermodynamics, Air standard cycles, Brayton cycle & its variants.

UNIT-II

Aircraft Propulsion: Thrust, Thrust equation, Propulsive efficiency, Factors effecting thrust, Fundamentals of gas turbine engines, Aircraft engine construction, Classification of compressors; centrifugal and axial compressor, Effect of pressure, velocity & temperature change through the compressor, classification of combustion chambers and performance, classification of gas turbines & operation, convergent/divergent nozzles, Type of aircraft engines; turbo jet, turbo-prop & turbo fan engines.

UNIT-III

Aerodynamics of Airplanes: Basics of aerodynamics, Wing airfoil profile and effects, Thrust, drag, lift & gravity, Control surfaces; aileron, elevator, rudder, slat, flap & spoiler, servo tab etc. Thrust reversers.

Engine Systems, Inspection& Maintenance: Fuel system, Lubrication system, Compressor air flow control system, Turbine vanes and blade cooling, Full authority digital electronic engine control, Engine starting and ignition, Fire protection system, Engine Inlet cowling anti icing, environmental control system, engine indicating system, Standard practices of aero engine maintenance, engine overhauling, Bore scope inspection.

UNIT-IV

Miscellaneous Aviation: Concepts and flight of Helicopter, Drone, Air taxi, Rocket etc. History & overview of air war fare, Difference between civil & fighter craft aerodynamics & engines, Development &types of fighter crafts, fighter craft weapons & firing, Safety, maintenance & emergency features. Maritime fighters.

Course Outcomes (COs): At the end of the course, the student shall be able to:

CO 1- Explore principles of flight and the basic thermodynamics involved.

CO 2- Have knowledge of Propulsion fundamentals and application of gas turbine system in aircraft.

CO 3- Understand aerodynamics, different aircraft systems, inspection and maintenance.

CO 4- Explore different aviation systems along with fighter crafts.

References:

1. Kermode, A.C. Flight without formulae, Pearson Education; latest edition

2. Anderson, J.D. Introduction to flights, McGraw-Hill latest edition

3. Engineering Thermodynamics- P K Nag, Tata McGraw Hill

4. Thermodynamics: An Engineering Approach- Cengel and Boles, McGraw Hill Company

5. Hill P.G & Peterson, C.R. "Mechanics & Thermodynamics of propulsion" Pearson education latest edition

6. United Technologies' Pratt & Whitney, "The Aircraft Gas Turbine Engine and its Operation

7. Kroes & Wild, "Aircraft Power Plants", 7th Edition- McGraw Hill, New York, latest edition

8. Mekinley, J.L and R.D. Bent, Aircraft Power Plants, McGraw Hill latest edition

9. Teager, S, "Aircraft Gas Turbine Technology, McGraw Hill latest edition

10. Aviation Maintenance Technician Hand Book- Power Plant Volume -2 FAA-H-8083-32.

<table>
<tr><td>Course code</td><td colspan="5">PEC-ME -326G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">RELIABILITY, AVAILABILITY & MAINTAINABILITY</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Objectives:</td><td colspan="5">The objective of the course is to provide the students with the fundamental concepts, the necessary knowledge and the basic skills related to systems reliability, availability and maintainability.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Reliability Availability and Maintainability (RAM), Development of RAM Engineering, Reliability Availability and Maintainability utilization factors, down time consequences. Failure data analysis, MTBF, MTBR, MTTR, Reliability improvement and apportionment;

UNIT-II

Concept of terro-technology; Statistical distribution associated with reliability engineering.; Quantitative measures of reliability, Bath tub curve; Quantitative; Fault tree analysis (FTA),Failure mode and effect analysis (FMEA), Failure mode, effect and criticality analysis (FMECA).

UNIT-III

Reliability engineering fundamentals and applications, Historical perspectives, Definition of Reliability, Role of Reliability evaluation, Reliability assessment, relationship between Different Reliability functions, typical Hazard functions, Mean time to failure, Cumulative Hazard function and average failure rate.

Application of Probability distribution function in Reliability evaluation combinational Aspects of Reliability, Markov models optimization of system Reliability, Heuristic Methods applied to optimal system Reliability.

UNIT-IV

Maintainability : Definition and application of Maintainability Engineering, Factors affecting Maintainability. Maintainability design criteria, operating and down time categories, Mean time to activity restore equipment, Mean Maintenance man hours, Mean time for corrective and Preventive Maintenance, measures of maintainability and measures to assure maintainability.

Availability, types of Availability, Steady state availability, approaches to increase equipment Availability, Markov analysis of availability.

Course Outcomes: At the end of his course, the students will be able to:

CO 1 Evaluate the reliability of a system and its subcomponents

CO 2 Gain the necessary knowledge about failure distributions and apply failure maintenance techniques.

CO 3 Perform reliability analysis of a system and designing the same CO 4 Estimate systems availability and maintainability,

CO 4 Develop the Markov model for the mechanical systems.

References:

1. Reliability Engineering Fundamentals R. Ramakumar

2 Maintainability, Availability and Dimitri Kececelogu

3. Reliability Engineering Govil

4. Reliability Engineering Balguruswamy

5. Elsayed A. Elsayed, Reliability is Engineering, Addison Wesley, latest edition

6.Cher Ming Tan, "Reliability Assessment of Integrated Circuits and its misconception", Nova Science Publisher, Inc, latest edition

<table>
<tr><td>Course code</td><td colspan="5">HSMC-02G</td></tr>
<tr><td>Category</td><td colspan="5">HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)</td></tr>
<tr><td>Course title</td><td colspan="5">ORGANIZATIONAL BEHAVIOUR</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Objectives:</td><td colspan="5">The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Management and social responsibility, difference between management and administration.

UNIT-II

Introduction of organization:-Meaning and process of Organization, Management v/s Organization;
Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB.
Individual Processes and Behavior-Personality- Concept, determinants and applications; Perception- Concept, process and applications, Learning- Concept ,theories ; Motivation- Concept, techniques and importance.

UNIT-III

Interpersonal Processes- Teams and Groups- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, Conflict- Concept, sources, types, management of conflict; Leadership: Concept, function, styles & qualities of leadership.
Communication – Meaning, process, channels of communication, importance, barriers and overcome of communication.

UNIT-IV

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; Organizational culture - Elements, types and factors affecting organizational culture. Organizational change: Concept, types & factors affecting organizational change, Resistance to Change.

Course Outcomes :On completion of this course, the students will be able

CO1: Students will be able to apply the managerial concepts in practical life.

CO2: The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
CO3: Students will be able to understand the behavioral dynamics in organizations.
CO4: Students will be able to understand the organizational culture and change.

References:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi.

Course code	**HSMC-04G**				
Category	**HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)**				
Course title	**HUMAN RESOURCE MANAGEMENT**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	2	0	0	2	
Objectives:	1. To acquaint the students with the concept and function of human resource management 2. To learn the various human resource systems and programme in an organization to achieve higher productivity 3. To acquaint the students with knowledge of career planning and development, occupational safety, health and wellbeing and union management relationship.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Human Resource Management: concept and scope; Roles, responsibilities and competencies of HR manager; Challenges to HR professionals; Human Resource Planning & Forecasting: significance and process.

UNIT-II

HR Sourcing: Recruitment, Selection and Induction. Job Analysis: job Description and job Specification; Job Design: concept and methods; Job Evaluation-concept &methods; Performance appraisal and counselling.

UNIT-III

Training: training process and methods; Career planning and Development; Succession planning; Employee Compensation: basic concepts & determinants;

UNIT-IV

Industrial Relations and Grievance Handling; Employee welfare; Dispute Resolution; International Human Resource Management; Contemporary Issues in HRM. HR Audit &Accounting, ethics & corporate social responsibility.

Course Outcomes :On completion of this course, the students will be able

CO1: To develop the understanding of the concept of human resource management and to understand its relevance in organizations.

CO2: To develop necessary skill set for application of various HR issues.

CO3: To analyse the strategic issues and strategies required to select and develop manpower resources.

CO4: To integrate the knowledge of HR concepts to take correct business decisions.

Suggested Readings: 1. K. Aswathapa Human resource Management: Text and cases, 6th edition, Tata McGraw Hill, New Delhi,2012

2. Uday Kumar Haldar &Juthika Sarkar(2012) Human resource Management New Delhi, Oxford University Press.

3. De Cenvo, Da & Robbins S.P.(2010) Fundamentals of Human Resource Management, 9th edition, New York, John Wiley & Sons.

4. Gary Dessler (2008) Human Resource Management, 11th edition New Delhi: Pearson Prentice Hall.

5. Tanuja Agarwala, Strategic Human resource Management, Oxford University Press 2007.

References:

1.Handbook of Industrial and Organizational Psychology: Personnel Psychology(Vol. 1). New Delhi: Sage Publications, New Delhi. Armstrong, M. latest edition

2.A Handbook of Human Resource Management Practice (9th ed.). New Delhi : Kogan Page India, Aswathappa, K. latest edition

3.Managing Human Resources. India: Thomson Asi Private Limited. Bratton, J. & Gold, J. latest edition

4.Human Resource Management Theory and Practice (4th ed.), New York, NY: Palgrave Macmillan. Cascio, W.F &Aguinis, H. latest edition

Course code	**HSMC-06G**				
Category	**OPEN ELECTIVE COURSES(OEC)**				
Course title	**INDUSTRIAL PSYCHOLOGY**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	2	0	0	2	
Objectives:	1. To acquaint students with the applications of psychometric tools and inventories in organizations 2. To acquaint the students with the tools of behavioral and organizational interventions & develop the skills to analyze behavioral issues in organizations. 3. To gain an understanding of the functioning of an organizations through organized field visit. 4. To gain firsthand experience through focused group discussions.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Structured Experience Students need to learn to plan, design and conduct the structured exercises in any of the following areas under supervisor supervision: self-awareness, team building, interpersonal skills, leadership skills, perception, decision-making and problem solving, creativity, power and politics, communication skills, conflict, stress management, motivation and goal setting, or any recent developments.

UNIT-II

HRD Instruments: (any five: administered, scored, interpreted and discussed) Role efficacy, role stress, coping styles, HRD climate, TOBI, SPRIO, MAOB, emotional intelligence, ENNEAGRAM, conflict management styles, OCTAPACE, leadership, trust, life and goal planning or any recent developments.

Field Visit: Students will get firsthand experience of the organization. Can take up any project given by the organization and write a report. A student can undertake specific or overall activity of the organizations in consultation with the supervisor. The student can choose any organization and write a report: education sector, government sector, health sector, banking sector, service industry, NGO, or any recent developments.

UNIT-III

Force-field Analysis and Appreciative Inquiry Students will conduct with the help of supervisor all the steps of force field analysis (identifying the problem and identifying the desired state; identifying the forces involved, and determining the strengths of each force. Action plans for increasing driving forces and reducing restraining forces and appreciative inquiry (4 D approach: discovery, dreaming, designing and destiny) as an OD intervention. After conducting the same students will write the report of the same.

UNIT-IV

Focused Group Discussion Either students conduct a focus group based on need diagnostic or problem focused group study in any area of consumer behavior (customers of sales, retail, banking, insurance, aviation etc) or industrial / organizational psychology/human resource and submit a report. a) Select the team b) Select the participants c) Decide on time and location d) Prepare for and conduct focus group discussion e) Submit a report .

Course Learning Outcomes (CLOs) By the end of this course, students will be able to demonstrate the following:

1. Describe major topics and subspecialties including critical theory and research finding that have defined the field of I/O psychology
2. Describe the complicated systems of individual and group psychological processes involved in the world of work
3. Connect the basic principles of I/O psychology to personnel and human resources management within the organization
4. Describe the ways in which individual career choices and work-lefe success can be improved through the benefits of I/O psychology
5. Use APA style writing and to enhance psychological writing

References:

1. Barbour, R. (2007). Doing Focus Groups. Los Angeles: Sage Publications. Clark, A.W. latest edition
2. Experimenting with organizational life: The action research approach. New York: Plenum Press. Cooperrider, D.L., Whitney, D. &Stavros, J.M. latest edition
3. Appreciative Inquiry Handbook: For Leaders of Change (2nd ed.). San Francisco, USA: Berrett – Koehler Publishers Inc. French, W.L., Cecil, H.B., & Vohra, V. latest edition
4. Organizational Development: Behavioral Science Interventions for Organization Improvement (latest ed.). New Delhi: Prentice Hall. Krueger, R.A., Casey, M.A. latest edition
5. Focus Groups: A practical guide for Applied Research (latest ed.). Los Angeles: Sage Publications, Los Angeles. Litosselitti, L. latest edition
6. Using Focus Groups in Research. New York, NY:Continuum. Pareek, U. & Purhoit, S. latest edition
7. Training Instruments in HRD and OD (3rd ed.). New Delhi: Tata McGraw Hill. Pfeiffer, J.W. &Jones, J.E. latest edition
8. A Handbook of structured Experiences for Human Relations Training. San Diego, CA: University Associates Inc. Sayeed, O.B & Pareek, U. latest edition
9. Actualizing Managerial Roles: Studies in Role Efficacy. New Delhi: Tata McGraw – Hill Publishing Company Limited. Watkins, J.M., Bernard, J., Kelly, M.R. latest edition
10. Appreciative Inquiry: Change at the Speed of Imagination (2nd ed.). USA: John Wiley and Sons Inc.

Course code	**HSMC-08G**				
Category	**HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES (HSMC)**				
Course title	**FUNDAMENTALS OF MANAGEMENT**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	2	0	0	2	
Objectives:	Students will be able to understand the how evolution of Management and contribution of Management thinkers. The importance of staffing and training ;the concept of material management and inventory control; the components of marketing and advertising ;various sources of finance and capital structure.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Meaning of management, Definitions of Management, Characteristics of management, Management vs. Administration. Management-Art, Science and Profession. Importance of Management. Development of Management thoughts. Principles of Management. The Management Functions, Inter-relationship of Managerial functions. Nature and Significance of staffing, Personnel management, Functions of personnel management, Manpower planning, Process of manpower planning, Recruitment, Selection; Promotion - Seniority Vs. Merit. Training - objectives and types of training.

UNIT-II

Production Management : Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Brief introduction to the concepts of material management, inventory control; its importance and various methods.

UNIT-III

Marketing Management - Definition of marketing, marketing concept, objectives & Functions of marketing. Marketing Research - Meaning; Definition; objectives; Importance; Limitations; Process. Advertising - meaning of advertising, objectives, functions, criticism.

UNIT-IV

Introduction of Financial Management, Objectives of Financial Management, Functions and Importance of Financial Management. Brief Introduction to the concept of capital structure and various sources of finance.

Course outcomes:

Students will be able to understand

CO1 - Evolution of Management and contribution of Management thinkers.

CO2 - importance of staffing and training

CO3 - the concept of material management and inventory control

CO4 - the components of marketing and advertising

CO5 - various sources of finance and capital structure

TEXT BOOKS: 1. Principles and Practice of Management - R.S. Gupta, B.D.Sharma, N.S. Bhalla.(Kalyani Publishers)

2. Organisation and Management - R.D. Aggarwal (Tata Mc Graw Hill)

REFERENCES:

1. Principles & Practices of Management – L.M. Prasad (Sultan Chand & Sons)

2. Management – Harold, Koontz and Cyrilo Donell (Mc.Graw Hill).

3. Marketing Management – S.A. Sherlikar (Himalaya Publishing House, Bombay).

4. Financial Management - I.M. Pandey (Vikas Publishing House, New Delhi)

5. Management - James A.F. Stoner & R.Edward Freeman, PHI.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Electronics & Communication Engineering)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Electronics & Communication Engineering) – 5th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Course	PCC-ECE301G	Electromagnetic Waves	3	1	0	4	4	25	75		100	3
2	Professional Core Course	PCC-ECE303G	Computer Organization & Architecture	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-ECE305G	Communication Engineering	3	1	0	4	4	25	75		100	3
4	Professional Core Course	PCC-ECE307G	Digital Signal Processing	3	1	0	4	4	25	75		100	3
5	Program Elective Course	Refer to Annexure I	Program Elective –I	3	1	0	4	4	25	75		100	3
6	Open Elective Course	Refer to Annexure II	Open Elective-I	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-ECE323G	Electromagnetic Waves Lab	0	0	3	3	1.5	25		25	50	3
8	Professional Core Course	LC-ECE325G	Digital Signal Processing Lab	0	0	3	3	1.5	25		25	50	3
9	Training	PT-ECE327G	Practical Training – 1	-	-	-	-	-	-	-	* Refer Note 1		
		TOTAL CREDIT						**25**				**700**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded ‘F’ grade is required to repeat Practical Training.

   Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Scheme of Studies and Examination
B.TECH (Electronics & Communication Engineering) – 6th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Course	PCC-ECE302G	Control Systems	3	1	0	4	4	25	75		100	3
2	Professional Core Course	PCC-ECE304G	Computer Network	3	1	0	4	4	25	75		100	3
3	Humanities/ Basic Science	HUM-ECE-306G	Engineering Ethics	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-ECE308G	CMOS Design	3	1	0	4	4	25	75		100	3
5	Program Elective Course	Refer to Annexure I	Program Elective –II	3	1	0	4	4	25	75		100	3
6	Open Elective Course	Refer to Annexure II	Open Elective-II	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-ECE322G	Computer Network Lab	0	0	4	4	2	25		25	50	3
8	Professional Core Course	LC-ECE324G	Control System Lab	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-ECE326G	Mini Project/Electronic Design workshop	0	0	4	4	2	25		25	50	3
		TOTAL CREDIT						**27.5**				**750**	

Note:

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

Annexure I

Program Elective Courses

Elective –I

PEC-ECE309G	Power Electronics
PEC-ECE311G	Nano electronics
PEC-ECE313G	Linear IC Applications
PEC-ECE315G	Scientific computing

Elective –II

PEC-ECE310G	Bio-Medical Electronics
PEC-ECE312G	VHDL and Digital Design
PEC-ECE314G	Introduction to MEMS
PEC-ECE316G	Speech and Audio Processing

Annexure II

Open Elective Courses

Open Elective-I

OEC-ECE317G	Object Oriented Programming with C++
OEC-ECE319G	Additive Manufacturing
OEC-ECE321G	Measurements and Instrumentation

Open Elective-II

OEC-ECE318G	Python Programming
OEC-ECE320G	Probability and Stochastic Processes

PCC-ECE301G ELECTROMAGNETIC WAVES

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant, characteristic impedance, reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Unit II

Maxwell's Equations - Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface. Uniform plane wave, Propagation of plane wave, Wave polarization, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection.

Unit III

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit IV

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

References:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, latest edition
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, latest edition, Prentice Hall, latest edition
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Characterize uniform plane wave
4 Calculate reflection and transmission of waves at media interface
5 Analyze wave propagation on metallic waveguides in modal form
6 Understand principle of radiation and radiation characteristics of an antenna

PCC-ECE303G COMPUTER ORGANIZATION & ARCHITECTURE

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes.

Register Transfer and Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit II

Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Central Processing Unit : General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

Unit III

Pipeline and Vector Processing: Introduction to Parallel Processors, Amdahl's Law, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors, SIMD Array Processors, Pipeline Hazards.

Unit IV

Input-output Organization: I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts.

Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

References:

1) "Computer System Architecture", latest edition by M.Morris Mano, Pearson.
2) "Computer Organization and Design: The Hardware/Software Interface", latest edition by David A. Patterson and John L. Hennessy, Elsevier.
3) "Computer Organization and Embedded Systems", latest edition by CarlHamacher, McGraw Hill Higher Education.

4) “Computer Architecture and Organization”, latest edition by John P. Hayes, WCB/McGraw-Hill
5) “Computer Organization and Architecture: Designing for Performance”, latest edition by William Stallings, Pearson Education
6) “Computer System Design and Architecture”, latest edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1 Understand the basics structure of computers, operations and instruction
2 Design arithmetic and logic unit.
3 Understand pipelined execution and design control unit.
4 Understand parallel processing architectures.
5 Understand the various memory systems and I/O communication.

PCC-ECE305G COMMUNICATION ENGINEERING

L T P
3 1 -

Theory : 75 Marks
Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Spectral Analysis:

Fourier series, Fourier transforms, Convolution Theorem, Correlation, Cross-Correlation and autocorrelation.

Unit -II

Information Theory:

Introduction to information and entropy, channel capacity for discrete and continuous channels, Shannon's Theorem, Shannon-Hartley Theorem, Noisy channels, coding theory : Shannon-Fano coding, minimum redundance coding, maximization of entropy of a continuous message transmission rate, effect of medium on the information, selection of channels ,effect of noise and its minimization.

Unit -III

Random Signal Theory:

Representation of random signals, concept of probability, probability of joint occurrence, conditional probability, discrete probability theory, continuous random variables, probability distribution function, probability density function, joint probability density functions.

Unit -IV

Random Signal Theory:

Statistical average and moments, Ergodic processes, correlation Function, power spectral density, central limit theory, response of linear system to random signals. Error function Covariance relation among the spectral densities of the two input-output random processes. Cross spectral densities, optimum filters. Introduction to Linear Block Code and cyclic Codes

References:

1. Principles of Communication Systems : Taub Schiling; TMH
2. Communication Systems : Singh and Sapre ; TMH
3. Communication Systems : A Bruce Carlson; TMH

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. To Study and Derive equations for entropy mutual information and channel capacity for all types of channels.

2. To acquire the knowledge about Fourier series and Fourier transform signal analysis tool.
3 Design a digital communication system by selecting an appropriate error correcting codes for a particular application.
4 To learn about Probability of Random signal theory and process.
5 Formulate the basic equations of linear block codes and a cyclic code.
6 Compare the performance of digital communication system by evaluating the probability of error for different error correcting codes

PCC-ECE307G DIGITAL SIGNAL PROCESSING

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z- transforms, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

Unit II

Frequency Representation of Signal and Systems: Frequency Domain analysis concept, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Parsevals Identity.

Unit III

Design of Digital Filter : Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling Method, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.

Unit IV

Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks

References :

1 John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles,

Algorithms And Applications, Prentice Hall, latest edition
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, latest edition
3. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, latest edition
6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, latest edition
7. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations, Convolution and Correlation.
2. To Study the basics, mathematical analysis and applications of DFT and FFT
3. To study the design and implementation of Digital Filters.
4. To impart practical knowledge of signal processing operations in MATLAB.

LC-ECE323G **ELECTROMAGNETIC WAVES LAB**

L T P
- - 3

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hour

Hands-on experiments related to the course contents PCC-ECE301G

LC-ECE325G **DIGITAL SIGNAL PROCESSING LAB**

L T P
- - 3

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hour

List of Experiments

Experiments to be performed:

1. Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
2. To develop program for Z-Transform
3. To develop program for Convolution of sequences
4. To develop program for Correlation of sequences
5. To develop program for DFT & IDFT of two sequences
6. To develop program for FFT of two Sequences
7. To develop program for Circular Convolution
8. To design analog filter (low-pass, high pass, band-pass, band-stop).
9. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
10. To develop program for Interpolation and Decimation of sequences
11. To design FIR filters using windows technique.
12. Detection of Signals buried in Noise
13. Effect of noise on signals

PCC-ECE302G CONTROL SYSTEMS

L T P
3 1 -

Theory : 75 Marks
Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Systems Components and Their Representation

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

Unit II

Time Response Analysis And Stability Concept

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control.

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus.

Unit III

Frequency Domain Analysis

Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

Unit IV

Control System Analysis Using State Variable Methods

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations.

References:

1. Gopal. M., " Control Systems: Principles and Design" , Tata McGraw-Hill, latest edition
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, latest edition
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, latest edition
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Characterize a system and find its steady state behaviour
2. Analyse the time domain specification and calculate steady state errors..
3. Investigate stability of a system using different tests
4. Illustrate the state space model of a physical system.

PCC-ECE304G **COMPUTER NETWORK**

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction and Physical Layer

Networks – Network Types LAN –MAN – WAN – Protocol Layering – OSI Model - TCP/IP Protocol suite – Network Hardware, Internetworks – Network Software – Protocol hierarchies –– Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II

Data-Link Layer & Media Access

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – ALOHA protocols - Overview of IEEE standards – Media Access Control – Sliding Window protocols, Error Handling - Bridges - Switches – High Speed LANs - Gigabit Ethernet - Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices - Multiplexing.

UNIT III

Network Layer

Network Layer Services –Performance – IPV4 Addresses –Network Layer Protocols: IP, Internet Control Protocols – ICMP, ARP, RARP, BOOTP. Internet Multicasting – IGMP-ICMP v4 – IP Addressing – Classless and Classfull Addressing - Sub-netting - Congestion control– QoS.- Overview of IPv6

UNIT IV

Transport Layer and Application Layer

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol –Connectionless vs Connection-oriented transport - Remote Procedure Call.
WWW and HTTP – FTP –Telnet –SSH – DNS –Electronic mail, MIME, SNMP.

References:

1. J.F. Kurose and K. W. Ross, " Computer Networking – A top down approach featuring the Internet", Pearson Education, latest edition
2. L. Peterson and B. Davie, " Computer Networks – A Systems Approach" Elsevier Morgan Kaufmann Publisher, latest edition
3. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall
4. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, latest edition
5. Andrew Tanenbaum, "Computer networks", Prentice Hall
6. D. Comer, "Computer Networks and Internet/TCP-IP", Prentice Hall

7. William Stallings, “Data and computer communications”, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to:

1. Visualise the different aspects of networks, protocols and network design models.
2. Examine various Data Link layer design issues and Data Link protocols.
3. Analyse and compare different LAN protocols.
4. Compare and select appropriate routing algorithms for a network.
5. Examine the important aspects and functions of network layer, transport layer and application layer in internetworking.

HUM-ECE306G ENGINEERING ETHICS

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Ethics and Professionalism: Ethics and Excellence in Engineering, Micro and Macro Issues, Dimensions of Engineering, Potential Moral Problems, What Is Engineering Ethics, Why Study Engineering Ethics? Responsible Professionals, Professions, and Corporations: Saving Citicorp Tower, Meanings of Responsibility, Engineering as a Profession, Ethical Corporations and Senses of Corporate Responsibility. Moral Reasoning and Codes of Ethics, Moral Choices and Ethical Dilemmas, Rights Ethics, Duty Ethics, Utilitarianism, Virtue Ethics, Self-Realization Ethics, Ethical Egoism, Which Ethical Theory Is Best?

UNIT II

Engineering as Social Experimentation: Engineering as Experimentation, Engineers as Responsible Experimenter, Commitment to Safety: The Concept of Safety, Risks, Acceptability of Risk, Assessing and Reducing Risk: Uncertainties in Design, Risk-Benefit Analyses, Personal Risk versus Public Risk, Examples of Improved Safety, Three Mile Island, Safe Exits.

UNIT III

Truth and Truthfulness: Whistle-Blowing, Moral Guidelines, Protecting Whistle-Blowers, Common Sense Procedures, Beyond Whistle-Blowing, Honesty and Research Integrity: Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity, Bias and Self-Deception, Protecting Research Subjects, Giving and Claiming Credit.
Computer Ethics: The Internet and Free Speech, Power Relationships, Property, Privacy,Additional Issues.

UNIT IV

Environmental Ethics: Engineering, Ecology, and Economics, Environmental Moral Frameworks, Human-Centered Ethics, Sentient-Centered Ethics, Biocentric Ethics, Ecocentric Ethics, Religious Perspectives.
Global Justice: Multinational Corporations, Technology Transfer and Appropriate Technology, Bhopal, “When in Rome”, International Rights, Promoting Morally Just Measures, Weapons Development and Peace, Involvement in Weapons Work, Defense Industry Problems, Peace Engineering.

References:

1. Mike W. Martin and Roland Schinzinger, “Introduction to Engineering Ethics”, Second Edition, McGraw Hill, New Delhi, latest edition

2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, latest edition
3. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, latest edition
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, latest edition
5. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, latest edition
6. Edmund G Seebauer and Robert L Barry, “Fundametals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, latest edition
7. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi latest edition
8. World Community Service Centre, " Value Education", Vethathiri publications, Erode, latest edition
9 Web sources:
i. www.onlineethics.org
ii. www.nspe.org
iii. www.globalethics.org
iv. www.ethics.org

Outcomes:

Upon completion of the course, the student should be able to

1. apply ethics in society
2. discuss the ethical issues related to engineering
3. realize the responsibilities and rights in the society
4. realize the importance of sustainable development

PCC-ECE308G **CMOS DESIGN**

L T P Theory : 75 Marks
3 1 - Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction of MOS Transistor

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V characteristics, C-V characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II

Combinational Circuit Design

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.

Power: Dynamic Power, Static Power, Low Power Architecture.

Interconnect: Interconnect Modelling and Impact

UNIT III

Sequential Circuit Design

Static latches and Registers Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

Timing Issues: Timing Classification of Digital System, Synchronous Design

UNIT IV

Design of Arithmetic Building Blocks and Subsystem

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry

References:

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4thEdition, Pearson Education India, latest edition
2. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, latest edition
3. C.Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, latest edition
4. P. Douglas, VHDL: programming by example, McGraw Hill, latest edition
5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Examine the CMOS circuit's behaviour and its characteristics.
2. Design and realization of combinational & sequential digital circuits.
3. Interpret different Architectures and performance tradeoffs involved in designing and realizing the circuits in CMOS technology.
4. Design the Arithmetic blocks and Memory structures

LC-ECE322G **COMPUTER NETWORK LAB**

L T P Practical Exam: 25 Marks

\- - 4 Lab work : 25 Marks

Total: 50 Marks

Duration of Exam: 3 Hours

List of Experiments

1. Running and using services/commands like ping, trace route, NSLOOKUP, ARP, TELNET, FTP, etc.
2. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
3. Network Topology – Star, Bus, Ring
4. Simulate the transmission of ping messaged over a network topology and find the number of packets dropped due to congestion.
5. Understanding IP Addressing using the simulation tool.
6. Study of various application protocols using the simulation like FTP, HTTP
7. Understand IP forwarding within a LAN and across a router
8. Understand the working of "Connection Establishment" in TCP using Network simulation using tools
9. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied
10. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)
11. To determine the optimum persistence of a CSMA / CD network
12. Implementation of distance vector routing algorithm
13. Implementation of Link state routing algorithm
14. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
15. Encryption and decryption.

LC-ECE324G **CONTROL SYSTEM LAB**

L T P
- - 3

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hour

Hands-on experiments related to the course contents PCC-ECE307G

LC-ECE326G MINI PROJECT/ELECTRONICDESIGN WORKSHOP

L T P Practical Exam: 25 Marks

- - 4 Lab work : 25 Marks

Total: 50 Marks

Duration of Exam: 3 Hours

Guidelines:

1. The mini- project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within two week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.
3. Write comprehensive report on mini project work.

PROGRAM ELECTIVE COURSES

PEC-ECE309G POWER ELECTRONICS

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Role of Power electronics, SCR- Construction, working principles of SCR, V-I characteristics of SCR, Two transistor analogy of SCR, Protection of SCR, Different methods of SCR triggering, Different commutation circuits for SCR, Construction & working principle of DIAC, TRIAC, IGBT, GTO, MOSFET, UJT and their V-I characteristics. Basic idea about the selection of Heat sink for thyristors.

Unit -II

Controlled Rectifiers: Single phase half wave-controlled rectifier with R, R-L Load & concept of freewheeling diode, Single phase half controlled full wave rectifier (Half Bridge and Full Bridge with R, R-L Load), Single phase full wave centre tapped rectifier, Three phase full wave half-controlled and fully controlled bridge rectifier (R Load)

Inverters: Principle of operation of basic inverter circuits, concepts of duty cycle, series & parallel, inverters & their applications.

Unit -III

Choppers: Introduction, types of choppers (Class A, Class B, Class C and Class D). Step up and step-down choppers.

Cyclo-converters: Dual Converters and cyclo- converters: Introduction, types & basic working principle of dual converters and cyclo- converters & their applications.

Unit -IV

Thyristorised Control of Electric drives

DC drive control: Half wave drives, Full wave drives, Chopper drives (Speed control of DC motor using choppers)

AC drive control: Phase control, Constant V/F operation, Cyclo-converter /Inverter drives, Slip control AC drives

Applications of power devices:

light intensity control, speed control of universal motors, fan regulator, battery charger. Uninterrupted power supplies (UPS online, off line), SMPS Application of Power Electronics in Electrical vehicles controls. UJT as relaxation oscillator.

References:

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.

3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V.R.Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

PEC-ECE311G **NANO ELECTRONICS**

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Introduction to nanotechnology, applications of nano electronics. Basics of Quantum Mechanics: Wave nature of particles and wave-particle duality, Pauli Exclusion Principle, wave functions and Schrodinger's equations, Density of States, Band Theory of Solids, Particle in a box Concepts

Unit -II

Shrink-down approaches: CMOS scaling: advantages and limitations. Nanoscale MOSFETs, FINFETs, Vertical MOSFETs, system integration limits (interconnect issues etc.)

Unit -III

Nanostructure materials, classifications of nanostructure materials, zero dimensional, one dimensional, two dimensional and three dimensional, properties and applications Characterization techniques for nanostructured materials: SEM, TEM and AFM

Unit -IV

Nano electronis devices : Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

References:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, latest edition
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, latest edition
3. K.E. Drexler, Nanosystems, Wiley, latest edition
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, latest edition
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.

PEC-ECE313G **LINEAR IC APPLICATIONS**

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Differential and cascade amplifiers: Balanced, unbalanced output differential amplifiers, FET differential amplifier, current mirrors, level Translators, cascade configuration of amplifiers, operational amplifiers, Introduction to ideal OP-AMP, characteristic parameters, Practical OP-AMP, its equivalent circuit and op-amp circuit configurations.

Unit-II

Op-amp with negative feedback and frequency response: Block diagram representation of feedback amplifier, voltage series feedback, voltage shunt feedback differential amplifiers, frequency response compensating network, frequency response of internally compensative op-amp and non compensating op-amp. High frequency op- amp equivalent circuit, open loop gain V/s frequency, closed loop frequency response, circuit stability, slew rate.

Unit-III

Op-amp application: DC, AC amplifiers, peaking amplifier, summing, scaling, averaging and instrumentation amplifier, differential input output amplifier, voltage to current converter, current to voltage converter, very high input impedance circuit, integration and differential circuit, wave shaping circuit, active filters, oscillators.

Unit-IV

Specialized liner IC applications: 555 timer IC (monostable & astable operation) & its applications, Universal active filter, PLL, power amplifier, 8038 IC.

References:

1. R.A. Gayakwaed , OP-amps and Linear Integrated circuits .
2. K.R.Botkar , Integrated circuit

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Design linear and non-linear applications of op-amps.
2. Design the applications using Timer and PLL.
3. Design the applications using Voltage regulator and Function generator ICs

.

PEC-ECE315G **SCIENTIFIC COMPUTING**

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

Unit-II

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination,Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Eigenvalues and singular values:Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Unit-III

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method

Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation

Unit-1V

Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigen value Problems Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

References:

1. Heath Michael T., "Scientific Computing: An Introductory Survey", McGraw-Hill, latest edition

2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, latest edition
3. Xin-she Yang (Ed.)., "Introduction To Computational Mathematics", World Scientific Publishing Co., latest edition
4. Kiryanov D. and Kiryanova E., "Computational Science", Infinity Science Press, latest edition
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, " Scientific Computing With MATLAB And Octave", Springer, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.
3. Analyse the various system using Linear and Non Linear methods.
4. Understand application of these methods in various areas.

PEC-ECE310G **BIO-MEDICAL ELECTRONICS**

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Physiology and Transducers

Brief introduction to human physiology: Cell and its structure; Resting and Action Potential; Nervous system: Functional organisation of the nervous system ; Structure of nervous system, neurons; synapse; transmitters and neural communication; Cardiovascular system; respiratory system; Basic components of a biomedical system. Biomedical transducers: Transducers selection criteria; Piezoelectric; ultrasonic; displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases; Temperature measurements; Fibre optic temperature sensors;

UNIT II

Electro – Physiological Measurements

Bio-electrodes and Biopotential amplifiers for ECG, EMG, EEG, etc.: Limb electrodes; floating electrodes; pregelled disposable electrodes ;Micro, needle and surface electrodes; Preamplifiers, differential amplifiers, chopper amplifiers ;Isolation amplifier. ECG; EEG; EMG; ERG; Lead systems and recording methods

UNIT III

Non-Electrical Parameter Measurements

Measurement of blood temperature, pressure and flow; ; Cardiac output ; Heart rate ; Heart sound ;Pulmonary function measurements ; spirometer ; Impedance plethysmography; Photo Plethysmography, Body Plethysmography

UNIT IV

Medical Imaging

Ultrasonic, X-ray and nuclear imaging: Radio graphic and fluoroscopic techniques; Computer tomography; MRI; Ultrasonography

UNIT V

Assisting And Therapeutic Equipments

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped; Safety aspects: safety parameters of biomedical equipments

References:

1. W.F. Ganong, Review of Medical Physiology, latest edition, Medical Publishers
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, latest edition
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, latest edition
4. R.S.Khander, Handbook of Biomedical Instrumentation‖, TATA Mc Graw-Hill, New Delhi, latest edition
5. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, latest edition

Course outcomes:

At the end of the course, students will demonstrate the ability to:

1. Apply the concept of electronic systems design in Bio- medical applications.
2. Examine the practical limitations on the electronic components while handling bio- substances.
3. Evaluate and analyze the biological processes like other electronic processes.
4. Familiar the various Bio Medical Measuring Instruments and therapeutic equipments.
5. Aware of electrical safety of medical equipments

PEC-ECE312G **VHDL AND DIGITAL DESIGN**

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioral dataflow and structural models.

Unit-II

VHDL Statements: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

Unit-III

Combinational & Sequential Circuit Design: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

Unit-IV

Design of Microcomputer & Programmable Device: Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

References:

1. Ashenden - Digital design,Elsevier
2. IEEE Standard VHDL Language Reference Manual latest edition
3. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society Press.
4. "A VHDL Primmer" : Bhasker; Prentice Hall latest edition
5. “Digital System Design using VHDL” : Charles. H.Roth ; PWS latest edition
6. "VHDL-Analysis & Modelling of Digital Systems” : Navabi Z; McGraw Hill.
7. VHDL-IV Edition: Perry; TMH latest edition
8. “Introduction to Digital Systems” : Ercegovac. Lang & Moreno; John Wiley latest edition
9. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH latest edition
10. Modern Digital Electronics- III Edition: R.P Jain; TMH latest edition
11. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier

Course Outcome

At the end of the course, students will demonstrate the ability to:

1. Understand the need & application of hardware description language.
2. Modelling & simulations of various basic & advanced digital systems using VHDL.
3. Implementation of various basic & advanced digital systems using FPGAs.
4. Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.

PEC-ECE314G **INTRODUCTION TO MEMS**

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Overview of MEMS and Microsystems: Introduction Microsystems vs. MEMS, Microsystems and Microelectronics, the Multidisciplinary Nature of Microsystems design and manufacture, Application of MEMS in various industries. MEMS and Miniaturization: Scaling laws in miniaturization: Introduction to Scaling, Scaling in Geometry, Rigid Body dynamics, Electrostatic forces, Electromagnetic forces, Electricity, Fluid Mechanics, Heat Transfer, Overview of Micro/Nano Sensors, Actuators and Systems.

Unit -II

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

Unit -III

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods

Unit -IV

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems: electrostatics, coupled electro mechanics.

References:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, latest edition
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano- and Microengineering (Vol. 8). CRC press, latest edition
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, latest edition
4. M. Madou, Fundamentals of Microfabrication, CRC Press, latest edition
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, latest edition
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Interpret the basics of micro/nano electromechanical systems including their applications and advantages
2. Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
3. Analyze the key performance aspects of electromechanical transducers including sensors and actuators
4. Comprehend the theoretical foundations of quantum mechanics and Nano systems

PEC-ECE316G **SPEECH AND AUDIO PROCESSING**

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

Unit-II

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Unit-III

Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

Unit-IV

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

References:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students *Edition)* latest edition
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C.Chu, WileyInter science, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.

OPEN ELECTIVE COURSE

OEC-ECE317G OBJECT ORIENTED PROGRAMMING WITH C++

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit – I

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, data abstraction, encapsulation, inheritance, polymorphism.

Basic Concepts of C++: Structure of C++ Program, Basic Data Types, Expressions and Control Structures, Functions in C++: Call by Value, Call by Reference, Recursion, Function Overloading.

Unit - II

Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static data members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes.

Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, destructors.

Unit - III

Inheritance: Introduction, defining derived classes, forms of inheritance, virtual base classes.

Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

Unit - IV

Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors.

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

References:

1. E. Balagurusamy,"Object Oriented Programming with C++", 7th edition, Mc Graw Hill Education(2018)
2. Bjrane Stroustrup, "C++ Programming language",3rd edition, Pearson education Asia(1997)
3. Lafore R."Object oriented Programming in C++",4th Ed. Techmedia,New Delhi(2002).
4. Yashwant Kenetkar,"Let us C++",1stEd.,Oxford University Press(2006)
5. B.A. Forouzan and R.F. Gilberg,CompilerScience,"A structured approach using C++" Cengage Learning, New Delhi.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Students will able to understand and implement real-world entities like inheritance, data hiding, polymorphism, etc in programming.
2. Students will aware about C++ Programming concepts.
3. Students will implement the function overloading and operator overloading concepts.
4. Students will understand the concept of Exception handling.

OEC-ECE319G ADDITIVE MANUFACTURING

L T P Theory: 75 Marks
3 - - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction and basic principles: Definition , Generic Additive Manufacturing (AM) Process, Terms related to AM, Benefits of AM, Distinction between AM and CNC machining, Additive manufacturing process chain: Variation between different AM machines, Metal systems, Maintenance of Equipment, Material Handling Issues.

Unit-II

Introduction to rapid prototyping (RP), Need of RP in context of batch production, Basic principles of RP, Steps in RP, Process chain in RP in integrated CAD- CAM environment, Advantages of RP, Medical applications.

Unit-III

Classification of different RP techniques – based on raw materials, layering technique (2-D or 3-D) and energy sources: Process technology, Stereo-lithography (SL), photo polymerization, liquid thermal polymerization, Solid foil polymerization

Unit-IV

Selective laser sintering, Selective powder binding, ballistic particle manufacturing – both 2- D and 3-D, Fused deposition modeling, Shape melting, Laminated object manufacturing, Solid ground curing, 3 D printing

Unit-V

Introduction to reverse engineering Meaning, Use, RE-The generic process, Phase of RE– scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development. Learning Resources

References:

1. Ian Gibson, David W. Rosen, Brent Stucker , “Additive Manufacturing Technologies” ,Springer, latest edition

2. Chua C. K., Leong K. F., and Lim C. S., “Rapid Prototyping: Principles and Applications”, Second Edition, World Scientific Publishers latest edition

3. Patri K. Venuvinod, Weiyin Ma “Rapid Prototyping: Laser-Based and Other Technologies” Springer , latest edition

4. Peter D. Hilton, Hilton/Jacobs, Paul F. Jacobs, “Rapid Tooling: Technologies and Industrial Applications”, CRC Press, latest edition

5. Burns. M, “Automated fabrication”, Prentice-Hall, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Apply the knowledge of Additive Manufacturing and Rapid Prototyping technologies.
2. Understand the applications in various fields, reverse engineering techniques.
3. Understand about mechanical properties and geometric issues relating to specific rapid prototyping applications.

OEC-ECE321G MEASUREMENTS AND INSTRUMENTATION

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Science of Measurement

Measurement System – Instrumentation – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards

Transducers

Classification of Transducers – Variable Resistive transducers – Strain gauges , Thermistor, RTD-Variable Inductive transducers- LVDT, RVDT,- Variable Capacitive Transducers – Capacitor microphone- Photo electric transducers – Piezo electric transducers – Thermocouple – IC sensors - Fibre optic sensors – Smart/intelligent sensors.

Unit-II

Signal Conditioning and Signal Analyzers

DC and AC bridges – Wheatstone, Kelvin, Maxwell, Hay and Schering. Pre- amplifier – Isolation amplifier – Filters – Data acquisition systems. Spectrum Analyzers – Wave analyzers – Logic analyzers

Unit-III

Digital Instruments

Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution in DVM - Guarding techniques – Frequency counter- Data Loggers – Introduction to IEEE 488/GPIB Buses.

Unit-IV

Data Display Recording and Systems

Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and Digital Recorders and printers. Virtual Instrumentation - Block diagram and architecture – Applications in various fields. Measurement systems applied to Micro and Nanotechnology

References:

1. Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, latest edition
2. Ernest o Doebelin and Dhanesh N Manik, "Measurement Systems", McGraw-Hill, latest edition
3. A course in Electrical & Electronics Measurements & Instrumentation : A.K.Sawhney; Dhanpat Rai & Sons.
4 Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Discuss about the principles of various measurement techniques.
2. Analyze the transducers and its impact.
3. Explain about the signal conditioning system and signal analyzers.
4. Illustrate the digital measurement equipments.
5. Emphasize the need for data acquisition, recording and display systems.

OEC-ECE318G **PYTHON PROGRAMMING**

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT I

Introduction: Fundamental ideas in computer science; modern computer systems, installing Python; basic syntax, interactive shell, editing, saving, and running a script; The concept of data types; variables, assignments; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Control statements: if-else, loops (for, while)

UNIT II

Strings, text files: String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

UNIT III

Lists, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries, arguments and return values. Recursive functions.

UNIT IV

Object Oriented concepts: Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, Inheritance, polymorphism, operator overloading; abstract classes.

References:

1. “Fundamentals of Python: First Programs” Kenneth Lambert, Course Technology, Cengage Learning, latest edition

2. “Introduction to Computer Science Using Python: A Computational Problem-Solving Focus”, By Charles Dierbach, John Wiley & Sons, latest edition

Course outcomes:

At the end of the course, students will demonstrate the ability to:

1. For a given conceptual problem student will able to analyze the problem and write a program in python with basic concepts.

2. For a given problem of Strings and texts, student will able to analyze the problem and write a program in python with basic concepts involving strings and texts.
3. The knowledge of list and dictionary will enable student to implement in python language and analyze the same.
4. Student will able to write a program using functions to implement the basic concepts of object oriented programming language

OEC-ECE320G PROBABILITY AND STOCHASTIC PROCESSES

L T P Theory: 75 Marks
3 - - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT I

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models. Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions;

UNIT II

Joint distributions, functions of one and two random variables, moments of randomvariables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;

UNIT III

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

UNIT IV

Random process. Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density.

References:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
6. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand representation of random signals
2. Investigate characteristics of random processes

3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited ‘A+’ Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Electronics & Telecommunication Engineering)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.Tech (Electronics &Telecommunication Engineering) – 5th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Engineering Science Course	PCC-ECE301G (Common with ECE)	Electromagnetic Waves	3	1	0	4	4	25	75		100	3
2	Professional Core Course	PCC-ECE303G (Common with ECE)	Computer Organization &Architecture	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-ETE301G	Digital Communication	3	1	0	4	4	25	75		100	3
4	Professional Core Course	PCC-ECE307G (Common with ECE)	Digital Signal Processing	3	1	0	4	4	25	75		100	3
5	Program Elective Course	Refer to Annexure I	Program Elective–I	3	1	0	4	4	25	75		100	3
6	Open Elective Course	Refer to Annexure II	Open Elective-I	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-ECE323G (Common with ECE)	Electromagnetic Waves Lab	0	0	3	3	1.5	25		25	50	3
8	Professional Core Course	LC-ECE325G (Common with ECE)	Digital Signal Processing Lab	0	0	3	3	1.5	25		25	50	3
9	Training	PT-ETE-327G	Practical Training – 1	-	-	-	-	-	-	-	* Refer Note 1		
		TOTAL CREDIT						**25**				**700**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.

   Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Scheme of Studies and Examination
B.Tech (Electronics & Telecommunication Engineering) – 6th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Course	PCC-ECE302G (Common with ECE)	Control Systems	3	1	0	4	4	25	75		100	3
2	Professional Core Course	PCC-ECE304G (Common with ECE)	Computer Network	3	1	0	4	4	25	75		100	3
3	Humanities/ Basic Science	HUM-ECE306G (Common with ECE)	Engineering Ethics	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-ECE308G (Common with ECE)	CMOS Design	3	1	0	4	4	25	75		100	3
5	Program Elective Course	Refer to Annexure I	Program Elective–II	3	1	0	4	4	25	75		100	3
6	Open Elective Course	Refer to Annexure II	Open Elective-II	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-ECE322G (Common with ECE)	Computer Network Lab	0	0	4	4	2	25		25	50	3
8	Professional Core Course	LC-ECE324G (Common with ECE)	Control System Lab	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-ECE326G (Common with ECE)	MiniProject/ElectronicDesignworkshop	0	0	4	4	2	25		25	50	3
		TOTAL CREDIT						**27.5**				**750**	

Note:

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

Annexure I

Program Elective Courses

Elective–I

PEC-ETE303G	Information Theory and Coding
PEC-ECE311G	Nano Electronics (Common with ECE)
PEC-ECE313G	Linear IC Applications (Common with ECE)
PEC-ECE315G	Scientific Computing (Common with ECE)

Elective–II

PEC-ECE310G	Bio-Medical Electronics (Common with ECE)
PEC-ECE312G	VHDL and Digital Design (Common with ECE)
PEC-ECE314G	Introduction to MEMS (Common with ECE)
PEC-ECE316G	Speech and Audio Processing (Common with ECE)

Annexure II

Open Elective Courses

Open Elective-I

OEC-ECE317G	Object Oriented Programming with C++ (Common with ECE)
OEC-ECE319G	Additive Manufacturing (Common with ECE)
OEC-ECE321G	Measurements and Instrumentation (Common with ECE)

Open Elective-II

OEC-ECE318G	Python Programming(Common with ECE)
OEC-ECE320G	Probability and Stochastic Processes(Common with ECE)

PCC-ECE301G **ELECTROMAGNETIC WAVES**

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Transmission Lines- Equations of Voltage and Current on TX line, Propagation constant, characteristic impedance, reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

Unit II

Maxwell's Equations - Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface. Uniform plane wave, Propagation of plane wave, Wave polarization, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Plane Waves at a Media Interface- Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection.

Unit III

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

Unit IV

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

References:

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, latest edition
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, latest edition, Prentice Hall, latest edition
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Characterize uniform plane wave
4 Calculate reflection and transmission of waves at media interface
5 Analyze wave propagation on metallic waveguides in modal form
6 Understand principle of radiation and radiation characteristics of an antenna

PCC-ECE303G **COMPUTER ORGANIZATION & ARCHITECTURE**

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes.

Register Transfer and Microoperations: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit II

Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Central Processing Unit : General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

UnitIII

Pipeline and Vector Processing: Introduction to Parallel Processors, Amdahl's Law, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processors, SIMD Array Processors, Pipeline Hazards.

Unit IV

Input-output Organization: I/O deviceinterface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts.

Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

References:

1) "Computer System Architecture", 3rd Edition by M.Morris Mano, Pearson.
2) "Computer Organization and Design: The Hardware/Software Interface", latest Edition by David A. Patterson and John L. Hennessy, Elsevier.
3) "Computer Organization and Embedded Systems", latest Edition by CarlHamacher, McGraw Hill Higher Education.
4) "Computer Architecture and Organization", latest Edition by John P. Hayes, WCB/McGraw-Hill

5) “Computer Organization and Architecture: Designing for Performance”, latest Edition by William Stallings, Pearson Education
6) “Computer System Design and Architecture”, latest Edition by Vincent P. Heuring and Harry F. Jordan, PearsonEducation.

CourseOutcomes:

Attheendofthis coursestudentswilldemonstratetheability to

1 Understand the basics structure of computers, operations and instruction
2 Design arithmetic and logic unit.
3 Understand pipelined execution and design control unit.
4 Understand parallel processing architectures.
5 Understand the various memory systems and I/O communication.

PCC-ETE301G DIGITAL COMMUNICATION

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Pulse modulation: sampling process, PAM and TDM; aperture effect. PPM noise inPPM, channel Bandwidth, Recovery of PAM and PPM signals Quantization process, quantization noise, PCM, µ Law and A- law compressors. Encoding, Noise in PCM,DM, delta sigma modulator, DPCM, ADM.

UNIT-II

Base band pulse transmission: Matched filter and its properties average probability of symbol error in binary enclosed PCM receiver, Intersymbol interference, Nyquist criterion for distortionless base band binary transmission, ideal Nyquist channel raised cosine spectrum, correlative level coding Duo binary signalling, tapped delay line equalization, adaptive equalization, LMS algorithm, Eye pattern.

UNIT-III

Digital pass band transmission: Pass band transmission model; gram Schmidt orthogonalization procedure, geometric Interpretation of signals, Response of bank ofcorrelaters to noise input, detection of known signal in noise, Hierarchy of digital modulation techniques, BPSK, DPSK, DEPSK, QPSK, systems; ASK, FSK, QASK, Many FSK, MSK, Many QAM, Signal space diagram and spectra of the above systems, effect of intersymbol interference, bit symbol error probabilities, synchronization.

UNIT-IV

Spread spectrum modulation: Pseudonoise sequence, A notion of spread spectrum, direct sequence spread spectrum with coherent BPSK, signal space dimensionality & processing gain, probability of error, frequency spread spectrum, CDM.

References:

1. John G. Proakis, Digital Communication, PHI
2. Taub & Schilling, Principles of Communication, TMH
3. Simon Haykin, Communication systems, John Wiley & Sons

CourseOutcomes:

Attheendofthis coursestudentswilldemonstratetheability to

1. Design PCM systems
2. Design and implement base band transmission schemes
3. Design and implement band pass signaling schemes
4. Analyze the spectral characteristics of band pass signaling schemes and their noise performance
5. Design digital modulation techniquesschemes

PCC-ECE307G DIGITAL SIGNAL PROCESSING

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z- transforms, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

Unit II

Frequency Representation of Signal and Systems: Frequency Domain analysis concept, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Parsevals Identity.

Unit III

Design of Digital Filter : Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling Method, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.

Unit IV

Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks

References :

1 John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, latest edition
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, latest edition
3. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, latest edition
6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, latest edition
7. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations, Convolution and Correlation.
2. To Study the basics, mathematical analysis and applications of DFT and FFT
3. To study the design and implementation of Digital Filters.
4. To impart practical knowledge of signal processing operations in MATLAB.

LC-ECE323G ELECTROMAGNETIC WAVES LAB

L T P
- - 3

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hours

Hands-onexperimentsrelatedtothecoursecontentsPCC-ECE301G

LC-ECE325G DIGITAL SIGNAL PROCESSING LAB

L T P
- - 3

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hours

List of Experiments

Experiments to be performed:

1. Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
2. To develop program for Z-Transform
3. To develop program for Convolution of sequences
4. To develop program for Correlation of sequences
5. To develop program for DFT & IDFT of two sequences
6. To develop program for FFT of two Sequences
7. To develop program for Circular Convolution
8. To design analog filter (low-pass, high pass, band-pass, band-stop).
9. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
10. To develop program for Interpolation and Decimation of sequences
11. To design FIR filters using windows technique.
12. Detection of Signals buried in Noise
13. Effect of noise on signals

PCC-ECE302G **CONTROL SYSTEMS**

L T P Theory : 75 Marks
3 1 - Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Systems Components and Their Representation

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

Unit II

Time Response Analysis And Stability Concept

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control.

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus.

Unit III

Frequency Domain Analysis

Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

Unit IV

Control System Analysis Using State Variable Methods

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations.

References:

1. Gopal.M.,“ControlSystems:PrinciplesandDesign”,TataMcGraw-Hill,latest edition
2. Kuo,B.C.,“AutomaticControl System”,PrenticeHall,sixthedition,latest edition
3. Ogata,K.,“ModernControlEngineering”,PrenticeHall,secondedition,latest edition
4. Nagrath&Gopal,“ModernControlEngineering”, NewAgeInternational,NewDelhi

CourseOutcomes:

Attheendofthis coursestudentswilldemonstratethe ability to

1. Characterizeasystemandfinditssteadystatebehaviour
2. Analyse the time domain specification and calculate steady state errors..
3. Investigatestabilityofasystemusingdifferenttests
4. Illustrate the state space model of a physical system.

PCC-ECE304G **COMPUTER NETWORK**

L T P — Theory: 75 Marks
3 1 - — Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction and Physical Layer

Networks – Network Types – Protocol Layering – TCP/IP Protocol suite – OSI Model - Network Hardware – LAN –MAN – WAN, Internetworks – Network Software – Protocol hierarchies — Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT II

Data-Link Layer & Media Access

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – ALOHA protocols - Overview of IEEE standards – Media Access Control – Sliding Window protocols, Error Handling - Bridges - Switches – High Speed LANs - Gigabit Ethernet - Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices - Multiplexing.

UNIT III

Network Layer

Network Layer Services –Performance – IPV4 Addresses –Network Layer Protocols: IP, Internet Control Protocols – ICMP, ARP, RARP, BOOTP. Internet Multicasting – IGMP-ICMP v4 – IP Addressing – Classless and Classfull Addressing - Sub-netting - Congestion control– QoS.- Overview of IPv6

UNIT IV

Transport Layer and Application Layer

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol –Connectionless vsConnection-oriented transport - RemoteProcedureCall.
WWW and HTTP – FTP –Telnet –SSH – DNS –Electronic mail, MIME, SNMP.

References:

1. J.F.KuroseandK.W.Ross,"ComputerNetworking–Atopdownapproachfeaturing theInternet",PearsonEducation,latestEdition
2. L. Peterson andB. Davie, "Computer Networks – A Systems Approach" Elsevier MorganKaufmannPublisher,latestEdition.
3. T.Viswanathan,"TelecommunicationSwitchingSystemandNetworks",Prentice Hall
4. B. A. Forouzan, "Data Communications and Networking", Tata McGraw Hill, latest Edition
5. AndrewTanenbaum,"Computernetworks",PrenticeHall

6. D.Comer,“ComputerNetworksandInternet/TCP-IP”, PrenticeHall
7. WilliamStallings,“Dataandcomputercommunications”,PrenticeHall

CourseOutcomes:

Attheendofthis coursestudentswilldemonstratetheability to:

i. Visualise the different aspects of networks, protocols and network design models.
ii. Examine various Data Link layer design issues and Data Link protocols.
iii. Analyse and compare different LAN protocols.
iv. Compare and select appropriate routing algorithms for a network.
v. Examine the important aspects and functions of network layer, transport layer and application layer in internetworking.

HUM-ECE306G ENGINEERING ETHICS

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Ethics and Professionalism: Ethics and Excellence in Engineering, Micro and Macro Issues, Dimensions of Engineering, Potential Moral Problems, What Is Engineering Ethics, Why Study Engineering Ethics? Responsible Professionals, Professions, and Corporations: Saving Citicorp Tower, Meanings of Responsibility, Engineering as a Profession, Ethical Corporations and Senses of Corporate Responsibility. Moral Reasoning and Codes of Ethics, Moral Choices and Ethical Dilemmas, Rights Ethics, Duty Ethics, Utilitarianism, Virtue Ethics, Self-Realization Ethics, Ethical Egoism, Which Ethical Theory Is Best?

UNIT II

Engineering as Social Experimentation: Engineering as Experimentation, Engineers as Responsible Experimenter, Commitment to Safety: The Concept of Safety, Risks, Acceptability of Risk, Assessing and Reducing Risk: Uncertainties in Design, Risk-Benefit Analyses, Personal Risk versus Public Risk, Examples of Improved Safety, Three Mile Island, Safe Exits.

UNIT III

Truth and Truthfulness: Whistle-Blowing, Moral Guidelines, Protecting Whistle-Blowers, Common Sense Procedures, Beyond Whistle-Blowing, Honesty and Research Integrity: Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity, Bias and Self-Deception, Protecting Research Subjects, Giving and Claiming Credit.
Computer Ethics: The Internet and Free Speech, Power Relationships, Property, Privacy,Additional Issues.

UNIT IV

Environmental Ethics: Engineering, Ecology, and Economics, Environmental Moral Frameworks, Human-Centered Ethics, Sentient-Centered Ethics, Biocentric Ethics, Ecocentric Ethics, Religious Perspectives.
Global Justice: Multinational Corporations, Technology Transfer and Appropriate Technology, Bhopal, “When in Rome”, International Rights, Promoting Morally Just Measures, Weapons Development and Peace, Involvement in Weapons Work, Defense Industry Problems, Peace Engineering.

References:

1. Mike W. Martin and Roland Schinzinger, “Introduction to Engineering Ethics”, Second Edition, McGraw Hill, New Delhi, latest edition
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, latest edition

3. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, latest edition
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, latest edition
5. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, latest edition
6. Edmund G Seebauer and Robert L Barry, “Fundametals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, latest edition
7. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi latest edition
8. World Community Service Centre, " Value Education", Vethathiri publications, Erode, latest edition
9 Web sources:
i. www.onlineethics.org
ii. www.nspe.org
iii. www.globalethics.org
iv. www.ethics.org

Outcomes:

Upon completion of the course, the student should be able to

1. apply ethics in society
2. discuss the ethical issues related to engineering
3. realize the responsibilities and rights in the society
4. realize the importance of sustainable development

PCC-ECE308G **CMOS DESIGN**

L T P Theory : 75 Marks
3 1 - Class work : 25 Marks
Total : 100 Marks
Duration of Exam : 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Introduction of MOS Transistor

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V characteristics, C-V characteristics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II

CombinationalCircuitDesign

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls.

Power: Dynamic Power, Static Power, Low Power Architecture.

Interconnect: Interconnect Modelling and Impact

UNITIII

Sequential Circuit Design

Static latches and Registers Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.

Timing Issues: Timing Classification of Digital System, Synchronous Design

UNIT IV

Design of Arithmetic Building Blocks and Subsystem

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff.

Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry

References:

1. N.H.E. WesteandD.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective,4thEdition,Pearson EducationIndia,latest edition
2. J.Rabaey,DigitalIntegratedCircuits:ADesignPerspective,PrenticeHallIndia,latest edition
3. C.MeadandL.Conway,IntroductiontoVLSISystems,AddisonWesley,latest edition
4. P.Douglas,VHDL:programmingbyexample,McGrawHill,latest edition
5. L.GlaserandD.Dobberpuhl,TheDesignandAnalysis ofVLSICircuits,Addison Wesley,latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Examine the CMOS circuit’s behaviour and its characteristics.
2. Design and realization of combinational & sequential digital circuits.
3. Interpret different Architectures and performance tradeoffs involved in designing and realizing the circuits in CMOS technology.
4. Design the Arithmetic blocks and Memory structures

LC-ECE322G **COMPUTER NETWORK LAB**

L T P Practical Exam: 25 Marks

\- - 4 Lab work : 25 Marks

Total: 50 Marks

Duration of Exam: 3 Hours

List of Experiments

1. Running and using services/commands like ping, trace route, NSLOOKUP, ARP, TELNET, FTP, etc.
2. Network simulation using tools like Cisco Packet Tracer, NetSim, OMNeT++, NS2, NS3, etc.
3. Network Topology – Star, Bus, Ring
4. Simulate the transmission of ping messaged over a network topology and find the number of packets dropped due to congestion.
5. Understanding IP Addressing using the simulation tool.
6. Study of various application protocols using the simulation like FTP, HTTP
7. Understand IP forwarding within a LAN and across a router
8. Understand the working of “Connection Establishment” in TCP using Network simulation using tools
9. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied
10. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF)
11. To determine the optimum persistence of a CSMA / CD network
12. Implementation of distance vector routing algorithm
13. Implementation of Link state routing algorithm
14. Study of Network simulator (NS) and simulation of Congestion Control Algorithms using NS
15. Encryption and decryption.

LC-ECE324G **CONTROL SYSTEM LAB**

L T P
- - 3

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 3 Hours

Hands-onexperimentsrelatedtothecoursecontentsPCC-ECE307G

LC-ECE326G MINI PROJECT/ELECTRONICDESIGNWORKSHOP

L T P Practical Exam: 25 Marks

\- - 4 Lab work : 25 Marks

Total: 50 Marks

Duration of Exam: 3 Hours

Guidelines:

1. The mini- project is a team activity having 3-4 students in a team. This is electronic product design work with a focus on electronic circuit design.
2. The mini project may be a complete hardware or a combination of hardware and software. The software part in mini project should be less than 50% of the total work.
3. Mini Project should cater to a small system required in laboratory or real life.
4. It should encompass components, devices, analog or digital ICs, micro controller with which functional familiarity is introduced.
5. After interactions with course coordinator and based on comprehensive literature survey/ need analysis, the student shall identify the title and define the aim and objectives of mini-project.
6. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and submit the proposal within two week of the semester.
7. The student is expected to exert on design, development and testing of the proposed work as per the schedule.
8. Art work and Layout should be made using CAD based PCB simulation software. Due considerations should be given for power requirement of the system, mechanical aspects for enclosure and control panel design.
9. Completed mini project and documentation in the form of mini project report is to be submitted at the end of semester.
10. The tutorial sessions should be used for discussion on standard practices used for electronic circuits/product design, converting the circuit design into a complete electronic product, PCB design using suitable simulation software, estimation of power budget analysis of the product, front panel design and mechanical aspects of the product, and guidelines for documentation /report writing.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Conceive a problem statement either from rigorous literature survey or from the requirements raised from need analysis.
2. Design, implement and test the prototype/algorithm in order to solve the conceived problem.

3 Write comprehensive report on mini project work.

PROGRAM ELECTIVECOURSES

PEC-ETE303G INFORMATION THEORY AND CODING

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Probabilityandrandomprocesses:Probability, randomvariables,Probabilitydistribution and density functions,JointStatistics,Conditional Statistics,independence,Functionsof random variables &randomvectors,Expectation,moments,Characteristic Functions,Convergenceof a sequenceofrandomvariables,CentralLimitTheorem,RandomProcesses, meanandAuto Correlation,Stationaryergodicity,PowerSpectraldensity,Responseofmemory-lessand linear systems,GaussianPoisson,Markovprocesses..

Unit-II

Elementsofinformation theoryandsourcecoding: Introduction,informationasameasureof uncertainty, Entropy, itsproperties, discretememory less channels, Mutualinformation, its properties,BSC,BEC.Channelcapacity,Shanon'stheoremon coding formemory lessnoisy channels.Separable binarycodes,Shanon–Fanoencoding,Noiselesscoding,Theoremof decodability, Averagelength of encoded message, Shanon's binary encoding, Fundamental theoremofdiscretenoiselesscoding,Huffman'sminimumredundancycodes.

Unit-III

Linearblockcodes:Introductiontoerrorcontrolcoding,Typesofcodes,MaximumLikelihood decoding,Types oferrorsanderrorcontrol strategies,Galoisfields,Linearblockcodes,Error detectingandcorrectingcapabilitiesofablockcode,Hammingcode,cycliccode,B.C.H.codes.

Unit-IV

ConvolutionalcodesandARQ:Transferfunctionof convolutionalcode,Syndromdecoding, Majoritylogicdecodablecodes,Viterbidecoding,distance propertiesofbinaryconvolutional codes,Bursterrorcorrectingconvolutionalcodes,generaldescription ofbasicARQstrategies, HybridARQschemes.

References:

1.Papoulis,A.Probability,RandomVariablesandStochastic Processes,MGH.
2.Gray, R.M.Davission,L.D,IntroductiontoStatisticalSignalProcessing-WebEdition-1999.
3.F. M. Reza,InformationTheory,McGrawHill.
4.Das,MullickandChatterjee,DigitalCommunication,WileyEasternLtd.
5.ShuLinandJ.Costello,ErrorControlCoding,PrenticeHall.

6.B. R.Bhat,ModernProbabilityTheory,NewAgeInternationalLtd.

CourseOutcomes:

Attheendofthis coursestudentswilldemonstratetheability to

1. Describe the concepts of information theory and digital communication.
2. Construct efficient codes for data on imperfect communication channels.
3. Explain the concepts of coding schemes.

PEC-ECE311G **NANO ELECTRONICS**

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Introduction to nanotechnology, Basics ofQuantumMechanics: Wave nature of particles and wave-particle duality, Pauli Exclusion Principle, wave functions and Schrodinger's equations,Densityof States, BandTheory of Solids,ParticleinaboxConcepts

Unit -II

Shrink-down approaches: CMOS scaling: advantages and limitations. Nanoscale MOSFETs, FINFETs, Vertical MOSFETs, system integration limits (interconnect issues etc.)

Unit -III

Nanostructure materials, classifications of nanostructure materials, zero dimensional, one dimensional, two dimensional and three dimensional, properties and applications Characterization techniques for nanostructured materials: SEM, TEM and AFM

Unit -1V

Nano electronis devices : ResonantTunnelingDiode,Coulombdots, Quantum blockade,Singleelectron transistors, Carbonnanotubeelectronics,Band structureand transport,devices, applications,2D semiconductorsandelectronicdevices,Graphene,atomisticsimulation

References:

1. G.W.Hanson,FundamentalsofNanoelectronics,Pearson,latest edition
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic MaterialandNovelDevices),Wiley-VCH,latest edition
3. K.E.Drexler,Nanosystems,Wiley,latest edition
4. J.H.Davies,ThePhysicsofLow-DimensionalSemiconductors,Cambridge University Press,latest edition
5. C.P.Poole,F.J.Owens,IntroductiontoNanotechnology,Wiley,latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.

PEC-ECE313G LINEAR IC APPLICATIONS

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Differential and cascade amplifiers:Balanced, unbalanced outputdifferential amplifiers,FETdifferential amplifier,currentmirrors,level Translators,cascade configurationof amplifiers,operational amplifiers,IntroductiontoidealOP-AMP, characteristic parameters,Practical OP-AMP,itsequivalentcircuitandop-amp circuit configurations.

Unit-II

Op-amp with negative feedback and frequency response: Block diagram representation offeedback amplifier,voltageseriesfeedback,voltageshuntfeedback differentialamplifiers,frequencyresponsecompensatingnetwork,frequencyresponse ofinternallycompensativeop-ampandnon compensatingop-amp.Highfrequency op-ampequivalentcircuit,openloopgainV/sfrequency,closedloopfrequency response, circuitstability,slewrate.

Unit-III

Op-ampapplication:DC,AC amplifiers,peakingamplifier,summing,scaling, averagingandinstrumentationamplifier, differentialinputoutputamplifier,voltage to currentconverter, current to voltage converter, very high inputimpedance circuit, integrationanddifferentialcircuit,waveshapingcircuit,activefilters,oscillators.

Unit-IV

Specializedliner ICapplications: 555timerIC(monostable&astableoperation)&its applications,Universalactivefilter,PLL,poweramplifier,8038 IC.

References:

1.R.A.Gayakwaed,OP-ampsandLinearIntegratedcircuits.

2.K.R.Botkar,Integratedcircuit

Course Outcomes:

Attheendofthis coursestudentswilldemonstratetheability to

1. Design linearandnon-linearapplications of op-amps.
2. DesigntheapplicationsusingTimer andPLL.
3. Designtheapplicationsusing Voltageregulator and Functiongenerator ICs.

PEC-ECE315G **SCIENTIFIC COMPUTING**

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

Unit-II

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination,Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Eigenvalues and singular values:Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Unit-III

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method

Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation

Unit-1V

Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigen value Problems Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers AndSimulation,Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

References:

1. Heath Michael T., " Scientific Computing: An Introductory Survey" , McGraw-Hill, latest edition
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P.

Flannery, "Numerical Recipes: The Art of Scientific Computing" , Cambridge University Press, latest edition
3. Xin-she Yang (Ed.)., " Introduction To Computational Mathematics" , World Scientific Publishing Co., latest edition
4. Kiryanov D. and Kiryanova E., " Computational Science" , Infinity Science Press, latest edition
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, "Scientific Computing With MATLAB And Octave", Springer, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.
3. Analyse the various system using Linear and Non Linear methods.
4. Understand application of these methods in various areas.

PEC-ECE310G BIO-MEDICAL ELECTRONICS

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Physiology and Transducers

Brief introduction to human physiology: Cell and its structure; Resting and Action Potential; Nervous system: Functional organisation of the nervous system ; Structure of nervous system, neurons; synapse; transmitters and neural communication; Cardiovascular system; respiratory system; Basic components of a biomedical system. Biomedical transducers: Transducers selection criteria; Piezoelectric; ultrasonic; displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases; Temperature measurements; Fibre optic temperature sensors;

UNIT II

Electro – Physiological Measurements

Bio-electrodes and Biopotential amplifiers for ECG, EMG, EEG, etc.: Limb electrodes; floating electrodes; pregelled disposable electrodes ;Micro, needle and surface electrodes; Preamplifiers, differential amplifiers, chopper amplifiers ;Isolation amplifier. ECG; EEG; EMG; ERG; Lead systems and recording methods

UNIT III

Non-Electrical Parameter Measurements

Measurement of blood temperature, pressure and flow; ; Cardiac output ; Heart rate ; Heart sound ;Pulmonary function measurements ; spirometer ; Impedance plethysmography; Photo Plethysmography, Body Plethysmography

UNIT IV

Medical Imaging

Ultrasonic, X-ray and nuclear imaging: Radio graphic and fluoroscopic techniques; Computer tomography; MRI; Ultrasonography

UNIT V

Assisting And Therapeutic Equipments

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped; Safety aspects: safety parameters of biomedical equipments

References:

1. W.F. Ganong, Review of Medical Physiology, latest edition, Medical Publishers
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, latest edition
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, latest edition
4. R.S.Khander, Handbook of Biomedical Instrumentation‖, TATA Mc Graw-Hill, New Delhi, latest edition

5. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, latest edition

Course outcomes:

At the end of the course, students will demonstrate the ability to:

1. Apply the concept of electronic systems design in Bio- medical applications.
2. Examine the practical limitations on the electronic components while handling bio- substances.
3. Evaluate and analyze the biological processes like other electronic processes.
4. Familiar the various Bio Medical Measuring Instruments and therapeutic equipments.
5. Aware of electrical safety of medical equipments

PEC-ECE312G **VHDL AND DIGITAL DESIGN**

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioral dataflow and structural models.

Unit-II

VHDL Statements: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

Unit-III

Combinational & Sequential Circuit Design: VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

Unit-IV

Design of Microcomputer & Programmable Device: Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

References:

1. Ashenden - Digital design,Elsevier
2. IEEE Standard VHDL Language Reference Manual latest edition
3. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society Press.
4. "A VHDL Primmer" : Bhasker; Prentice Hall latest edition
5. “Digital System Design using VHDL” : Charles. H.Roth ; PWS latest edition
6. "VHDL-Analysis & Modelling of Digital Systems” : Navabi Z; McGraw Hill.
7. VHDL-IV Edition: Perry; TMH latest edition
8. “Introduction to Digital Systems” : Ercegovac. Lang & Moreno; John Wiley latest edition
9. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH latest edition
10. Modern Digital Electronics- III Edition: R.P Jain; TMH latest edition
11. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier

Course Outcome

At the end of the course, students will demonstrate the ability to:

1. Understand the need & application of hardware description language.
2. Modelling & simulations of various basic & advanced digital systems using VHDL.
3. Implementation of various basic & advanced digital systems using FPGAs.
4. Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.

PEC-ECE314G **INTRODUCTION TO MEMS**

L T P Theory: 75 Marks

3 1 - Class work : 25 Marks

Total: 100 Marks

Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Overview of MEMS and Microsystems: Introduction Microsystems vs. MEMS, Microsystems and Microelectronics, the Multidisciplinary Nature of Microsystems design and manufacture, Application of MEMS in various industries. MEMS and Miniaturization: Scaling laws in miniaturization: Introduction to Scaling, Scaling in Geometry, Rigid Body dynamics, Electrostatic forces, Electromagnetic forces, Electricity, Fluid Mechanics, Heat Transfer, Overview of Micro/Nano Sensors, Actuators and Systems.

Unit -II

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

Unit -III

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear

Thermal Expansion, Bending; Energy methods

Unit -IV

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems: electrostatics, coupled electro mechanics.

References:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, latest edition
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano- and Microengineering (Vol. 8). CRC press, latest edition
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, latest edition
4. M. Madou, Fundamentals of Microfabrication, CRC Press, latest edition
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, latest edition
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Interpret the basics of micro/nano electromechanical systems including their applications and advantages
2. Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
3. Analyze the key performance aspects of electromechanical transducers including sensors and actuators
4. Comprehend the theoretical foundations of quantum mechanics and Nano systems

PEC-ECE316G SPEECH AND AUDIO PROCESSING

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction- Speech production and modeling - Human Auditory System; General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

Unit-II

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters, convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Linear Prediction of Speech- Basic concepts of linear prediction; Linear Prediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer, logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Unit-III

Scalar Quantization of LPC- Spectral distortion measures, Quantization based on reflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPC encoders and decoders; Voicing detection; Limitations of the LPC model.

Unit-IV

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.

Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

References:

1. "Digital Speech" by A.M.Kondoz, Second Edition (Wiley Students *Edition)* latest edition
2. "Speech Coding Algorithms: Foundation and Evolution of Standardized Coders", W.C.Chu, WileyInter science, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.

OPEN ELECTIVE COURSE

OEC-ECE317G OBJECT ORIENTED PROGRAMMING WITH C++

L T P Theory: 75 Marks
3 - - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit – I

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, data abstraction, encapsulation, inheritance, polymorphism.

Basic Concepts of C++: Structure of C++ Program, Basic Data Types, Expressions and Control Structures, Functions in C++: Call by Value, Call by Reference, Recursion, Function Overloading.

Unit - II

Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static data members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes.

Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, destructors.

Unit - III

Inheritance: Introduction, defining derived classes, forms of inheritance, virtual base classes.

Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

Unit - IV

Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes, virtual destructors.

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

References:

1. E. Balagurusamy,"Object Oriented Programming with C++", 7th edition, Mc Graw Hill Education(2018)
2. Bjrane Stroustrup, "C++ Programming language",3rd edition, Pearson education Asia(1997)
3. Lafore R."Object oriented Programming in C++",4th Ed. Techmedia,New Delhi(2002).
4. Yashwant Kenetkar,"Let us C++",1stEd.,Oxford University Press(2006)
5. B.A. Forouzan and R.F. Gilberg,CompilerScience,"A structured approach using C++" Cengage Learning, New Delhi.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Students will able to understand and implement real-world entities like inheritance, data hiding, polymorphism, etc in programming.
2. Students will aware about C++ Programming concepts.
3. Students will implement the function overloading and operator overloading concepts.
4. Students will understand the concept of Exception handling.

OEC-ECE319G **ADDITIVE MANUFACTURING**

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction and basic principles: Definition , Generic Additive Manufacturing (AM) Process, Terms related to AM, Benefits of AM, Distinction between AM and CNC machining, Additive manufacturing process chain: Variation between different AM machines, Metal systems, Maintenance of Equipment, Material Handling Issues.

Unit-II

Introduction to rapid prototyping (RP), Need of RP in context of batch production, Basic principles of RP, Steps in RP, Process chain in RP in integrated CAD- CAM environment, Advantages of RP, Medical applications.

Unit-III

Classification of different RP techniques – based on raw materials, layering technique (2-D or 3-D) and energy sources: Process technology, Stereo-lithography (SL), photo polymerization, liquid thermal polymerization, Solid foil polymerization

Unit-IV

Selective laser sintering, Selective powder binding, ballistic particle manufacturing – both 2-D and 3-D, Fused deposition modeling, Shape melting, Laminated object manufacturing, Solid ground curing, 3 D printing

Unit-V

Introduction to reverse engineering Meaning, Use, RE-The generic process, Phase of RE–scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development. Learning Resources

References:

1. Ian Gibson, David W. Rosen, Brent Stucker , "Additive Manufacturing Technologies" ,Springer,latest edition

2. Chua C. K., Leong K. F., and Lim C. S., "Rapid Prototyping: Principles and Applications", Second Edition, World Scientific Publishers latest edition

3. Patri K. Venuvinod, Weiyin Ma "Rapid Prototyping: Laser-Based and Other Technologies" Springer ,latest edition

4. Peter D. Hilton, Hilton/Jacobs, Paul F. Jacobs, "Rapid Tooling: Technologies and Industrial Applications", CRC Press,latest edition

5.Burns. M, “Automated fabrication”, Prentice-Hall,latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Apply the knowledge of Additive Manufacturing and Rapid Prototyping technologies.
2. Understand the applications in various fields, reverse engineering techniques.
3. Understand about mechanical properties and geometric issues relating to specific rapid prototyping applications.

OEC-ECE321G MEASUREMENTS AND INSTRUMENTATION

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Science of Measurement

Measurement System – Instrumentation – Characteristics of measurement systems – Static and Dynamic – Errors in Measurements – Calibration and Standards

Transducers

Classification of Transducers – Variable Resistive transducers – Strain gauges , Thermistor, RTD-Variable Inductive transducers- LVDT, RVDT,- Variable Capacitive Transducers – Capacitor microphone- Photo electric transducers – Piezo electric transducers – Thermocouple – IC sensors - Fibre optic sensors – Smart/intelligent sensors.

Unit-II

Signal Conditioning and Signal Analyzers

DC and AC bridges – Wheatstone, Kelvin, Maxwell, Hay and Schering. Pre- amplifier – Isolation amplifier – Filters – Data acquisition systems. Spectrum Analyzers – Wave analyzers – Logic analyzers

Unit-III

Digital Instruments

Digital Voltmeters – Millimeters – automation in Voltmeter – Accuracy and Resolution in DVM - Guarding techniques – Frequency counter- Data Loggers – Introduction to IEEE 488/GPIB Buses.

Unit-IV

Data Display Recording and Systems

Dual trace CRO – Digital storage and Analog storage oscilloscope. Analog and Digital Recorders and printers. Virtual Instrumentation - Block diagram and architecture – Applications in various fields. Measurement systems applied to Micro and Nanotechnology

References:

1. Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, latest edition
2. Ernest o Doebelin and Dhanesh N Manik, "Measurement Systems", McGraw-Hill, latest edition
3. A course in Electrical & Electronics Measurements & Instrumentation : A.K.Sawhney; Dhanpat Rai & Sons.
4 Albert D.Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Discuss about the principles of various measurement techniques.
2. Analyze the transducers and its impact.
3. Explain about the signal conditioning system and signal analyzers.
4. Illustrate the digital measurement equipments.
5. Emphasize the need for data acquisition, recording and display systems.

OEC-ECE318G PYTHON PROGRAMMING

L T P
3 - -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT I

Introduction: Fundamental ideas in computer science; modern computer systems, installing Python; basic syntax, interactive shell, editing, saving, and running a script; The concept of data types; variables, assignments; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Control statements: if-else, loops (for, while)

UNIT II

Strings, text files: String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

UNIT III

Lists, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries, arguments and return values. Recursive functions.

UNIT IV

Object Oriented concepts: Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, Inheritance, polymorphism, operator overloading; abstract classes.

References:

1. “Fundamentals of Python: First Programs” Kenneth Lambert, Course Technology, Cengage Learning, latest edition

2. “Introduction to Computer Science Using Python: A Computational Problem-Solving Focus”, By Charles Dierbach, John Wiley & Sons, latest edition

Course outcomes

At the end of the course, students will demonstrate the ability to:

1. For a given conceptual problem student will able to analyze the problem and write a program in python with basic concepts.
2. For a given problem of Strings and texts, student will able to analyze the problem and write a program in python with basic concepts involving strings and texts.
3. The knowledge of list and dictionary will enable student to implement in python language and analyze the same.
4. Student will able to write a program using functions to implement the basic concepts of object oriented programming language

OEC-ECE320G PROBABILITY AND STOCHASTIC PROCESSES

L T P Theory: 75 Marks
3 - - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT I

Sets and set operations; Probability space; Conditional probability and Bayes theorem; Combinatorial probability and sampling models. Discrete random variables, probability mass function, probability distribution function, example random variables and distributions; Continuous random variables, probability density function, probability distribution function, example distributions;

UNIT II

Joint distributions, functions of one and two random variables, moments of randomvariables; Conditional distribution, densities and moments; Characteristic functions of a random variable; Markov, Chebyshev and Chernoff bounds;

UNIT III

Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square); Limit theorems; Strong and weak laws of large numbers, central limit theorem.

UNIT IV

Random process. Stationary processes. Mean and covariance functions. Ergodicity. Transmission of random process through LTI. Power spectral density.

References:

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
6. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand representation of random signals

2. Investigate characteristics of random processes
3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Computer Science & Engineering)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Computer Science & Engineering) – 5th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Mark of Class work	Theory	Practical	Total	
1	Engineering Science Course	ESC-CSE-301G	Microprocessor	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-CSE-303G	Computer Networks	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-CSE-305G	Formal Languages & Automata	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-CSE-307G	Design & Analysis of Algorithms	3	0	0	3	3	25	75		100	3
5	Professional Core Course	PCC-CSE-309G	Programming in Java	3	0	0	3	3	25	75		100	3
6	Professional Elective Course	Refer to Annexure I	Elective–I	3	0	0	3	3	25	75		100	3
7	Engineering Science Course	LC-ESC-321G	Microprocessor Lab	0	0	2	2	1	25	-	25	50	3
8	Professional Core Course	LC-CSE-323G	Computer Networks Lab	0	0	3	3	1.5	25	-	25	50	3
9	Professional Core Course	LC-CSE-325G	Design & Analysis of Algorithms Using C++	0	0	3	3	1.5	25	-	25	50	3
10	Professional Core Course	LC-CSE-327G	Programming in Java Lab	0	0	3	3	1.5	25	-	25	50	3
11	Training	PT-CSE-329G	Practical Training-1	-	-	-	-	-	-	-	* Refer Note 1		
		TOTAL CREDIT						**23.5**				**800**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.
   Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Scheme of Studies and Examination
B.TECH (Computer Science & Engineering) – 6th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Mark of Class work	Theory	Practical	Total	
1	Professional Core Course	PCC-CSE-302G	Compiler Design	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-CSE-304G	Artificial Intelligence	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-CSE-306G	Advanced Java	3	0	0	3	3	25	75		100	3
4	Engineering Science Course	ESC-CSE-308G	Mobile and Wireless Communication	3	0	0	3	3	25	75		100	3
5	Professional Elective Course	Refer to Annexure II	Elective-II	3	0	0	3	3	25	75		100	3
6	Professional Elective Course	Refer to Annexure III	Elective-III	3	0	0	3	3	25	75		100	3
7	Project	PROJ-CSE-322G	Project-I	0	0	4	4	2	25		25	50	3
8	Professional Core Course	LC-CSE-324G	Compiler Design Lab	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-CSE-326G	Artificial Intelligence Lab using python	0	0	3	3	1.5	25		25	50	3
10	Professional Core Course	LC-CSE-328G	Advanced Java Lab	0	0	2	2	1	25		25	50	3
11.	Mandatory Courses	MC-317G	Constitution of India	2	0	0							
	TOTAL							**24**				**800**	

*__MC-317G__ is a mandatory non –credit course in which the students will be required passing marks in theory.

NOTE: At the end of 6th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.

Annexure I

Elective –I (Professional Elective Course)

1. PEC-CSE-311G:Software Engineering
2. PEC-CSE-313G : System Programming and System Administration
3. PEC-CSE-315G :Digital Image Processing

Annexure II

Elective –II (Professional Elective Course)

1. PEC-CSE-310G:Advanced Database Management System
2. PEC-CSE-312G :Mobile Application Development
3. PEC-CSE-314G:Computer Graphics
4. PEC-CSE-330G :Communication Engineering

Annexure III

Elective –III (Professional Elective Course)

1. PEC-CSE-316G: Distributed System
2. PEC-CSE-318G :Information Technology & Industry Business Skills
3. PEC-CSE-320G : Data Science
4. PEC-CSE-332G :VHDL and Digital Design

MICROPROCESSOR

<table>
<tr><td>Course code</td><td colspan="5">ESC-CSE-301G</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Microprocessor</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>3</td><td>0</td><td></td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Objectives:

- To make understand architecture and working of Intel 8085 microprocessor in depth.
- To make understand architecture and working of Intel 8086 microprocessor in depth.
- Familiarization with the assembly language programming.
- Familiarization with various peripheral operations

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1
THE 8085 PROCESSOR: Introduction to microprocessor, 8085 microprocessor: Architecture, instruction set, interrupt structure, and Assembly language programming.

Unit: 2
THE 8086 MICROPROCESSOR ARCHITECTURE: Architecture, block diagram of 8086, details of sub-blocks such as EU, BIU; memory segmentation and physical address computations, program relocation, addressing modes, instruction formats, pin diagram and description of various signals.

Unit: 3
INSTRUCTION SET OF 8086: Instruction execution timing, assembler instruction format, data transfer instructions, arithmetic instructions, branch instructions, looping instructions, NOP and HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators, programming examples.

Unit: 4
INTERFACING DEVICE: 8255 Programmable peripheral interface, interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller.

TEXT BOOKS:

1. Microprocessor Architecture, Programming & Applications with 8085: Ramesh S Gaonkar; Wiley Eastern Ltd.
2. Intel Microprocessors 8086- Pentium processor: Brey; PHI

REFERENCE BOOKS:

1. Microprocessors and interfacing: D V Hall; TMH
2. The 8088 & 8086 Microprocessors-Programming, interfacing, Hardware & Applications: Triebel & Singh; PHI
3. Microcomputer systems: the 8086/8088 Family: architecture, Programming &Design: Yu-Chang Liu & Glenn A Gibson; PHI.
4. Advanced Microprocessors and Interfacing: Badri Ram; TMH

Course Outcomes:

- Understand the operation and architecture of Intel 8085 microprocessor including Instruction Set Architecture, assembly language programming, timing and speed of operation.
- Learn the operation of circuits for user interaction through switches, keyboard and display devices.
- Understand the operation and architecture of Intel 8086 microprocessor including Instruction Set Architecture, assembly language programming, timing and speed of operation.
- Understand the motivation and need for peripheral operations circuits for digital data exchange, timer, serial communication, merits of direct memory access, interrupt controller and other circuits.

COMPUTER NETWORKS

Course code	PCC-CSE-303G				
Category	Professional Core Course				
Course title	Computer Networks				
Scheme and Credits	L	T	P	Credits	Semester 5
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objectives:

- To develop an understanding of modern network architectures from a design and
- Performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do Network programming
- To provide a WLAN measurement idea.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: Data communication, Components, Computer networks and its historical development, distributed processing, Internet

Network Models: OSI model and TCP/IP Model

Physical Layer – physical layer functions, Data Representation, Simplex, Half Duplex and Full Duplex Transmission, Modulation and Multiplexing, Packet and circuit switching, Transmission media, Topologies, connectionless and connection-oriented services.

Data Link Layer : Data link layer functions and services, MAC Addressing, Framing, Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Unit: 2

Medium Access Control: MAC layer functions, Random access, Controlled Access and channelization protocols.

Network Layer: Network layer functions and services, Logical addressing, IPv4 classful and classless addressing, subnetting, NAT, IPv4, ICMPv4, ARP, RARP and BOOTP, IPv6, IPv6 addressing, DHCP.

Network Devices: Repeater, hub, switch, router and gateway.

Unit: 3

Routing Algorithms: introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State and Distance Vector Routing

Transport Layer: Transport layer functions and services, Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management

Application Layer: Application layer functions and services, Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP

Unit: 4

Congestion Control, Quality of Service, QoS Improving techniques.

LAN: Ethernet, Token Bus, Token Ring, MAN Architecture- DQDB, WAN Architectures- Frame Relay, ATM, SONET/SDH

Network Security: Firewalls, security goals, types of attack, Introduction to cryptography, Types of ciphers: symmetric and asymmetric key ciphers.

Suggested books:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Suggested reference books:

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

Course Outcomes:

- Explain the functions of the different layer of the OSI Protocol.
- Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) and describe the function of each.
- Identify and connect various connecting components of a computer network.
- Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

FORMAL LANGUAGES AND AUTOMATA

<table>
<tr><td>Course code</td><td colspan="5">PCC-CSE-305G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Formal Languages & Automata</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>3</td><td>0</td><td></td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Objectives:

- To understand basic concepts of formal languages and automata theory.
- To study the types of Automata i.e. NFA, DFA, NFA with ϵ-transition and their interconversion methods and importance.
- To Study formal languages of different kinds, such as regular and context-free languages. Understand the concept of grammar and its types. Removal of ambiguity and reduced form and Normal forms of grammar.
- To develop the concepts and design of higher-level automata to accept the language not accepted by finite automata such as PDA &Turing machine.
- To study the various properties of turing machine and their designing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit 1:

Finite Automata: Introduction: Set, Power Set, Super Set, Alphabet, languages and grammars, productions and derivation, Deterministic finite automata (DFA), Non-Deterministic finite automata (NDFA), Equivalence of DFA and NDFA, Conversion of NFA to DFA , minimization of finite automata, Finite automata with ϵ- moves, Acceptability of a string by a finite Automata.

Introduction to Machines: Properties and limitations of Finite Automata, Mealy and Moore Machines, Equivalence of Mealy and Moore machines.

Unit 2:

Regular Expression: State and prove Arden's Method, Regular Expressions, Recursive definition of regular expression, Regular expression conversion to Finite Automata and vice versa.

Properties of regular languages: Regular language, pumping lemma for regular sets/languages, Application of regular languages.

Unit 3:

Grammars: Chomsky hierarchy of languages, Relation between different types of grammars, Context-free grammar, Derivation tree / Parse tree, Ambiguity in regular grammar and their removal, Reduced Forms: Removal of useless symbols, null and unit productions, Normal Form: Chomsky Normal form(CNF) and Greibach Normal Form(GNF),

Push Down Automata: Introduction to PDA, Deterministic and Non-Deterministic PDA, Design of PDA: Transition table, Transition diagram and acceptability of strings by designed PDA, Pushdown automata (PDA) and equivalence with CFG.

Unit 4:

Turing machines: The basic model for Turing machines (TM), Deterministic and Non-Deterministic Turing machines and their equivalence, Design of Turing Machines: Transition table, Transition diagram and acceptability of strings by designed turing machine. Variants of Turing machines, Halting problem of Turing machine, PCP Problem of Turing Machine, Linear Bounded Automata, TMs as enumerators.

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Suggested books:

1. Introduction to Automata Theory, Languages, and Computation, 3nd Edition, John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Pearson Education.
2. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage Learning.

Suggested reference books

1. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.
2. Raymond Greenlaw, H. James Hoover, Fundamentals of the Theory of Computation, Principles and Practice, Morgan Kaufmann, 1998.
3. John C. Martin: Introduction to Languages and Automata Theory, 3rd edition, Tata Mcgraw-Hill, 2007

Course Outcomes:

- To use basic concepts of formal languages of finite automata techniques.
- To Design Finite Automata's for different Regular Expressions and Languages.
- To Construct context free grammar for various languages.
- To solve various problems of applying normal form techniques, push down automata and Turing Machines.

DESIGN AND ANALYSIS OF ALGORITHMS

<table>
<tr><td>Course code</td><td colspan="5">PCC-CSE-307G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Design and Analysis of Algorithms</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>3</td><td>0</td><td></td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Objectives:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit 1:
Introduction to Algorithms: Algorithm, Performance Analysis (Time and Space complexity), Asymptotic Notation (Big OH, Omega and Theta)-best, average and worst-case behaviour. Elementary Data Structures (Basic terminology of Stacks and Queues, Tree, Graph), Sets and Disjoint Set Union.

Divide and Conquer: General method, Binary Search, Merge Sort, Quick Sort, and other sorting algorithms with divide and conquer strategy, Strassen's Matrix Multiplication algorithms and analysis of these problems.

Unit 2:
Greedy Method: General method, Fractional Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Single source shortest paths.

Dynamic Programming: General method, Optimal Binary Search Trees, 0/1 knapsack, The Traveling Salesperson problem.

Unit 3:
Back Tracking: General method, The 8-Queen's problem, Sum of subsets, Graph Colouring, Hamiltonian Cycles.
Branch and Bound: The method, 0/1 knapsack problem, Traveling Salesperson problem, Efficiency considerations.

Unit 4:

NP Hard and NP Complete Problems: Basic concepts, Cook's theorem, NP hard graph problems, NP hard scheduling problems, NP hard code generation problems, and Some simplified NP hard problems.

Suggested Text Books:

1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publication
2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson and Ronald L Rivest: 1990, TMH

Suggested Reference Books:

1. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., 1974, Addison Wesley.
2. Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., 1986. Johan Wiley & Sons,
3. Writing Efficient Programs, Bentley, J.L., PHI
4. Introduction to Design and Analysis of Algorithm, Goodman, S.E. &Hedetnieni, 1997, MGH.
5. Introduction to Computers Science- An algorithms approach, Jean Paul Trembley, Richard B.Bunt, 2002, T.M.H.
6. Fundamentals of Algorithms: The Art of Computer Programming Vol Knuth, D.E.: 1985, Naresh Publication.

Course Outcomes:

- To identify and justify correctness of algorithms and to analyse running time of algorithms based on asymptotic analysis.
- To understand when an algorithmic design situation calls for the divide-and-conquer paradigm. Synthesize divide-and-conquer algorithms.
- Describe the greedy paradigm and dynamic-programming paradigm. Explain when an algorithmic design situation calls for it.
- Developing greedy algorithms/dynamic programming algorithms, and analyze it to determine its computational complexity.
- To write the algorithm using Backtracking and Branch and Bound strategy to solve the problems for any given model engineering problem.

PROGRAMMING IN JAVA

Course code	PCC-CSE-309G				
Category	Professional Core Course				
Course title	Programming in JAVA				
Scheme and Credits	L	T	P	Credits	Semester 5
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objectives:

- Programming in the Java programming language.
- Knowledge of object-oriented paradigm in the Java programming language.
- The use of Java in a variety of technologies and on different platforms.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit 1:
Introduction to Java: Evolution of Java, Object Oriented Programming Structure, Overview and characteristics of Java, Java program Compilation and Execution Process, Organization of the Java Virtual Machine, Client side Programming, Platform Independency & Portability, Security, Relation b/w JVM, JRE and JDK, Introduction to JAR format, Naming Conventions, Data types & Type casting, operators, Security Promises of the JVM, Security Architecture and Security Policy, security aspects, sandbox model

Unit 2:
OOPS Implementation: Classes, Objects, attributes, methods, data encapsulation, reference variables, Constructors, Anonymous block, Method Overloading, Static Data members, Block & methods; Memory Structure: Stack, Heap, Class & Method area
Class loading & Execution flow: Static vs Dynamic Class loading, implicit vs explicit class loading, class loading operations;
Argument Passing Mechanism: Passing primitive arguments, passing objects, Wrapper Classes;
This keyword: Referencing instance members, Intra class constructor chaining, Method chaining;
Inheritance & code reusability: Extending classes for code reusability, Usage of super keyword, Method Overriding, Object class
Inheritance & Runtime Polymorphism: Static & Dynamic binding, Inheritance and Is-A relation, Runtime Polymorphism and Generalization, Abstract classes & methods, Final Keyword;
Interfaces and Role based Inheritance: Feature & Role based Inheritance, Static & Dynamic classing Environment, classes & interfaces, interface applications in real scenarios; Has-A relation: Aggregation & Composition, Nested classes, Inner classes, Anonymous Inner classes, String Buffer Class, tokenizer, applets, Life cycle of applet and Security concerns

Unit 3:

Threads: Creating Threads, Thread Priority, Blocked States, Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization, Synchronize Threads, Sync Code Block, Overriding Synced Methods, Thread Communication, wait, notify and notify all.

Swing & AWT:
Swing class hierarchy, containers, user interface components, graphics context, AWT Components, Component Class, Container Class, Layout Manager Interface Default Layouts, Insets and Dimensions, Border Layout, Flow Layout, Grid Layout, Card Layout Grid Bag Layout AWT Events, Event Models, Listeners, Class Listener, Adapters, Action Event Methods Focus Event Key Event, Mouse Events, Window Event

Package & Scopes: Need of Packages, associating classes to Packages, Class path environment variable, Import Keyword and Feature of static import, Public, protected, private & default scope, Private Inheritance;

Exception Handling: exception and error, Exception Handling & Robustness, Common Exceptions and Errors, Try and catch block, Exception handlers, throw keyword, Checked and Unchecked Exceptions, Role of finally, User defined Exceptions;

Unit 4:

Collection Framework: Role and Importance of Collection Framework, List & Set based collection, Iterator & List Iterator, Maps, Searching elements in List, Hash and Tree based collections, Role of equals and hashCode() methods, Comparable and Comparator Interfaces, Thread Safety and Vector, Difference b/w Enumeration and Iterator, Type safety and Generics, Common algorithms and Collections class, Using Properties class for managing properties files;

Database Connectivity Using JDBC: Overview of native and ODBC Drives, Introduction to JDBC, Type of JDBC drivers, Usage of drivers, Defining properties-based Connection Factory;
Basic database operations: Insert, Delete, Update, and Select;
Prepared Statement: Statement, Prepared Statement, Setting Query parameters, Executing Queries;
Callable Statement: Creating PL/SQL Stored procedures and functions, Creating Callable statements, Executing procedures & functions, Batch Updation, Transacting Queries, Programmatic initialization of database, ResultSetMetaData, DatabaseMetaData;
Input/Output Stream, Stream Filters, Buffered Streams, Data input and Output Stream, Print Stream Random Access File,
Reflection: reflection API, newInstance()method, javap tool, creating javap tool, creating applet viewer, call private method, java 9 features;

Text Books:
1. Patrick Naughton and HerbertzSchidt, “Java-2 the complete Reference”, TMH
2. Sierra & bates, “Head First Java”, O’Reilly.

Reference Books:
1. E. Balaguruswamy, “Programming with Java”, TMH
2. Horstmann, “Computing Concepts with Java 2 Essentials”, John Wiley.
3. Decker &Hirshfield, “Programming.Java”, Vikas Publication.

Course Outcomes:
- Knowledge of the structure and model of the Java programming language, (knowledge)

- Use the Java programming language for various programming technologies (understanding)
- Develop software in the Java programming language

MICROPROCESSOR LAB

<table>
<tr><td>Course code</td><td colspan="5">LC-ESC-321G</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Microprocessor Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Hands-on experiments related to the course contents of ESC-CSE-301G.

COMPUTER NETWORKS LAB

<table>
<tr><td>Coursec ode</td><td colspan="5">LC-CSE-323G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Computer Networks Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1.5</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Hands-on experiments related to the course contents of PCC-CSE-303G using hardware resources and using simulation tool.

DESIGN & ANALYSIS OFALGORITHMS USING C++

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-325G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Design & Analysis of Algorithms Using C++</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Objectives:

- Implementation of various algorithms and to analyze the performance of algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

List of programs:

1. Write a Program for iterative and recursive Binary Search.
2. Write a Program to sort a given set of elements using the Quick Sort/Merge Sort/Selection Sort method and determine the time required to sort the elements.
3. Write a Program for implementation of Fractional Knapsack problem using Greedy Method and 0/1 Knapsack problem using Dynamic Programming.
4. Write a Program to find the shortest path from a given vertex to other vertices in a weighted connected graph using Dijkstra's algorithm.
5. Write a Program to find the minimum cost spanning tree (MST) of a given undirected graph using Kruskal's algorithm/Prim's Algorithms.
6. Write a Program to implement N-Queens problem using back tracking.
7. Write a Program to check whether a given graph is connected or not using DFS method.
8. Write a program to implement the Travelling Salesman Problem (TSP).

Note: At least 5 to 10 more exercises to be given by the teacher concerned.

Course Outcomes:

- The course will help in improving the programming skills of the students.
- The design of algorithms for any problem will inculcate structured thinking process in the students and improve the analytical power.

PROGRAMMING IN JAVA LAB

Course code	LC-CSE-327G				
Category	Professional Core Course				
Course title	Java Programming Lab				
Scheme and Credits	L	T	P	Credits	Semester 5
	0	0	3	1.5	
Classwork	25Marks				
Exam	25Marks				
Total	50Marks				
Duration of Exam	03Hours				

List of Experiments:

1. Create a java program to implement stack and queue concept.
2. Write a java package to show dynamic polymorphism and interfaces.
3. Write a java program to show multithreaded producer and consumer application.
4. Create a customized exception and also make use of all the5 exception keywords.
5. Convert the content of a given file into the upper case content of the same file.
6. Develop an analog clock using applet.
7. Develop a scientific calculator using swings.
8. Create an editor like MS-word using swings.
9. Create a servlet that uses Cookies to store the number of times a user has visited your servlet.
10. Create a simple java bean having bound and constrained properties.

PRACTICAL TRAINING 1

<table>
<tr><td>Course code</td><td colspan="5">PT-CSE-329G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">PRACTICAL TRAINING 1</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td></tr>
<tr><td>Classwork</td><td colspan="5">-</td></tr>
<tr><td>Exam</td><td colspan="5">-</td></tr>
<tr><td>Total</td><td colspan="5">-</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">-</td></tr>
</table>

The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded ‘F’ grade is required to repeat Practical Training.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

SOFTWARE ENGINEERING

<table>
<tr><td>Course code</td><td colspan="5">PEC CSE-311G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Software Engineering</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives of the course

- Be successful professionals in the field with solid fundamental knowledge of software engineering
- Utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams
- Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: The process, software products, emergence of software engineering, evolving role of software, software life cycle models, Software Characteristics, Applications, Software crisis.

Software project management: Project management concepts, software process and project metrics Project planning, project size estimation metrics, project estimation Techniques, empirical estimation techniques, COCOMO- A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management, project scheduling and tracking

Unit: 2

Requirements Analysis and specification requirements engineering, system modeling and simulation Analysis principles modeling, partitioning Software, prototyping: , Prototyping methods and tools; Specification principles, Representation, the software requirements specification and reviews Analysis Modeling: Data Modeling, Functional modeling and information flow: Data flow diagrams, Behavioral Modeling; The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the control and process specification; The data dictionary; Other classical analysis methods.

System Design: Design concepts and principles: the design process: Design and software quality, design principles; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

Unit: 3

Architectural Design: Software architecture, Data Design: Data modeling, data structures, databases and the data warehouse, Analyzing alternative Architectural Designs, architectural complexity; Mapping requirements into a software architecture; Transform flow, Transaction flow; Transform mapping: Refining the architectural design.

Testing and maintenance: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, white box testing, basis path testing: Control structure testing: Black box testing, testing for specialized environments, architectures and applications. Software Testing Strategies: Verification and validation, Unit testing, Integration testing, Validation testing, alpha and beta testing; System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, the debugging process debugging approaches. Software re-engineering, reverse engineering, restructuring, forward engineering.

Unit: 4

Software Reliability and Quality Assurance :Quality concepts, Software quality assurance , SQA activities; Software reviews: cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting and record keeping, review guidelines; Formal approaches to SQA; Statistical software quality assurance; software reliability: Measures of reliability and availability ,The ISO 9000 Quality standards: The ISO approach to quality assurance systems, The ISO 9001 standard, Software Configuration Management. Computer Aided software Engineering: CASE, building blocks, integrated case environments and architecture, repository.

Suggested books:

- Software Engineering – A Practitioner's Approach, Roger S. Pressman, 1996, MGH.

Suggested reference books

- Fundamentals of software Engineering, Rajib Mall, PHI Software Engineering by Nasib Singh Gill, Khanna Book Publishing Co (p) Ltd
- Software Engineering by Ian Somerville, Pearson Edu, 5 edition, 1999, AW,
- Software Engineering – David Gustafson, 2002, T.M.H
- Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson 1995 JW&S,
- An Integrated Approach to software engineering by Pankaj jalote , 1991 Narosa,

Course Outcomes

1. How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
2. An ability to work in one or more significant application domains
3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software
4. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle
5. Demonstrate an ability to use the techniques and tools necessary for engineering practice

SYSTEM PROGAMMING AND SYSTEM ADMINISTRATION

<table>
<tr><td>Course code</td><td colspan="5">PEC CSE-313G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">System Programming and System Administration</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>3</td><td>0</td><td></td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives of the course

1. Evolution of the components of system programming.
2. To learn working and different stages of compilation process.
3. To learn basic of assembler and loading schemes.
4. To learn basics of file structure.
5. To know about filters and pipeline.
6. To learn shell programming

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Evolution of Components Systems Programming, Assemblers, Loaders, Linkers, Macros, Compilers. software tools, Text editors, Interpreters and program generators, Debug Monitors, Programming environment.

Compiler: Brief overview of compilation process, Incremental compiler, Assembler: Problem statement, symbol table; Loader schemes, compile and go Loader, general loader schemes, absolute loader, Reallocating loader, Direct linkage Loader, Binders, overlays.

Unit: 2

Theoretical Concept of Unix Operating System: Basic features of operating system; File structure: CPU scheduling; Memory management: swapping, demand paging; file system: block and fragments, inodes, directory structure; User to user communication

Unit: 3

Getting Started with Unix: User names and groups, logging in; Format of Unix commands; Changing your password; Characters with special meaning; Unix documentation; Files and directories; Current directory, looking at the directory contents, absolute and relative pathnames, some Unix directories and files; Looking at the file contents; File permissions; basic operation on files; changing permission modes; Standard files, standard output; Standard input, standard error; filters and pipelines; Processes; finding out about processes; Stopping background process; Unix editor vi.

Unit-4

Shell Programming: Programming in the Borne and C-Shell; Wild cards; Simple shell programs; Shell variables; interactive shell scripts; Advanced features.

System Administration: Definition of system administration; Booting the system; Maintaining user accounts; File systems and special files; Backups and restoration; Role and functions of a system manager. Overview of the Linux operating system

Suggested books:

1. Systems Programming by Donovan, TMH.
2. The unix programming environment by Brain Kernighen& Rob Pike, 1984, PHI & Rob Pike.
3. Design of the Unix operating system by Maurich Bach, 1986, PHI.
4. Introduction to UNIX and LINUX by John Muster, 2003, TMH.

Suggested reference books

1. Advanced Unix programmer's Guide by Stephen Prato, BPB
2. Unix- Concept and applications by Sumitabha Das, 2002, T.M..H

Course Outcomes

1. To understand various file statistics.
2. To work on wildcards.
3. To know about shell programming and AWK utility.

Digital Image Processing

Course Code	PEC-CSE-315G				
Category	Professional Elective Course				
Course title	Digital Image Processing				
Scheme and Credits	L	T	P	Credits	Semester 5
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition method

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

Unit: 2

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms.

Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering

Unit: 3

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

Unit-4

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors.

Suggested books:

1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition,2010.
2. Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.

Suggested reference books

1. Kenneth R. Castleman, Digital Image Processing Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, Digital Image Processing John Wiley, New York, 2002
5. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

Course Outcomes

1. Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
2. Operate on images using the techniques of smoothing, sharpening and enhancement.
3. Understand the restoration concepts and filtering techniques.
4. Learn the basics of segmentation, features extraction, compression and recognition methods for colour models

COMPILER DESIGN

Course code	PCC-CSE-302G				
Category	Professional Core Course				
Course title	Compiler Design				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis.
3. Design top-down and bottom-up parsers.
4. Identify synthesized and inherited attributes.
5. Develop syntax directed translation schemes.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction to Compilers: Language Processors, The Structure of compiler: its different phases, Compiler Construction Tools, Applications of Compiler Technology.
Lexical Analysis: Role of lexical analyzer, Input Buffering, Specification and recognition of tokens, design of lexical analyzer, regular expressions, A language specifying lexical analyzer, Finite automata, conversion from regular expression to finite automata, and vice versa, minimizing number of states of DFA, Implementation of lexical analyzer.

UNIT 2

Syntax Analysis: Role of parsers, context free grammars.
Parsing Technique: Shift-reduce parsing, Operator precedence parsing, Top down parsing, Predictive parsing.

UNIT 3

LR parsers, SLR, LALR and Canonical LR parser.
Syntax Directed Translations: Syntax directed definitions, construction of syntax trees, syntax directed translation scheme, implementation of syntax directed translation, Intermediate-Code Generation: three address code, quadruples and triples.

UNIT 4

Symbol Table & Error Detection and Recovery: Symbol tables: its contents and data structure for symbol tables; trees, arrays, linked lists, hash tables. Errors, lexical phase error, syntactic phase error, Semantic error.
Code Optimization & Code Generation: Code generation, forms of objects code, machine dependent code, optimization, register allocation for temporary and user defined variables.

Suggested Text Books:

1. Compilers Principle, Techniques & Tools - Alfread V. AHO, Ravi Sethi & J.D. Ullman; 1998 Addison Wesley.

Suggested Reference Books:

1. Theory and practice of compiler writing, Tremblay & Sorenson, 1985, Mc. Graw Hill.
2. System software by Dhamdere, 1986, MGH.
3. Principles of compiler Design, Narosa Publication
4. Elements compiler Design, Dr. M. Joseph, University Science Press

Course Outcomes:

1. To develop the lexical analyser for a given grammar specification.
2. For a given parser specification design top-down and bottom-up parsers.
3. To Develop syntax directed translation schemes.

ARTIFICIAL INTELLIGENCE

Course code	PCC-CSE-304G				
Category	Professional Core Course				
Course title	Artificial Intelligence				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- To provide historical perspective of AI and its foundation.
- To provide the most fundamental knowledge to the students so that they become familiar with basic principles of AI towards problem solving, inference, knowledge representation and learning.
- Explore application of AI techniques in Expert systems, Neural Networks.
- Explore the current trends, potential, limitations, and implications of AI.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction: Definition of AI, History of AI, nature of AI problems, examples of AI problems.
Problem solving by search: *Uninformed Search*: Depth First Search (DFS), Breadth First Search (BFS). *Informed Search*: Best First Search, A*. *Local Search*: Hill Climbing. *Problem Reduction Search*: AO*. *Population Based Search*: Ant Colony Optimization, Genetic Algorithm. *Game Playing:* Min Max Algorithm, Alpha-Beta Pruning.

UNIT 2

Knowledge Representation: Types of Knowledge, Knowledge Representation Techniques/schemes: Propositional Logic, Predicate Logic, Semantic nets, Frames. Knowledge representation issues. Rule based systems.

UNIT 3

Reasoning under Uncertainty: Basics of Probability Theory, Probabilistic Reasoning, Bayesian Reasoning, Dempster-Shafer Theory.
Planning: Introduction to Planning, Representation of Planning, Partial-order Planning.

UNIT 4

Learning: Introduction to Learning, Types of Learning: Learning by Induction, Rote Learning, Symbol Based Learning, Identification Trees, Explanation Based Learning, Transformational Analogy, Introduction to Neural Networks, Expert Systems, Current trends in Artificial Intelligence

Suggested Test books:

1. Artificial Intelligence: A Modern Approach Third Edition Stuart Russell and Peter Norvig, 2010, Pearson Education.

Suggested reference books:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, 3rd ed.,2009.
2. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010.
3. Artificial intelligence, Patrick Henry Winston, 1992, Addition Wesley 3 Ed.

Course Outcomes:

1. Display the understanding of the historical perspective of AI and its foundation.
2. Apply basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.
3. Demonstrate fundamental understanding of various application of AI techniques in Expert systems, Neural Networks.
4. Demonstrate an ability to share in discussion of AI, it’s the current trends, limitations, and implications of AI.

ADVANCED JAVA

Course code	PCC-CSE-306G				
Category	Professional Course Code				
Course title	Advanced Java				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Classwork	25Marks				
Exam	75Marks				
Total	100Marks				
Duration of Exam	03Hours				

Objectives of the course:

1. Programming in the Java programming language,
2. Knowledge of object-oriented paradigm in the Java programming language,
3. The use of Java in a variety of technologies and on different platforms.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Servlet: Servlet introduction, web terminology, servlet API, servlet Interface, generic servlet, Http servlet, servlet lifecycle, servlet with IDE (eclipse, My eclipse, Net beans), servlet request, servlet collaboration, servlet configuration, context, attribute in servlet, session technique in servlet, event and listener, servlet filter, CRUD, pagination, input output stream, annotation, single thread model, SSI;

JSP: Lifecycle of JSP, JSPAPI, scripting elements, 9Implicit Objects, directive elements,

Exceptions, action elements, expression language, MVC in JSP, JSTL, custom tags, pagination, CRUD,JSTL function, formatting, XML, SQL tags,

UNIT 2

Struts: Introduction, features, models, components, struts2 architecture, action, configuration, interceptors, validation method, aware Interfaces, stuts2withI18N, zero configuration, struts2withtiles, hibernate with struts2, spring with struts2, UI tags;

Mail API: java mail introduction, methods of sending email, sending mail by Gmail, receiving email, sending attachment, receiving attachment, sending html, forwarding, deleting email;

UNIT3

Hibernate(HB): Introduction, architecture, HB with IDE, HB Log4j, inheritance mapping, HB mapping, transaction management, HB query language, HB criteria query language, named query, HB caching, integration, HB lifecycle;

Spring: Introduction, modules, spring with IDE, dependency injection methods, spring AOP, spring Jdbc template, spring ORM, SPEL, MVC tag library, applications, spring remoting, spring OXM, spring web, security models, spring boot, spring with angular;

UNIT 4

Android: Introduction, history & versions, architecture, building blocks, emulator, android widgets, activity and intents, android fragments, android menu, android service, SQLite, XML & JSON, android speech, multimedia, telephony, maps;

Design Pattern: java design pattern, creational, structural, behavioral, J2EE patterns, presentation layers,

Course Outcome:

1. Knowledge of the structure and model of the Java programming language, (knowledge)
2. Use the Java programming language for various programming technologies (understanding)
3. Develop software in the Java programming language,

Suggested Text Books:

1. Patrick Naught on and Herbertz Schidt, “Java-2 the complete Reference”,TMH
2. Sierra & bates, “Head First Java”, O’Reilly.

Suggested Reference Books:

1. E. Balaguruswamy, “Programming with Java”,TMH
2. Horstmann, “Computing Conceptswith Java2 Essentials”, John Wiley.
3. Decker & Hirsh field, “Programming.Java”, Vikas Publication.

MOBILE AND WIRELESS COMMUNICATION

Course code	ESC-CSE-308G				
Category	Engineering Science Course				
Course title	Mobile and wireless communication				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- Understand the wireless/cellular radio concepts such as frequency reuse, handoff and interference between mobiles and base stations.
- Identify the techno-political aspects of wireless and mobile communications such as the allocation of the limited wireless spectrum by regulatory agencies.
- Understand the information theoretical aspects such as channel capacity, propagation effects, modeling the impact of signal bandwidth and motion in mobile systems.
- Describe the current and future Mobile Communication Systems, GSM, Satellite, Broadcasting, Bluetooth, Wireless LANs, Mobile Adhoc Networks.
- Describe the mobility support mechanism, WWW and WAPs.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction: Application, History, Market Scenario, Reference Model and Overview, Wireless Local Loop and Cellular system.

Wireless Transmission: Frequencies, Signals, Antennae, Signal Propagation, Multiplexing, Modulation, Spread Spectrum.

MAC Layer: Specialized MAC, SDMA, FDMA, TDMA – Fixed TDM, Classical ALOHA, Slotted, ALOHA, CSMA, DAMA, PKMA, Reservation TDMA. Collision Avoidance, Polling, Inhibit Sense Multiple Access, CDMA.

Broadcasting: Unidirectional Distribution Systems, Digital Audio Broadcasting, Digital Video Broadcasting, Convergence of Mobile and Broadcasting Techniques.

UNIT 2

GSM: Mobile Services, Architecture Radio, Interface, Protocol, Localization, Calling Handover, Security, New data services.

Wireless LAN: IEEE 802 11- System and Protocol Architecture, Physical Layer, MAC Layered Management.

Bluetooth: User scenarios, Physical layer, MAC Layer, Networking, Security and Link Management.

Wimax

UNIT 3

Mobile Network Layer: Mobile IP-Goals, Assumptions, Requirement, Entities, Terminology, IP Packet delivery, Agent Advertisement and Discovery, Registration, Tunneling, Encapsulation, Optimization, Reserve Tunneling, Security, IPv6 , DHCP.

Mobile Adhoc Networks: Routing, Destination Sequence Distance Vector, Dynamic Source Routing, Hierarchical algorithms, Performance Metrics.

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping, TCP, Mobile TCP, Fast-retransmission TCP, Transaction oriented TCP.

UNIT 4

Satellite Systems: History, Applications, GEO, LEO, MEO, Routing, Localization, Handover in Satellite System.

Support for Mobility: File System, WWW, HTML, System Architecture.

WAP: Architecture, Wireless Datagram, Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Application Environment, Telephony Applications.

Suggested Reference Books:

1. Jochen Schiller, “MobileCommunication”, Pearson Education, 2002
2. LEE, “Mobile Cellular Telecommunications”, McGRAW-Hill, 2nd Edition.
3. Theodore S Rappaport, “Wireless Communications”, Pearson Education.

Course Outcomes:

- Explain the principles and theories of mobile computing technologies.
- Describe infrastructures and technologies of mobile computing technologies.
- List applications in different domains that mobile computing offers to the public, employees, and businesses.
- Describe the possible future of mobile computing technologies and applications.
- Effectively communicate course work through written and oral presentations

PROJECT - I

Course code	PROJ-CSE-322G				
Category	Professional Core Course				
Course title	PROJECT- I				
Scheme and Credits	L	T	P	Credits	Semester 6
	0	0	4	2	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Students will be assigned projects individually or in a group of not more than 3 students depending on the efforts required for completion of project.

The project will have 4 stages :
(*Marks for internal evaluation are given in brackets)

- Synopsis submission (5 marks),
- 1stmid term progress evaluation (5 marks)
- 2nd mid term progress evaluation (5 marks)
- Final submission evaluation (10 marks).

The external examiner will evaluate the project on the basis of idea/quality of project, implementation of the project, project report and viva.

COMPILERDESIGN LAB

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-324G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Compiler Design Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 6</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives of the course:

- Implementation of different concepts of lexical analysis.
- Implementation of parsers.
- Study and use of compiler design tools.

List of programs:

1. Write a Program for Token separation with a given expression.
2. Write a Program for Token separation with a given file.
3. Write a Program for Lexical analysis using LEX tools.
4. Write a Program to identify whether a given line is a comment or not.
5. Write a Program to check whether a given identifier is valid or not.
6. Write a Program to recognize strings under 'a', 'a*b+', 'abb'.
7. Write a Program to simulate lexical analyser for validating operators.
8. Write a Program for implementation of Operator Precedence Parser.
9. Study of LEX and YACC tools:
   i) Write a Program for implementation of calculator using YACC tool.
   ii) Write a Program for implementation of Recursive Descent Parser using LEX tool.
10. Write a Program for implementation of LL (1) Parser.
11. Write a Program for implementation of LALR Parser

Note: At least 5 to 10 more exercises to be given by the teacher concerned.

Course Outcomes:

- The course will help in improving the programming skills of the students.
- The implementation of different parsers will help in understanding of compiler designing.

ARTIFICIAL INTELLIGENCE LAB USING PYTHON

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-326G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Artificial Intelligence Lab Using Python</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 6</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Program:

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to Implement 8-Puzzle problem using Python.
5. Write a Program to Implement Water-Jug problem using Python.
6. Write a Program to Implement Travelling Salesman Problem using Python.
7. Write a Program to Implement Tower of Hanoi using Python.
8. Write a Program to Implement Monkey Banana Problem using Python.
9. Write a Program to Implement Missionaries-Cannibals Problems using Python.
10. Write a Program to Implement 8-Queens Problem using Python.

Note: At least 5 to 10 more exercises to be given by the teacher concerned.

ADVANCED JAVA LAB

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-328G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Advanced Java Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 6</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Students have to write at list 15 programs based on the course PCC-CSE-306G

Course code	MC-317G			
Category	Mandatory Course			
Course title	**Constitution of India**			
Scheme and credits	L	T	P	Credits
	2	0	0	0

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit – I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

Unit – II

Federal structure and distribution of legislative and financial powers between the Union and the States

Unit – III

Organs of Governance: President – Qualification and Powers of the President, Governor- Qualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

Unit – IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Right to equality , Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score minimum 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

ADVANCED DATABASE MANAGEMENT SYSTEM

<table>
<tr><td>Course code</td><td colspan="5">PEC-CSE-310G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Advanced Database Management System</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 6</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objective of the course:

- To understand DBMS Components, Advantages and Disadvantages.
- Understanding Data modeling: ER, EER, Network, Hierarchical and Relational data models.
- Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
- To understand transaction concept, schedules, serializability, locking and concurrency control protocols.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction: Architecture, Advantages, Disadvantages, Data models, relational algebra, SQL, Normal forms.

Query Processing: General strategies for query processing, transformations, expected size, statistics in estimation, query improvement. Query evaluation, view processing, query processor.

UNIT 2

Recovery: Reliability, Transactions, recovery in centralized DBMS, reflecting updates, Buffer management logging schemes, disaster recovery.

Concurrency: Introduction, Serializability, Concurrency control, Locking schemes, Timestamp based ordering, Optimistic, Scheduling, Multiversion techniques, Deadlocks.

UNIT 3

Parallel and Distributed Databases: Distributed Data Storage – Fragmentation & Replication, Location and Fragment.
Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

UNIT 4

Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases

Suggested Text Book:

1. Elmarsi, Navathe, Somayajulu, Gupta, “Fundamentals of Database Systems”, 4th Edition, Pearson Education,2007
2. Garcia, Ullman, Widom, “Database Systems, The complete book”, Pearson Education, 2007
3. R. Ramakrishnan, “Database Management Systems”, McGraw Hill International Editions, 1998

Suggested References Books:

1. Date, Kannan, Swaminathan, “An Introduction to Database Systems”, 8th Edition Pearson Education, 2007
2. Singh S.K., “Database System Concepts, design and application”, Pearson Education, 2006.
3. Silberscatz, Korth, Sudarshan, “Database System Concepts”, Mcgraw Hill, 6th Edition, 2006
4. W. Kim, “Modern Database Systems”, 1995, ACM Press, Addision Wesley,

Course Outcomes:

- Students will get understanding of DBMS Components, Its advantages and disadvantages.
- Understanding about various types of Data modeling: ER, EER, Network, Hierarchical and Relational data models.
- Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
- Understanding transaction concept, schedules, serializability, locking and concurrency control protocols.

MOBILE APPLICATIONS DEVELOPMENT

<table>
<tr><td>Course code</td><td colspan="5">PEC-CSE-312G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Mobile applications development</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 6</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives of the course:

- Introduce the students with the various “Next Generation Technologies” in the area of mobile computing
- Assist students understand the various Mobile operating Systems
- Explore the findings using Android Technologies

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

UNIT 2

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

UNIT 3

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

UNIT 4

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment.

iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment

Suggested text books:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition:
2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.
3. Barry Burd, "Android Application Development All in one for Dummies", Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS

Suggested reference books:

1. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons
2. Henry Lee, Eugene Chuvyrov, "Beginning Windows Phone App Development", Apress, 2012.
3. Jochen Schiller,"Mobile Communications", Addison-Wesley, 2nd edition, 2004.
4. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.

Course Outcomes:

- Explain the principles and theories of mobile computing technologies.
- Describe infrastructures and technologies of mobile computing technologies.
- List applications in different domains that mobile computing offers to the public, employees, and businesses.
- Describe the possible future of mobile computing technologies and applications.
- Effectively communicate course work through written and oral presentations

COMPUTER GRAPHICS

Course code	PEC-CSE-314G					
Category	Professional Elective Course					
Course title	Computer Graphics					
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks					
Exam	75 Marks					
Total	100 Marks					
Duration of Exam	03 Hours					

Objectives of the course:

- To have basic understanding of the core concepts of Computer Graphics.
- Understand scan conversion, 2D, 3D – transformation and viewing.
- To be able to create interactive computer Graphics with understanding of shading, image processing and illumination model.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software; Two dimensional Graphics Primitives: Points and Lines, Scan Conversion: Point, Line, Circle; Region Filling: Scanline algorithm, Polygon filling algorithm, boundary filled algorithm.

UNIT 2

Two dimensional transformations: Geometric, Coordinate and, composite transformation.
Two Dimensional Viewing: window to view port mapping; Clipping: point, line, polygon, curve and text clipping

UNIT 3

Three-dimensional transformations: Three dimensional graphics concept, Geometric and Coordinate transformations, **Viewing in 3D:** Projection, Taxonomy of projection,
Hidden surface removal: Introduction to hidden surface removal, The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.

UNIT 4

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, B-Spline curves. Parametric representation of surfaces; Interpolation method.
Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency, image processing.

Suggested Text Books:

1. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
2. Computer Graphics by Donald Hearn and M.Pauline Baker, 2 Edition, 1999, PHI
3. Computer Graphics by Z. Xiang, R. Plastock, 2nd Edition, TMH Education.

Suggested Reference Books:

1. Procedural Elements for Computer Graphics – David F. Rogers, 2001, T.M.H Second Edition
2. Fundamentals of 3-Dimensional Computer Graphics by Alan Watt, 1999, Addision Wesley.
3. Computer Graphics: Secrets and Solutions by Corrign John, BPB
4. Graphics, GUI, Games & Multimedia Projects in C by Pilania & Mahendra, Standard Publ.
5. Computer Graphics Secrets and solutions by Corrign John, 1994, BPV
6 Introduction to Computer Graphics by N. Krishanmurthy T.M.H 2002

Course Outcomes:

- Understanding of the software, hardware and applications of Computer Graphics.
- Understanding of Scan conversion, 2D, 3D – transformation and viewing.
- To be able to implement picture on screen using projection, shading, image processing and illumination model.

COMMUNICATION ENGINEERING

Course code	PEC-CSE-330G (Common with ECE)				
Category	Program Elective Course				
Course title	Communication Engineering				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objective:

1. The course will give students about depth knowledge of the communication system.
2. To introduce students to random process and fundamental theorems
3. To make awareness of information theory and coding techniques

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit:1
SPECTRAL ANALYSIS:
Fourier series, Fourier transforms, Convolution Theorem, Correlation, Cross-Correlation and autocorrelation.

Unit: 2
INFORMATION THEORY:
Introduction to information and entropy, channel capacity for discrete and continuous channels, Shannon's Theorem, Shannon-Hartley Theorem, Noisy channels, coding theory : Shannon-Fano coding, minimum redundance coding, maximization of entropy of a continuous message transmission rate, effect of medium on the information, selection of channels ,effect of noise and its minimization.

Unit:3
RANDOM SIGNAL THEORY:
Representation of random signals, concept of probability, probability of joint occurrence, conditional probability, discrete probability theory, continuous random variables, probability distribution function, probability density function, joint probability density functions.

Unit:4
RANDOM SIGNAL THEORY:
Statistical average and moments, Ergodic processes, correlation Function, power spectral density, central limit theory, response of linear system to random signals. Error function Covariance relation among the spectral densities of the two input-output random processes. Cross spectral densities, optimum filters. Introduction to Linear Block Code abd cyclic Codes

TEXT BOOK :
1. Principles of Communication Systems: Taub Schiling; TMH
REFERENCE BOOKS.
1. Communication Systems: Singh and Sapre ; TMH
2. Communication Systems: A Bruce Carlson; TMH

COURSE OUTCOMES: After the completion of the course the student will be able to:

- To Study and Derive equations for entropy mutual information and channel capacity for all types of channels.
- To acquire the knowledge about Fourier series and Fourier transform signal analysis tool.
- Design a digital communication system by selecting an appropriate error correcting codes for a particular application.
- To learn about Probabilityof Random signal theory and process.
- Formulate the basic equations of linear block codes and a cyclic code.
- Compare the performance of digital communication system by evaluating the probability of

error for different error correcting codes

DISTRIBUTED SYSTEM

Course code	PEC-CSE-316G				
Category	Professional Elective Course				
Course title	Distributed System				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- To examine the fundamental principles of distributed systems, and provide students hands-on experience in developing distributed protocols.
- Analyze the issues in distributed operating systems and to address these distributed systems issues in a broader sense. Emphasis will be placed on communication, process, naming, synchronization and fault tolerance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction: Distributed Operating Systems Definition and goals, Hardware and Software concepts, Design issues.

Communication in Distributed System: Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC

UNIT 2

Synchronization in Distributed System: Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems

Processes and processors in Distributed systems: Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, real time distributed systems, Process migration and related issues

UNIT 3

Distributed File systems: Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study.

Distributed Shared Memory: Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing

UNIT 4

Security Issues: Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management

Distributed Web-based Systems: Architecture, Processes, Communication, Naming, Synchronization

Case Studies: JAVA RMI, Sun Network File System, Google Case Study

Suggested Reference books:

1. Distributed Operating Systems by Andrew S Tannebaum, Pearson
2. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI
3. Distributed Systems: Concepts and Design by George Coulouris, Jean Dollimore, TimKindberg, Pearson
4. Distributed Computing by Sunita Mahajan & Seema Shah OXFORD
5. Distributed Systems: Principles and Paradigms by Andrew S Tanebaum, Maarten Van Steen, PHI
6. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, HagitAttiya and Jennifer Welch, Wiley India

Course Outcomes:

- List the principles of distributed systems and describe the problems and challenges associated with these principles.
- Understand Distributed Computing techniques, Synchronous and Processes.
- Apply Shared Data access and Files concepts.
- Design distributed system that fulfills requirements with regards to key distributed systems properties.
- Understand Distributed File Systems and Distributed Shared Memory.
- Apply Distributed web-based system and understand the importance of security in distributed system

INFORMATION TECHNOLOGY & INDUSTRY BUSINESS SKILLS

Course code	PEC-CSE-318G				
Category	Professional Core Course				
Course title	Information Technology & Industry Business Skills				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- To understand the novel information technology techniques and industry business skills.
- To study about the concept of amazon web services.
- To understand the use of cloud in web services and their different application.
- To study business models used in industry and their implementation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Web Services: History and Introduction to cloud computing, Introduction to AWS, Instances creation methods in AWS, Scalable Computing in AWS, Storage in AWS, Persistence in AWS, Routing from AWS, Delivering strategies with AWS, Messaging management inside AWS, Communicating technique with AWS, AWS Free Tier, Identity Access Management, Security Assertion Markup language, Simple Storage Service, introduction to Google APP Engine, Azure computing method, service models, deployments models of cloud computing, difference between AWS, AZURE, Google Cloud;

Unit: 2

Cloud: Amazon Elastic Compute Cloud, Elastic Block Store, Security Group management, Amazon Machine Images, Storing data in the cloud, storing your objects: S3 and Glacier, ELB and SQS, auto-scaling and Cloud Watch, Cloud Formation, Elastic Beanstalk, and Ops Works, RDS, fault-tolerance, scaling, AZURE architecture and services, Google cloud applications;

Unit: 3

Business: Business models, Building blocks of Sales force, Understand the Security model, Understand the Data model, Configure and manage Sales and Service Cloud, Learn about Sales force Objects, create, rename or modify objects, validation rules, Create different field types and validation rules, Sales Cloud and Service Cloud modules, reports and dashboard, Sales force A Chatter, and Social features, chatter, application lifecycle, visual workflow;

Unit: 4

Security & Applications: security group, NACL, difference between security group and NACL, AWS-Data pipeline, Simple queue services, Simple workflow services, Simple notification Services, Elastic Transcoder.

Suggested reference books:

1. Amazon Web Services in Action by Michael Wittig and Andreas Wittig, Manning Publications;
2. AWS Certified Solutions Architect by Joe Baron, Hisham Baz, Tim Bixler, Biff Gaut, Kevin E. Kelly, Wiley publication;

Course Outcomes:

- Student will understand the concept of web services of amazon, virtual machines and their working.
- For a given region the availability of resources and cost management.
- For a given application scalable model and selection of services.

DATA SCIENCE

Course code	PCC-CSE-320G				
Category	Professional Core Course				
Course title	Data Science				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- The objective of this course is to impart necessary knowledge of the basic foundations needed for understanding data science domain and develop programming skills required to build data science applications.
- To introduce the conceptual knowledge of the area of data science domain, feature and scope of applications.
- To impart programming knowledge needed for data sciences.
- To understand the different issues involved in the design and implementation of a data science applications.
- To understand case studies of essential Data sciences applications.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting, Collection, storing, processing, describing and modelling, statistical modelling and algorithm modelling, AI and data science, Myths of Data science

UNIT 2

Introduction to Programming Tools for Data Science: Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, Working with data: Reading Files, Scraping the Web,

UNIT 3

Data Science Methodology: Business Understanding, Analytic Approach, Data Requirements, Data Collection, Data Understanding, data Preparation, Modeling, Evaluation, Deployment, feedback

UNIT 4

Data Science Application: Prediction and elections, Recommendations and business analytics, clustering and text analytics

Suggested Text books:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
2. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
3. Jain V.K., “Data Sciences”, Khanna Publishing House, Delhi.
4. Jain V.K., “Big Data and Hadoop”, Khanna Publishing House, Delhi.

Suggested Reference books:

1. Data Science Workflow: Overview and Challenges by Philip Guo
2. Python for Data Analysis, O’Reilly Media Rajiv, “Machine Learning”, Khanna Publishing House, Delhi.
3. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press
4. http://www.deeplearningbook.org
5. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan
6. Kaufmann Publishers

Course Outcomes:

- Understand the value of data science and the process behind using it.
- Use Python to gather, store, clean, analyse, and visualise data-sets.
- Apply toolkits to formulate and test data hypotheses and uncover relationships within data-sets
- Understand the data science methodology in the data science pipeline
- Understand real-world challenges with several case studies

VHDL AND DIGITAL DESIGN

Course code	PEC-CSE-332G (common with ECE)				
Category	Program Elective Course				
Course title	VHDL and Digital Design				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objective:

- To understand the modelling & simulation & its role in digital evaluation.
- To learn basic concepts of VHDL language, its different architecture, designing of various Combinational & sequential circuits.
- To study various PLDs & detail study of FPGAs and implementation of various combinational & sequential logic circuits on FPGAs.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-1

INTRODUCTION: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioural dataflow and structural models.

UNIT- 2

VHDL STATEMENTS: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

UNIT -3

COMBINATIONAL & SEQUENTIAL CIRCUIT DESIGN:VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

UNIT-4

DESIGN OF MICROCOMPUTER & PROGRAMMABLE DEVICE: Basic components of a computer, specifications, architecture of a simple microcomputer system, and implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

REFERENCE BOOKS:

1. Ashenden - Digital design,Elsevier
2. IEEE Standard VHDL Language Reference Manual (1993).
3. Digital Design and Modelling with VHDL and Synthesis: KC Chang; IEEE Computer Society Press.
4. "A VHDL Primmer" : Bhasker; Prentice Hall 1995.
5. "Digital System Design using VHDL" : Charles. H.Roth ; PWS (1998).
6. "VHDL-Analysis & Modelling of Digital Systems" :Navabi Z; McGraw Hill.
7. VHDL-IV Edition: Perry; TMH (2002)
8. "Introduction to Digital Systems" :Ercegovac. Lang & Moreno; John Wiley (1999).
9. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH (2000)
10. Modern Digital Electronics- III Edition: R.P Jain; TMH (2003).
11. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier

Course Outcome: After the completion of the course the student will be able to:

- Understand the need & application of hardware description language.
- Modelling & simulations of various basic & advanced digital systems using VHDL.
- Implementation of various basic & advanced digital systems using FPGAs.
- Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Information Technology)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Information Technology) – 5th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week L	T	P	Total Contact Hrs. Per week	Credit	Examination Schedule (Marks) Internal Assessment	External Examination	Practical	Total	Duration of Exam (Hours)
1	Engineering Science Course	ESC-IT-301G	Signals and Systems	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-IT-303G	Web Technology	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-CSE-307G	Design & Analysis of Algorithms (Common with CSE)	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-CSE-309G	Programming in Java (Common with CSE)	3	0	0	3	3	25	75		100	3
5	Professional Elective Course	Refer to Annexure I	Elective –I	3	0	0	3	3	25	75		100	3
6	Professional Core Course	LC-IT-317G	Web Technology Lab	0	0	3	3	1.5	25		25	50	3
7	Professional Core Course	LC-IT-319G	Design & Analysis of Algorithms Lab.	0	0	3	3	1.5	25		25	50	3
8	Professional Core Course	LC-IT-321G	IT Workshop (MATLAB/SCILAB)	0	0	3	3	2	25		25	50	3
9	Professional Core Course	LC-CSE327G	Programming in Java Lab (Common with CSE)	0	0	3	3	1.5	25		25	50	3
10	Training	PT-IT329G	Practical Training – 1	-	-	-	-	-	-	-	* Refer Note 1		
Total Credits/Marks								**21.5**				**700**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Scheme of Studies and Examination
B.TECH (Information Technology) – 6th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. Per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Course	PCC-CSE-304G	Artificial Intelligence (Common with CSE)	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-CSE-303G	Computer Network (Common with CSE)	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-CSE-306G	Advanced Java (Common with CSE)	3	0	0	3	3	25	75		100	3
4	Engineering Science Course	ESC-CSE-308G	Mobile and Wireless Communication (Common with CSE)	3	0	0	3	3	25	75		100	3
5	Professional Elective Course	Refer to Annexure II	Elective-II	3	0	0	3	3	25	75		100	3
6	Professional Elective Course	Refer to Annexure III	Elective-III	3	0	0	3	3	25	75		100	3
7	Project	PROJ-CSE-322G	Project-I	0	0	4	4	2	25		25	50	4
8	Professional Core Course	LC-CSE-326G	Artificial Intelligence Lab using Python (Common with CSE)	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-CSE-323G	Computer Network LAB (Common with CSE)	0	0	3	3	1.5	25		25	50	3
10	Mandatory Courses	MC-317G	Constitution of India	2	0	0	2						3
Total Credits/Marks								**23**				**750**	

Note:

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

Annexure I

Elective –I (Professional Elective Course)

1. PEC-CSE-311G:Software Engineering
2. PEC-CSE-313G : System Programming and System Administration
3. PEC-CSE-315G :Digital Image Processing

Annexure II

Elective –II (Professional Elective Course)

1. PEC-CSE-310G:Advanced Database Management System
2. PEC-CSE-312G :Mobile Application Development
3. PEC-CSE-314G:Computer Graphics

Annexure III

Elective –III (Professional Elective Course)

1. PEC-IT-302G: Information Retrieval
2. PEC-IT-304G : Soft Computing
3. PEC-IT-306G : Internet of things

ESC-IT-301G **SIGNALS AND SYSTEM**

B.TECH SEMESTER V			SESSIONAL: 25
L	T	P	THEORY EXAM: 75
3	0	0	TOTAL: 100

Course Objectives:

The aim of the course is for:

1. Understanding the fundamental characteristics of signals and systems.
2. Understanding the concepts of vector space, inner product space and orthogonal series.
3. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
4. Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

UNIT-I

INTRODUCTION TO SIGNALS AND SYSTEMS:

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

UNIT-II

BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse respons

UNIT-III

FOURIER, LAPLACE AND Z- TRANSFORMS

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The DiscreteTime Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

UNIT-IV

SAMPLING AND RECONSTRUCTION

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

a. Understand the concepts of continuous time and discrete time systems.
b. Analyse systems in complex frequency domain.
c. Understand sampling theorem and its implications.

REFERENCES:

1. **A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "*Signals and systems*", Prentice Hall India, latest edition**
2. **J. G. Proakis and D. G. Manolakis, "*Digital Signal Processing: Principles, Algorithms, and Applications*", Pearson, latest edition.**
3. **H. P. Hsu, "*Signals and systems*", Schaum's series, McGraw Hill Education, latest edition.**
4. **S. Haykin and B. V. Veen, "*Signals and Systems*", John Wiley and Sons, latest edition.**
5. **A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall,** latest edition**.**
6. **M. J. Robert "*Fundamentals of Signals and Systems*", McGraw Hill Education, latest edition.**
7. **B. P. Lathi, "Linear Systems and Signals", Oxford University Press,** latest edition**.**

PCC-IT-303G **WEB TECHNOLOGY**

B.TECH SEMESTER V	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL :	100

Pre-requisites: Computer Networks Course Objectives:

1. To familiarize the students with the basic concepts of internet, its history, ways to connect to internet and basics of world wide web and search engines.
2. To familiarize the student with the fundamental language of internet i.e. HTML
3. To teach the student aware of the concepts of cascading style sheets
4. To teach the student the students the basics of client side and Server side scripting

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

UNIT-I

INTRODUCTION TO NETWORKS AND WWW

Introduction to internet, history, Working of Internet, Modes of Connecting to Internet, Internet Address, standard address, classful and classless ip addressing, subnetting, supernetting, w3c consortium, searching the www: Directories search engines and Meta search engines, search fundamentals, search strategies, Architecture of the search engines, Crawlers and its types, Delivering multimedia over web pages, VRML.

UNIT-II

HYPERTEXT MARKUP LANGUAGE

The anatomy of an HTML document: Marking up for structure and style: basic page markup, absolute and relative links, ordered and unordered lists, embedding images and controlling appearance, table creation and use, frames, nesting and targeting.

UNIT-III

STYLE SHEETS

Separating style from structure with style sheets, Internal style specifications within HTML, External linked style specification using CSS, page and site design considerations.

UNIT-IV

CLIENT SIDE PROGRAMMING

Introduction to Client side programming, Java Script syntax, the Document object model, Event handling, Output in JavaScript, Forms handling, cookies, Introduction to VBScript, Form Handling.

SERVER SIDE SCRIPTING

CGI, Server Environment, Servlets, Servlet Architecture, Java Server Pages, JSP Engines, Beans, Introduction to J2EE.

Course Outcomes:
At the end of the course/session the student would be

a. Acquainted with the basics of internet &search engines.
b. Have a hands on HTML
c. Learned the need and basics of CSS
d. Learned the concepts of client side and server side scripting.

REFERENCES

1. "*Fundamentals of the Internet and the World Wide Web*", Raymond Greenlaw and Ellen Hepp, TMH , latest edition.
2. "*Internet & World Wide Programming*", Deitel,Deitel & Nieto, Pearson Education
3. "*Complete idiots guide to java script*". Aron Weiss, QUE.
4. "*Network firewalls*", Kironjeet syan - New Rider Pub.

PCC-CSE-307G DESIGN & ANALYSIS OF ALGORITHMS

B.TECH SEMESTER V		SESSIONAL:	25
L T P		THEORY EXAM:	75
3 0 0		TOTAL:	100

Pre-requisites: Data

structure and Algorithm

Course Objectives:

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

Unit-I

INTRODUCTION

Characteristics of algorithm, Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters’ theorem.

Unit-II

FUNDAMENTAL ALGORITHMIC STRATEGIES

Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, Job sequencing with deadline, Optimal Binary Search tree, N-Queen problem, Hamiltonian Cycle, TSP, Heuristics – characteristics and their application domains.

Unit-III

GRAPH AND TREE TRAVERSAL ALGORITHMS

Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit-IV

TRACTABLE AND INTRACTABLE PROBLEMS

Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard, Cook's theorem, Standard NP-complete problems and Reduction techniques.

ADVANCED TOPICS

Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Course Outcomes:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.
6. Explain the ways to analyze randomized algorithms (expected running time, probability of error).
7. Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

REFERENCES

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "*Introduction to Algorithms*", MIT Press/McGraw-Hill; 3rd edition, [ISBN: 978-0262533058], 2009.

***2.* Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "*Fundamentals of Algorithms*",**

Universities Press; 2nd edition [ISBN: 978-8173716126], 2008.

3. Jon Kleinberg and Éva Tardos, "*Algorithm Design",* Pearson Publisher; 1st edition [ISBN: 978-0321295354], 2012.
Michael T Goodrich and Roberto Tamassia, "*Fundamentals of Algorithms"* Wiley Press; 1st edition [ISBN: 978-8126509867], 2006.

Course code	PCC-CSE-309G				
Category	Professional Core Course				
Course title	Programming in JAVA				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course
1. Programming in the Java programming language,
2. Knowledge of object-oriented paradigm in the Java programming language,
3. The use of Java in a variety of technologies and on different platforms.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction to Java: Evolution of Java, Object Oriented Programming Structure, Overview and characteristics of Java, Java program Compilation and Execution Process, Organization of the Java Virtual Machine, Client side Programming, Platform Independency & Portability, Security, Relation b/w JVM, JRE and JDK, Introduction to JAR format, Naming Conventions, Data types & Type casting, operators, Security Promises of the JVM, Security Architecture and Security Policy, security aspects, sandbox model;

Unit: 2

OOPS Implementation: Classes, Objects, attributes, methods, data encapsulation, reference variables, Constructors, Anonymous block, Method Overloading, Static Data members, Block & methods;
Memory Structure: Stack, Heap, Class & Method area;
Class loading & Execution flow: Static vs Dynamic Class loading, implicit vs explicit class loading, class loading operations;
Argument Passing Mechanism: Passing primitive arguments, passing objects, Wrapper Classes;
This keyword: Referencing instance members, Intra class constructor chaining, Method chaining;
Inheritance & code reusability: Extending classes for code reusability, Usage of super keyword, Method Overriding, Object class;
Inheritance & Runtime Polymorphism: Static & Dynamic binding, Inheritance and Is-A relation, Runtime Polymorphism and Generalization, Abstract classes & methods, Final Keyword;
Interfaces and Role based Inheritance: Feature & Role based Inheritance, Static & Dynamic classing Environment, classes & interfaces, interface applications in real scenarios;
Has-A relation: Aggregation & Composition, Nested classes, Inner classes, Anonymous Inner classes, String Buffer Class, tokenizer, applets, Life cycle of applet and Security concerns;

Unit: 3

Threads: Creating Threads, Thread Priority, Blocked States, Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization, Synchronize Threads, Sync Code Block, Overriding Synced Methods, Thread Communication, wait, notify and notify all.

Swing & AWT:
Swing class hierarchy, containers, user interface components, graphics context, AWT Components, Component Class, Container Class, Layout Manager Interface Default Layouts, Insets and Dimensions, Border Layout, Flow Layout, Grid Layout, Card Layout Grid Bag Layout AWT Events, Event Models, Listeners, Class Listener, Adapters, Action Event Methods Focus Event Key Event, Mouse Events, Window Event

Package & Scopes: Need of Packages, Associating classes to Packages, Class path environment variable, Import Keyword and Feature of static import, Public, protected, private & default scope, Private Inheritance;

Exception Handling: exception and error, Exception Handling & Robustness, Common Exceptions and Errors, Try and catch block, Exception handlers, Throw keyword, Checked and Unchecked Exceptions, Role of finally, User defined Exceptions;

Unit-4

Collection Framework: Role and Importance of Collection Framework, List & Set based collection, Iterator & List Iterator, Maps, Searching elements in List, Hash and Tree based collections, Role of equals and hashCode() methods, Comparable and Comparator Interfaces, Thread Safety and Vector, Difference b/w Enumeration and Iterator, Type safety and Generics, Common algorithms and Collections class, Using Properties class for managing properties files;
Database Connectivity Using JDBC: Overview of native and ODBC Drives, Introduction to JDBC, Type of JDBC drivers, Usage of drivers, Defining properties based Connection Factory;
Basic database operations: Insert, Delete, Update, and Select;
Prepared Statement: Statement, Prepared Statement, Setting Query parameters, Executing Queries;
Callabe Statement: Creating PL/SQL Stored procedures and functions, Creating Callable statements, Executing procedures & functions, Batch Updation, Transacting Queries, Programmatic initialization of database, ResultSetMetaData, DatabaseMetaData;
Input/Output Stream, Stream Filters, Buffered Streams, Data input and Output Stream, Print Stream Random Access File,
Reflection: reflection API, newInstance()method, javap tool, creating javap tool, creating applet viewer, call private method, java 9 features;

Course Outcome:
1. Knowledge of the structure and model of the Java programming language, (knowledge)
2. Use the Java programming language for various programming technologies (understanding)
3. Develop software in the Java programming language,

Text Books:
1. Patrick Naughton and HerbertzSchidt, “Java-2 the complete Reference”,TMH
2. Sierra & bates, “Head First Java”, O’Reilly.

References:

1. E. Balaguruswamy, “Programming with Java”, TMH
2. Horstmann, “Computing Concepts with Java 2 Essentials”, John Wiley.
3. Decker &Hirshfield, “Programming.Java”, Vikas Publication.

LC-IT-317G **WEB TECHNOLOGY LAB**

B.TECH SEMESTER V		SESSIONAL:	25
L T P		THEORY EXAM:	25
3 0 0		TOTAL :	50

Hands on practical experiments based on theory subject.

LC-IT-319G **DESIGN & ANALYSIS OF ALGORITHMS LAB**

B.TECH SEMESTER V		SESSIONAL:	15
L T P		THEORY EXAM:	35
0 0 4		TOTAL:	50

Hands-on experiments related to the course contents of PCC-IT-307G

LC-IT-321G **IT WORKSHOP (MATLAB/SCILAB)**

B.TECH SEMESTER V		SESSIONAL: 15
L T P		THEORY EXAM: 35
0 0 4		TOTAL: 50

The course is intended to assist undergraduates in learning the basics of programming in general and programming MATLAB/SCILAB in particular. Basics of programming in MATLAB/SCILAB will be covered, with the goal of having students become comfortable enough to continue learning MATLAB/SCILAB and other programming languages on their own.

Course code	LC-CSE-327G				
Category	Engineering Science Course				
Course title	Programming in Java Lab				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25Marks				
Exam	75Marks				
Total	100Marks				
Duration of Exam	03Hours				

List of Experiment

1. Create a java program to implement stack and queue concept.
2. Write a java package to show dynamic polymorphism and interfaces.
3. Write a java program to show multithreaded producer and consumer application.
4. Create a customized exception and also make use of all the5 exception keywords.
5. Convert the content of a given file into the upper case content of the same file.
6. Develop an analog clock using applet.
7. Develop a scientific calculator using swings.
8. Create an editor like MS-word using swings.
9. CreateaservletthatusesCookiestostorethenumberoftimesauserhasvisited your servlet.
10. Create a simple java bean having bound and constrained properties.

Course code	PCC-CSE-304G				
Category	Professional Core Course				
Course title	Artificial Intelligence				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

1. To provide historical perspective of AI and its foundation.
2. To provide the most fundamental knowledge to the students so that they become familiar with basic principles of AI towards problem solving, inference, knowledge representation and learning.
3. Explore application of AI techniques in Expert systems, Neural Networks.
4. Explore the current trends, potential, limitations, and implications of AI.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: Definition of AI, History of AI, nature of AI problems, examples of AI problems.
Problem solving by search: *Uninformed Search*: Depth First Search (DFS), Breadth First Search (BFS). *Informed Search*: Best First Search, A*. *Local Search*: Hill Climbing. *Problem Reduction Search*: AO*. *Population Based Search*: Ant Colony Optimization, Genetic Algorithm. *Game Playing:* MinMax Algorithm, Alpha-Beta Pruning.

Unit: 2

Knowledge Representation: Types of Knowledge, Knowledge Representation Techniques/schemes: Propositional Logic, Predicate Logic, Semantic nets, Frames. Knowledge representation issues. Rule based systems.

Unit: 3

Reasoning under Uncertainty: Basics of Probability Theory, Probabilistic Reasoning, Bayesian Reasoning, Dempster-Shafer Theory.
Planning: Introduction to Planning, Representation of Planning, Partial-order Planning.

Unit: 4

Learning: Introduction to Learning, Types of Learning: Learning by Induction, Rote Learning, Symbol Based Learning, Identification Trees, Explanation Based Learning, Transformational Analogy, Introduction to Neural Networks, Expert Systems, Current trends in Artificial Intelligence

Suggested books:

1. Artificial Intelligence: A Modern Approach Third Edition Stuart Russell and Peter Norvig, 2010, Pearson Education.

References:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, latest edition
2. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., latest edition
3. Artificial intelligence, Patrick Henry Winston, Addition Wesley latest edition

Course Outcomes

1. Display the understanding of the historical perspective of AI and its foundation.
2. Apply basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.
3. Demonstrate fundamental understanding of various application of AI techniques in Expert systems, Neural Networks.
4. Demonstrate an ability to share in discussion of AI, it’s the current trends, limitations, and implications of AI.

Course code	PCC-CSE-303G				
Category	Professional Core Course				
Course title	Computer Networks				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

a. To develop an understanding of modern network architectures from a design and Performance perspective.
b. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
c. To provide an opportunity to do Network programming
d. To provide a WLAN measurement ideas.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: Data communication,Components, Data Representation, Simplex, Half Duplex and Full Duplex Transmission, Modulation and Multiplexing, Computer networks, distributed processing, Internet, Topologies, Packet and circuit switching, connectionless and connection oriented services.

Network Models: OSI model and TCP/IP Model

Physical Layer – LAN: Ethernet, Token Bus, Token Ring, MAN Architecture- DQDB, WAN Architectures- Frame Relay, ATM, SONET/SDH

Unit: 2

Data Link Layer and Medium Access Sub Layer: MAC Addressing, Framing, Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Medium Access Control: Random access, Controlled Access and channelization protocols.

Network Layer: Logical addressing, classful and classless addressing, subnetting, IPv4, ICMPv4, ARP, RARP and BOOTP, IPv6, IPv6 addressing, DHCP.

Unit: 3

Network Devices: Repeater, hub, switch, router and gateway.
Routing Algorithms: introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State and Distance Vector Routing

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management,

Unit: 4

Congestion Control, Quality of Service, QoS Improving techniques.

Application Layer: Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP

Network Security: Firewalls, security goals, types of attack, symmetric and asymmetric key ciphers.

Suggested books:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

References:

1. Computer Networks, latest Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, latest Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

Course Outcomes

1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) and describe the function of each.
3. Identify and connect various connecting components of a computer network.
4. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

ADVANCED JAVA

Course code	PCC-CSE-306G				
Category	Professional Course Code				
Course title	Advanced Java				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Classwork	25Marks				
Exam	75Marks				
Total	100Marks				
Duration of Exam	03Hours				

Objectives of the course:

1. Programming in the Java programming language,
2. Knowledge of object-oriented paradigm in the Java programming language,
3. The use of Java in a variety of technologies and on different platforms.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Servlet: Servlet introduction, web terminology, servlet API, servlet Interface, generic servlet, Http servlet, servlet lifecycle, servlet with IDE (eclipse, My eclipse, Net beans), servlet request, servlet collaboration, servlet configuration, context, attribute in servlet, session technique in servlet, event and listener, servlet filter, CRUD, pagination, input output stream, annotation, single thread model, SSI;

JSP: Lifecycle of JSP, JSPAPI, scripting elements, 9Implicit Objects, directive elements,

Exceptions, action elements, expression language, MVC in JSP, JSTL, custom tags, pagination, CRUD,JSTL function, formatting, XML, SQL tags,

UNIT 2

Struts: Introduction, features, models, components, struts2 architecture, action, configuration, interceptors, validation method, aware Interfaces, stuts2withI18N, zero configuration, struts2withtiles, hibernate with struts2, spring with struts2, UI tags;

Mail API: java mail introduction, methods of sending email, sending mail by Gmail, receiving email, sending attachment, receiving attachment, sending html, forwarding, deleting email;

UNIT3

Hibernate(HB): Introduction, architecture, HB with IDE, HB Log4j, inheritance mapping, HB mapping, transaction management, HB query language, HB criteria query language, named query, HB caching, integration, HB lifecycle;

Spring: Introduction, modules, spring with IDE, dependency injection methods, spring AOP, spring Jdbc template, spring ORM, SPEL, MVC tag library, applications, spring remoting, spring OXM, spring web, security models, spring boot, spring with angular;

UNIT 4

Android: Introduction, history & versions, architecture, building blocks, emulator, android widgets, activity and intents, android fragments, android menu, android service, SQLite, XML & JSON, android speech, multimedia, telephony, maps;

Design Pattern: java design pattern, creational, structural, behavioral, J2EE patterns, presentation layers,

Course Outcome:

1. Knowledge of the structure and model of the Java programming language, (knowledge)
2. Use the Java programming language for various programming technologies (understanding)
3. Develop software in the Java programming language,

Suggested Text Books:

1. Patrick Naught on and Herbertz Schidt, “Java-2 the complete Reference”,TMH
2. Sierra & bates, “Head First Java”, O’Reilly.

Suggested Reference Books:

1. E. Balaguruswamy, “Programming with Java”,TMH
2. Horstmann, “Computing Conceptswith Java2 Essentials”, John Wiley.
3. Decker & Hirsh field, “Programming.Java”, Vikas Publication.

Course code	ESC -CSE -308G				
Category	Professional Elective Course				
Course title	Mobile and wireless communication				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes

1. Understand the wireless/cellular radio concepts such as frequency reuse, handoff and interference between mobiles and base stations.
2. Identify the techno-political aspects of wireless and mobile communications such as the allocation of the limited wireless spectrum by regulatory agencies.
3. Understand the information theoretical aspects such as channel capacity, propagation effects, modeling the impact of signal bandwidth and motion in mobile systems.
4. Describe the current and future Mobile Communication Systems, GSM, Satellite, Broadcasting, Bluetooth, Wireless LANs, Mobile Adhoc Networks.
5. Describe the mobility support mechanism, WWW and WAPs.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- 1

Introduction: Application, History, Market Scenario, Reference Model and Overview, Wireless Local Loop and Cellular system.

Wireless Transmission: Frequencies, Signals, Antennae, Signal Propagation, Multiplexing, Modulation, Spread Spectrum.

MAC Layer: Specialized MAC, SDMA, FDMA, TDMA – Fixed TDM, Classical ALOHA, Slotted, ALOHA, CSMA, DAMA, PKMA, Reservation TDMA. Collision Avoidance, Polling, Inhibit Sense Multiple Access, CDMA.

Broadcasting: Unidirectional Distribution Systems, Digital Audio Broadcasting, Digital Video Broadcasting, Convergence of Mobile and Broadcasting Techniques.

UNIT 2

GSM: Mobile Services, Architecture Radio, Interface, Protocol, Localization, Calling Handover, Security, New data services.

Wireless LAN: IEEE 802 11- System and Protocol Architecture, Physical Layer, MAC Layered Management.

Bluetooth: User scenarios, Physical layer, MAC Layer, Networking, Security and Link Management.

UNIT 3

Mobile Network Layer: Mobile IP-Goals, Assumptions, Requirement, Entities, Terminology, IP Packet delivery, Agent Advertisement and Discovery, Registration, Tunneling, Encapsulation, Optimization, Reserve Tunneling, Security, IPv6 , DHCP.

Mobile Adhoc Networks: Routing, Destination Sequence Distance Vector, Dynamic Source Routing, Hierarchical algorithms, Performance Metrics.

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping, TCP, Mobile TCP, Fast- retransmission TCP, Transaction oriented TCP.

UNIT 4

Satellite Systems: History, Applications, GEO, LEO, MEO, Routing, Localization, Handover in Satellite System.

Support for Mobility: File System, WWW, HTML, System Architecture.

WAP: Architecture, Wireless Datagram, Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Application Environment, Telephony Applications.

References:

1. Jochen Schiller, “MobileCommunication”, Pearson Education, latest edition
2. LEE, “Mobile Cellular Telecommunications”, McGRAW-Hill, latest edition
3. Theodore S Rappaport, “Wireless Communications”, Pearson Education.

Course Outcomes

- Explain the principles and theories of mobile computing technologies.
- Describe infrastructures and technologies of mobile computing technologies.
- List applications in different domains that mobile computing offers to the public, employees, and businesses.
- Describe the possible future of mobile computing technologies and applications.
- Effectively communicate course work through written and oral presentations

Course code	PROG-CSE-322G				
Category	Professional Elective Course				
Course title	PROJECT				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-326G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Artificial Intelligence Lab Using Python</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2"></td></tr>
<tr><td></td><td>0</td><td>3</td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Practical

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to Implement 8-Puzzle problem using Python.
5. Write a Program to Implement Water-Jug problem using Python.
6. Write a Program to Implement Travelling Salesman Problem using Python.
7. Write a Program to Implement Tower of Hanoi using Python.
8. Write a Program to Implement Monkey Banana Problem using Python.
9. Write a Program to Implement Missionaries-Cannibals Problems using Python.
10. Write a Program to Implement 8-Queens Problem using Python.

Course code	LC-CSE-323G				
Category	Engineering Science Course				
Course title	Computer Networks Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	0	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course code	MC-317G			
Category	Mandatory Course			
Course title	**Constitution of India**			
Scheme and credits	L	T	P	Credits
	2	0	0	0

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit – I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

Unit – II

Federal structure and distribution of legislative and financial powers between the Union and the States

Unit – III

Organs of Governance: President – Qualification and Powers of the President, Governor- Qualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

Unit – IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Right to equality , Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score minimum 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

<table>
<tr><td>Course code</td><td colspan="5">PEC CSE-311G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Software Engineering</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2"></td></tr>
<tr><td>3</td><td>0</td><td></td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives of the course

- Be successful professionals in the field with solid fundamental knowledge of software engineering
- Utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams
- Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: The process, software products, emergence of software engineering, evolving role of software, software life cycle models, Software Characteristics, Applications, Software crisis.

Software project management: Project management concepts, software process and project metrics Project planning, project size estimation metrics, project estimation Techniques, empirical estimation techniques, COCOMO- A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management, project scheduling and tracking

Unit: 2

Requirements Analysis and specification requirements engineering, system modeling and simulation Analysis principles modeling, partitioning Software, prototyping: , Prototyping methods and tools; Specification principles, Representation, the software requirements specification and reviews Analysis Modeling: Data Modeling, Functional modeling and information flow: Data flow diagrams, BehavioralModeling; The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the control and process specification; The data dictionary; Other classical analysis methods.

System Design: Design concepts and principles: the design process: Design and software quality, design principles; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

Unit: 3

Architectural Design: Software architecture, Data Design: Data modeling, data structures, databases and the data warehouse, Analyzing alternative Architectural Designs, architectural complexity; Mapping requirements into a software architecture; Transform flow, Transaction flow; Transform mapping: Refining the architectural design.

Testing and maintenance: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, white box testing, basis path testing: Control structure testing: Black box testing, testing for specialized environments, architectures and applications. Software Testing Strategies: Verification and validation, Unit testing, Integration testing, Validation testing, alpha and beta testing; System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, the debugging process debugging approaches. Software re-engineering, reverse engineering, restructuring, forward engineering.

Unit: 4

Software Reliability and Quality Assurance :Quality concepts, Software quality assurance , SQA activities; Software reviews: cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting and record keeping, review guidelines; Formal approaches to SQA; Statistical software quality assurance; software reliability: Measures of reliability and availability ,The ISO 9000 Quality standards: The ISO approach to quality assurance systems, The ISO 9001 standard, Software Configuration Management. Computer Aided software Engineering: CASE, building blocks, integrated case environments and architecture, repository.

Suggested books:

- Software Engineering – A Practitioner‟s Approach, Roger S. Pressman, 1996, MGH.

References:

- Fundamentals of software Engineering, Rajib Mall, PHI Software Engineering by Nasib Singh Gill, Khanna Book Publishing Co (p) Ltd
- Software Engineering by Ian sommerville, Pearson Edu, latest edition, AW,
- Software Engineering – David Gustafson, T.M.H
- Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson JW&S,
- An Integrated Approach to software engineering by Pankaj jalote, Narosa,

Course Outcomes

1. How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
2. An ability to work in one or more significant application domains
3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software
4. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle
5. Demonstrate an ability to use the techniques and tools necessary for engineering practice

Course code	PEC CSE-313G				
Category	Professional Elective Course				
Course title	System Programming and System Administration				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

1. Evolution of the components of system programming.
2. To learn working and different stages of complitaion process.
3. To learn basic of assembler and loading schemes.
4. To learn basics of file structure.
5. To know about filters and pipeline.
6. To learn shell programming

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Evolution of Components Systems Programming, Assemblers, Loaders, Linkers, Macros, Compilers. software tools, Text editors, Interpreters and program generators, Debug Monitors, Programming environment.

Compiler: Brief overview of compilation process, Incremental compiler, Assembler: Problem statement, symbol table; Loader schemes, compile and go Loader, general loader schemes, absolute loader, Reallocating loader, Direct linkage Loader, Binders, overlays.

Unit: 2

Theoretical Concept of Unix Operating System: Basic features of operating system; File structure: CPU scheduling; Memory management: swapping, demand paging; file system: block and fragments, inodes, directory structure; User to user communication

Unit: 3

Getting Started with Unix: User names and groups, logging in; Format of Unix commands; Changing your password; Characters with special meaning; Unix documentation; Files and directories; Current directory, looking at the directory contents, absolute and relative pathnames, some Unix directories and files; Looking at the file contents; File permissions; basic operation on files; changing permission modes; Standard files, standard output; Standard input, standard error; filters and pipelines; Processes; finding out about processes; Stopping background process; Unix editor vi.

Unit-4

Shell Programming: Programming in the Borne and C-Shell; Wild cards; Simple shell programs; Shell variables; interactive shell scripts; Advanced features.

System Administration: Definition of system administration; Booting the system; Maintaining user accounts; File systems and special files; Backups and restoration; Role and functions of a system manager. Overview of the Linux operating system

Suggested books:

1. Systems Programming by Donovan, TMH.
2. The unix programming environment by Brain Kernighen& Rob Pike, 1984, PHI & Rob Pike.
3. Design of the Unix operating system by Maurich Bach, 1986, PHI.
4. Introduction to UNIX and LINUX by John Muster, 2003, TMH.

References:

1. Advanced Unix programmer's Guide by Stephen Prato, BPB
2. Unix- Concept and applications by Sumitabha Das, T.M..H

Course Outcomes

1. To understand various file statistics.
2. To work on wildcards.
3.To know about shell programming and AWK utitliy.

Course Code	PEC-CSE-315G				
Category	Elective				
Course title	Digital Image Processing				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition method

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

Unit: 2

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms.
Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering

Unit: 3

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

Unit-4

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors.

Suggested books:

1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition,2010.
2. Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.

References:

1. Kenneth R. Castleman, Digital Image Processing Pearson, latest edition
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB Pearson Education, Inc., latest edition
3. D,E. Dudgeon and RM. Mersereau,Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, latest edition
4. William K. Pratt,Digital Image Processing John Wiley, New York, latest edition
5. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, latest edition

Course Outcomes

1. Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
2. Operate on images using the techniques of smoothing, sharpening and enhancement.
3. Understand the restoration concepts and filtering techniques.
4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models

Course code	PEC-CSE310G				
Category	Professional Elective Course				
Course title	Advance Database Management System				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objective of the course:

1. To understand DBMS Components, Advantages and Disadvantages.
2. Understanding Data modeling: ER, EER, Network, Hierarchical and Relational data models.
3. Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
4. To understand transaction concept, schedules, serializability, locking and concurrency control protocols.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Architecture, Advantages, Disadvantages, Data models, relational algebra,SQL, Normal forms.

Query Processing: General strategies for query processing, transformations, expected size, statistics in estimation, query improvement. Query evaluation, view processing, query processor.

Unit-II

Recovery: Reliability, Transactions, recovery in centralized DBMS, reflecting updates, Buffer management logging schemes, disaster recovery.

Concurrency: Introduction, Serializability, Concurrency control, Locking schemes, Timestamp based ordering, Optimistic, Scheduling, Multiversion techniques, Deadlocks.

Unit-III

Parallel and Distributed Databases: Distributed Data Storage – Fragmentation & Replication, Location and Fragment.
Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

Unit-IV

Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases

Suggested Text Book:

1. Elmarsi, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", 4^{th} Edition, Pearson Education,2007
2. Garcia, Ullman, Widom, "Database Systems, The complete book", Pearson Education, 2007
3. R. Ramakrishnan, "Database Management Systems", McGraw Hill International Editions, 1998

Suggested References Books:

1. Date, Kannan, Swaminathan, "An Introduction to Database Systems", 8th Edition Pearson Education, 2007
2. Singh S.K., "Database System Concepts, design and application", Pearson Education, 2006.
3. Silberscatz, Korth, Sudarshan, "Database System Concepts", Mcgraw Hill, 6th Edition, 2006
4. W. Kim, "Modern Database Systems", 1995, ACM Press, Addision Wesley,

Course Outcomes:

1. Students will get understanding of DBMS Components, Its advantages and disadvantages.
2. Understanding about various types of Data modeling: ER, EER, Network, Hierarchical and Relational data models.
3. Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
4. Understanding transaction concept, schedules, serializability, locking and concurrency control protocols.

Course code	PEC-CSE-312G				
Category	Elective				
Course title	Mobile applications development				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

- Introduce the students with the various "Next Generation Technologies" in the area of mobile computing
- Assist students understand the various Mobile operating Systems
- Explore the findings using Andriod Technologies

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

Unit: 2

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

Unit: 3

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

Unit-4

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment.

iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment

Suggested books:

1. Anubhav Pradhan, Anil V Deshpande, “ Mobile Apps Development” Edition:
2. Jeff McWherter, Scott Gowell “Professional Mobile Application Development”, John Wiley & Sons, 2012.
3. Barry Burd, “Android Application Development All in one for Dummies”, Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS

References:

1. Neal Goldstein, Tony Bove, “iPhone Application Development All-In-One For Dummies”, John Wiley & Sons
2. Henry Lee, Eugene Chuvyrov, “Beginning Windows Phone App Development”, Apress, latest edition.
3. Jochen Schiller,“Mobile Communications”, Addison-Wesley, latest edition
4. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002, ISBN 0471419028.

Course Outcomes

1. Explain the principles and theories of mobile computing technologies.
2. Describe infrastructures and technologies of mobile computing technologies.
3. List applications in different domains that mobile computing offers to the public, employees, and businesses.
4. Describe the possible future of mobile computing technologies and applications.
5. Effectively communicate course work through written and oral presentations

Course code	PEC-CSE-314G				
Category	Professional Elective Course				
Course title	Computer Graphics				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

1. To have basic understanding of the core concepts of Computer Graphics.
2. Understand scan conversion, 2D, 3D – transformation and viewing.
3. To be able to create interactive computer Graphics with understanding of shading, image processing and illumination model.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT1

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software; Two dimensional Graphics Primitives: Points and Lines, Scan Conversion: Point, Line, Circle; Region Filling: Scanline algorithm, Polygon filling algorithm, boundary filled algorithm.

UNIT 2

Two dimensional transformations: Geometric, Coordinate and, composite transformation.
Two Dimensional Viewing: window to view port mapping; Clipping: point, line, polygon, curve and text clipping

UNIT 3

Three-dimensional transformations: Three dimensional graphics concept, Geometric and Coordinate transformations, **Viewing in 3D:** Projection, Taxonomy of projection,
Hidden surface removal: Introduction to hidden surface removal, The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.

UNIT 4

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, B-Spline curves. Parametric representation of surfaces; Interpolation method.
Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency, image processing.

Suggested Text Books:

1. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
2. Computer Graphics by Donald Hearn and M.Pauline Baker, 2 Edition, 1999, PHI
3. Computer Graphics by Z. Xiang, R. Plastock, 2nd Edition, TMH Education.

References:

1. Procedural Elements for Computer Graphics – David F. Rogers, T.M.H latest Edition
2. Fundamentals of 3-Dimensional Computer Graphics by Alan Watt, Addision Wesley.
3. Computer Graphics: Secrets and Solutions by Corrign John, BPB
4. Graphics, GUI, Games & Multimedia Projects in C by Pilania&Mahendra, Standard Publ.
5. Computer Graphics Secrets and solutions by Corrign John, BPV
6. Introduction to Computer Graphics by N. Krishanmurthy T.M.H latest edition

Course Outcomes:

1. Understanding of the software, hardware and applications of Computer Graphics.
2. Understanding of Scan conversion, 2D, 3D – transformation and viewing.
3. To be able to implement picture on screen using projection, shading, image processing and illumination model.

PEC-IT-302G **INFORMATION RETRIEVAL**

B.TECH SEMESTER V	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL: 100

Course Objectives:

1. To build an understanding of the fundamental concepts of Information Retrieval
2. To understand the elements of Web Search Engines and Crawlers
3. To familiarize students with the basic taxonomy and terminology of Indices and to understand Heap's Law for estimation and Zipf's law for modeling distribution of terms
4. To understand dictionary compression and posting list compression and to introduce the scoring , tf-idf weighting and vector space model for scoring

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Information retrieval problem, an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval, an inverted index, Bi-word indexes, Positional indexes, Combination schemes

UNIT-II

Search Engines: Basic Building Blocks and Architecture, Text Acquisition, Text Transformation, Index Creation, User Interaction, Ranking, Evaluation.

CRAWL AND FEEDS: Crawling the Web, Retrieving Web Pages, The Web Crawler, Freshness, Focused Crawling, Deep Web, Crawling Documents and Email, Storing the Documents, Detecting Duplicates

UNIT-III

INDEX CONSTRUCTION AND COMPRESSION: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing

Index compression: Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage, Postings file compression

UNIT-IV

SCORING, TERM WEIGHTING AND THE VECTOR SPACE MODEL : Parametric and zone indexes, Weighted zone scoring, Learning weights, The optimal weight, Term frequency and weighting, Inverse document frequency, Tf-idf weighting, The vector space model for scoring , Computing scores in a complete search system.

Course Outcomes:

After taking the course, students will be able to:

a. Understand basic Information Retrieval Systems and learn how Boolean queries are processed.
b. understand the basic concept of Search Engines their architecture and its various functional components and understand the basic concept of Web crawlers and their architecture
c. identify the different types of indices: inverted index, positional index, bi-word index and be able make estimations and model distribution of terms and compressions
d. enumerate various types of indices and also understand the concept of efficient storage of indices and learn tf-idf scoring and vector space model scoring for ranking

REFERENCES

1. **C.D.Manning, P. Raghavan and H.Schutze "*Introduction to Information Retrieval*", Cambridge University Press, Latest Edition**
2. **B.Croft, D.Metzler, T.Strohman, "*Search Engines : Information Retrieval in Practice*", AddisionWesley, Latest Edition**

PEC-IT-304G **SOFT COMPUTING**

B.TECH SEMESTER VI	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL :	100

Course Objectives

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide students an hand-on experience on MATLAB to implement various strategies.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

UNIT-I

INTRODUCTION TO SOFT COMPUTING:

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

UNIT-II

FUZZY LOGIC:

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-III

NEURAL NETWORKS:

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT-IV

GENETIC ALGORITHMS:

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.

Matlab:

Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

Course Outcomes

After completion of course, students would be able to:

a. Identify and describe soft computing techniques and their roles in building intelligent Machines.
b. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
c. Apply genetic algorithms to combinatorial optimization problems.
d. Evaluate and compare solutions by various soft computing approaches for a given problem.

REFERENCES:

1. **George J. Klir and Bo Yuan, "*Fuzzy Sets and Fuzzy Logic: Theory and Applications*", PHI**
2. **Satish Kumar, "*Neural Networks: A classroom approach*" Tata McGraw Hill.**
3. **Haykin S., "*Neural Networks-A Comprehensive Foundations*", PHI**
4. **Anderson J.A., "*An Introduction to Neural Networks*", PHI**
5. **M.Ganesh, "*Introduction to Fuzzy sets and Fuzzy Logic*" PHI.**
6. **N P Padhy and S P Simon, " *Soft Computing with MATLAB Programming*", Oxford University Press**

PEC-IT-304G **INTERNET OF THINGS**

B.TECH SEMESTER VII		SESSIONAL:	25
L T P		THEORY EXAM:	75
3 0 0		TOTAL :	100

Pre-requisites: Internet and web Technology, Computer Networks Course Objectives:

1. Student will be able to learn the basics of IOT.
2. Student will be able to analyse basic protocols of wireless and MAC.
3. Students will get familiar with web of things.
4. Students will get basic knowledge of resource management.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

Unit-I

INTRODUCTION TO IOT

Introduction to IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs ,IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network, Challenges in IoT(Design ,Development, Security).

Unit-II

NETWORK AND COMMUNICATION ASPECTS

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit-III

WEB OF THINGS

Web of Things vs Internet of things, two pillars of web, Architecture and standardization of IoT, Unified multitier-WoT architecture, WoT portals and Business intelligence, Cloud of things: Grid/SOA and cloud computing, Cloud middleware, cloud standards

Unit-IV

RESOURCE MANAGEMENT IN IOT

Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications Clustering, Synchronization, Software agents.
Course Outcomes:

On successful completion of the course, the student will:

a. Understand the concepts of Internet of Things
b. Analyze basic protocols network
c. Understand the concepts of Web of Things
d. Design IoT applications in different domain and be able to analyze their performance

TEXT/REFERENCE BOOKS:

1. **Vijay Madisetti, Arshdeep Bahga, "*Internet of Things: A Hands-On Approach*"**
2. **Waltenegus Dargie, Christian Poellabauer, "*Fundamentals of Wireless Sensor Networks: Theory and Practice*"**

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Computer Science & Information Technology)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Computer Science & Information Technology) – 5th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Engineering Science Course	ESC-IT-301G	Signals and systems	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-CSE-303G	Computer Networks	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-IT-303G	Web Technology	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-CSE-307G	Design & Analysis of Algorithms	3	0	0	3	3	25	75		100	3
5	Professional Core Course	PCC-CSE-309G	Programming in Java	3	0	0	3	3	25	75		100	3
6	Professional Elective Course	Refer Annexure-I	Elective-I Common with CSE	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-IT-317G	Web Technology Lab	0	0	2	2	1	25	-	25	50	3
8	Professional Core Course	LC-CSE-323G	Computer Networks Lab	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-IT-319G	Design & Analysis of Algorithms Lab.	0	0	3	3	1.5	25		25	50	3
10	Professional Core Course	LC-CSE327G	Programming in Java Lab	0	0	3	3	1.5	25		25	50	3
11	Training	PT-CSIT329G	Practical Training – 1	-	-	-	-	-	-	-	* Refer Note 1		
		TOTAL						23.5				800	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Scheme of Studies and Examination
B.TECH (Computer Science & Information Technology) – 6th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week L	T	P	Total Contact Hrs. per week	Credit	Examination Schedule (Marks) Internal Assessment	External Examination	Practical	Total	Duration of Exam (Hours)
1	Professional Core Course	PCC-CSE-304G	Artificial Intelligence	3	0	0	3	3	25	75		100	3
2	Engineering Science Course	ESC-CSE-308G	Mobile and Wireless Communication	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-IT-304G	Cloud Computing	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-CSE-306G	Advanced Java Common with CSE	3	0	0	3	3	25	75		100	3
5	Professional Elective Course	Refer Annexure-I	Elective-II Common with CSE	3	0	0	3	3	25	75		100	3
6	Open Elective Course	Refer Annexure-II	Elective –III Common with IT	3	0	0	3	3	25	75		100	3
7	Project	PROJ-CSE-322G	Project-I	0	0	4	4	2	25		25	50	3
8	Professional Core Course	LC-CSE-326G	Artificial Intelligence Lab using python	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-CSE-328G	Advanced Java Lab	0	0	3	2	1	25		25	50	3
10	Mandatory Courses	MC-317G	Constitution of India	2	0	0							
		TOTAL CREDIT						**22.5**	**225**	**450**	**75**	**750**	

Note:

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

Annexure I

Elective –I (Professional Elective Course)

1. PEC-CSE-311G:Software Engineering
2. PEC-CSE-313G : System Programming and System Administration
3. PEC-CSE-315G :Digital Image Processing

Annexure II

Elective –II (Professional Elective Course)

1. PEC-CSE-310G:Advanced Database Management System
2. PEC-CSE-312G :Mobile Application Development
3. PEC-CSE-314G:Computer Graphics

Annexure III

Elective –III (Professional Elective Course)

1. PEC-IT-302G: Information Retrieval
2. PEC-IT-304G : Soft Computing
3. PEC-IT-306G : Internet of things

ESC-IT-301G SIGNALS AND SYSTEM

B.TECH SEMESTER V SESSIONAL: 25

L T P THEORY EXAM: 75

3 0 0 TOTAL: 100

Course Objectives:

The aim of the course is for:
1. Understanding the fundamental characteristics of signals and systems.
2. Understanding the concepts of vector space, inner product space and orthogonal series.
3. Understanding signals and systems in terms of both the time and transform domains, taking advantage of the complementary insights and tools that these different perspectives provide.
4. Development of the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

UNIT-I

INTRODUCTION TO SIGNALS AND SYSTEMS:

Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

UNIT-II

BEHAVIOR OF CONTINUOUS AND DISCRETE-TIME LTI SYSTEMS

Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse respons

UNIT-III

FOURIER, LAPLACE AND Z- TRANSFORMS

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The DiscreteTime Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

UNIT-IV

SAMPLING AND RECONSTRUCTION

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

a. Understand the concepts of continuous time and discrete time systems.
b. Analyse systems in complex frequency domain.
c. Understand sampling theorem and its implications.

REFERENCES:

1. **A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "*Signals and systems*", Prentice Hall India, latest edition**
2. **J. G. Proakis and D. G. Manolakis, "*Digital Signal Processing: Principles, Algorithms, and Applications*", Pearson, latest edition.**
3. **H. P. Hsu, "*Signals and systems*", Schaum's series, McGraw Hill Education, latest edition.**
4. **S. Haykin and B. V. Veen, "*Signals and Systems*", John Wiley and Sons, latest edition.**
5. **A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall,** latest edition**.**
6. **M. J. Robert "*Fundamentals of Signals and Systems*", McGraw Hill Education, latest edition.**
7. **B. P. Lathi, "Linear Systems and Signals", Oxford University Press,** latest edition**.**

Course code	PCC-CSE-303G				
Category	Professional Core Course				
Course title	Computer Networks				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

a. To develop an understanding of modern network architectures from a design and Performance perspective.
b. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
c. To provide an opportunity to do Network programming
d. To provide a WLAN measurement ideas.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: Data communication,Components, Data Representation, Simplex, Half Duplex and Full Duplex Transmission, Modulation and Multiplexing, Computer networks, distributed processing, Internet, Topologies, Packet and circuit switching, connectionless and connection oriented services.

Network Models: OSI model and TCP/IP Model

Physical Layer – LAN: Ethernet, Token Bus, Token Ring, MAN Architecture- DQDB, WAN Architectures- Frame Relay, ATM, SONET/SDH

Unit: 2

Data Link Layer and Medium Access Sub Layer: MAC Addressing, Framing, Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Medium Access Control: Random access, Controlled Access and channelization protocols.

Network Layer: Logical addressing, classful and classless addressing, subnetting, IPv4, ICMPv4, ARP, RARP and BOOTP, IPv6, IPv6 addressing, DHCP.

Unit: 3

Network Devices: Repeater, hub, switch, router and gateway.
Routing Algorithms: introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State and Distance Vector Routing

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management,

Unit: 4

Congestion Control, Quality of Service, QoS Improving techniques.

Application Layer: Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP

Network Security: Firewalls, security goals, types of attack, symmetric and asymmetric key ciphers.

Suggested books:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

References:

1. Computer Networks, latest Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, latest Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

Course Outcomes

1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) and describe the function of each.
3. Identify and connect various connecting components of a computer network.
4. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

PCC-IT-303G **WEB TECHNOLOGY**

B.TECH SEMESTER V	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL :	100

Pre-requisites: Computer Networks Course Objectives:

1. To familiarize the students with the basic concepts of internet, its history, ways to connect to internet and basics of world wide web and search engines.
2. To familiarize the student with the fundamental language of internet i.e. HTML
3. To teach the student aware of the concepts of cascading style sheets
4. To teach the student the students the basics of client side and Server side scripting

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

UNIT-I

INTRODUCTION TO NETWORKS AND WWW

Introduction to internet, history, Working of Internet, Modes of Connecting to Internet, Internet Address, standard address, classful and classless ip addressing, subnetting, supernetting, w3c consortium, searching the www: Directories search engines and Meta search engines, search fundamentals, search strategies, Architecture of the search engines, Crawlers and its types, Delivering multimedia over web pages, VRML.

UNIT-II

HYPERTEXT MARKUP LANGUAGE

The anatomy of an HTML document: Marking up for structure and style: basic page markup, absolute and relative links, ordered and unordered lists, embedding images and controlling appearance, table creation and use, frames, nesting and targeting.

UNIT-III

STYLE SHEETS

Separating style from structure with style sheets, Internal style specifications within HTML, External linked style specification using CSS, page and site design considerations.

UNIT-IV

CLIENT SIDE PROGRAMMING

Introduction to Client side programming, Java Script syntax, the Document object model, Event handling, Output in JavaScript, Forms handling, cookies, Introduction to VBScript, Form Handling.

SERVER SIDE SCRIPTING

CGI, Server Environment, Servlets, Servlet Architecture, Java Server Pages, JSP Engines, Beans, Introduction to J2EE.

Course Outcomes:
At the end of the course/session the student would be

a. Acquainted with the basics of internet &search engines.
b. Have a hands on HTML
c. Learned the need and basics of CSS
d. Learned the concepts of client side and server side scripting.

REFERENCES

1. **"*Fundamentals of the Internet and the World Wide Web*", Raymond Greenlaw and Ellen Hepp, TMH , latest edition.**
2. **"*Internet & World Wide Programming*", Deitel,Deitel & Nieto, Pearson Education**
3. **"*Complete idiots guide to java script*". Aron Weiss, QUE.**
4. **"*Network firewalls*", Kironjeet syan - New Rider Pub.**

PCC-CSE-307G DESIGN & ANALYSIS OF ALGORITHMS

B.TECH SEMESTER V		SESSIONAL:	25
L T P		THEORY EXAM:	75
3 0 0		TOTAL:	100

Pre-requisites: Data

structure and Algorithm

Course Objectives:

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

Unit-I

INTRODUCTION

Characteristics of algorithm, Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Unit-II

FUNDAMENTAL ALGORITHMIC STRATEGIES

Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knapsack, Job sequencing with deadline, Optimal Binary Search tree, N-Queen problem, Hamiltonian Cycle, TSP, Heuristics – characteristics and their application domains.

Unit-III

GRAPH AND TREE TRAVERSAL ALGORITHMS

Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit-IV

TRACTABLE AND INTRACTABLE PROBLEMS

Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard, Cook's theorem, Standard NP-complete problems and Reduction techniques.

ADVANCED TOPICS

Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Course Outcomes:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
5. For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.
6. Explain the ways to analyze randomized algorithms (expected running time, probability of error).
7. Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

REFERENCES

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "*Introduction to Algorithms*", MIT Press/McGraw-Hill; 3rd edition, [ISBN: 978-0262533058], 2009.

***2.* Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "*Fundamentals of Algorithms*",**

Universities Press; 2nd edition [ISBN: 978-8173716126], 2008.

3. Jon Kleinberg and Éva Tardos, "*Algorithm Design",* Pearson Publisher; 1st edition [ISBN: 978-0321295354], 2012.
Michael T Goodrich and Roberto Tamassia, "*Fundamentals of Algorithms"* Wiley Press; 1st edition [ISBN: 978-8126509867], 2006.

Course code	PCC-CSE-309G				
Category	Professional Core Course				
Course title	Programming in JAVA				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course
1. Programming in the Java programming language,
2. Knowledge of object-oriented paradigm in the Java programming language,
3. The use of Java in a variety of technologies and on different platforms.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction to Java: Evolution of Java, Object Oriented Programming Structure, Overview and characteristics of Java, Java program Compilation and Execution Process, Organization of the Java Virtual Machine, Client side Programming, Platform Independency & Portability, Security, Relation b/w JVM, JRE and JDK, Introduction to JAR format, Naming Conventions, Data types & Type casting, operators, Security Promises of the JVM, Security Architecture and Security Policy, security aspects, sandbox model;

Unit: 2

OOPS Implementation: Classes, Objects, attributes, methods, data encapsulation, reference variables, Constructors, Anonymous block, Method Overloading, Static Data members, Block & methods;
Memory Structure: Stack, Heap, Class & Method area;
Class loading & Execution flow: Static vs Dynamic Class loading, implicit vs explicit class loading, class loading operations;
Argument Passing Mechanism: Passing primitive arguments, passing objects, Wrapper Classes;
This keyword: Referencing instance members, Intra class constructor chaining, Method chaining;
Inheritance & code reusability: Extending classes for code reusability, Usage of super keyword, Method Overriding, Object class;
Inheritance & Runtime Polymorphism: Static & Dynamic binding, Inheritance and Is-A relation, Runtime Polymorphism and Generalization, Abstract classes & methods, Final Keyword;
Interfaces and Role based Inheritance: Feature & Role based Inheritance, Static & Dynamic classing Environment, classes & interfaces, interface applications in real scenarios;
Has-A relation: Aggregation & Composition, Nested classes, Inner classes, Anonymous Inner classes, String Buffer Class, tokenizer, applets, Life cycle of applet and Security concerns;

Unit: 3

Threads: Creating Threads, Thread Priority, Blocked States, Extending Thread Class, Runnable Interface, Starting Threads, Thread Synchronization, Synchronize Threads, Sync Code Block, Overriding Synced Methods, Thread Communication, wait, notify and notify all.

Swing & AWT:
Swing class hierarchy, containers, user interface components, graphics context, AWT Components, Component Class, Container Class, Layout Manager Interface Default Layouts, Insets and Dimensions, Border Layout, Flow Layout, Grid Layout, Card Layout Grid Bag Layout AWT Events, Event Models, Listeners, Class Listener, Adapters, Action Event Methods Focus Event Key Event, Mouse Events, Window Event

Package & Scopes: Need of Packages, Associating classes to Packages, Class path environment variable, Import Keyword and Feature of static import, Public, protected, private & default scope, Private Inheritance;

Exception Handling: exception and error, Exception Handling & Robustness, Common Exceptions and Errors, Try and catch block, Exception handlers, Throw keyword, Checked and Unchecked Exceptions, Role of finally, User defined Exceptions;

Unit-4

Collection Framework: Role and Importance of Collection Framework, List & Set based collection, Iterator & List Iterator, Maps, Searching elements in List, Hash and Tree based collections, Role of equals and hashCode() methods, Comparable and Comparator Interfaces, Thread Safety and Vector, Difference b/w Enumeration and Iterator, Type safety and Generics, Common algorithms and Collections class, Using Properties class for managing properties files;
Database Connectivity Using JDBC: Overview of native and ODBC Drives, Introduction to JDBC, Type of JDBC drivers, Usage of drivers, Defining properties based Connection Factory;
Basic database operations: Insert, Delete, Update, and Select;
Prepared Statement: Statement, Prepared Statement, Setting Query parameters, Executing Queries;
Callabe Statement: Creating PL/SQL Stored procedures and functions, Creating Callable statements, Executing procedures & functions, Batch Updation, Transacting Queries, Programmatic initialization of database, ResultSetMetaData, DatabaseMetaData;
Input/Output Stream, Stream Filters, Buffered Streams, Data input and Output Stream, Print Stream Random Access File,
Reflection: reflection API, newInstance()method, javap tool, creating javap tool, creating applet viewer, call private method, java 9 features;

Course Outcome:

1. Knowledge of the structure and model of the Java programming language, (knowledge)
2. Use the Java programming language for various programming technologies (understanding)
3. Develop software in the Java programming language,

Text Books:

1. Patrick Naughton and HerbertzSchidt, “Java-2 the complete Reference”,TMH
2. Sierra & bates, “Head First Java”, O’Reilly.

References:

1. E. Balaguruswamy, “Programming with Java”, TMH
2. Horstmann, “Computing Concepts with Java 2 Essentials”, John Wiley.
3. Decker &Hirshfield, “Programming.Java”, Vikas Publication.

LC-IT-317G **WEB TECHNOLOGY LAB**

B.TECH SEMESTER V	SESSIONAL:	25
L T P	THEORY EXAM:	25
3 0 0	TOTAL :	50

Hands on practical experiments based on theory subject.

Course code	LC-CSE-323G				
Category	Engineering Science Course				
Course title	Computer Networks Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	0	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

LC-IT-319G DESIGN & ANALYSIS OF ALGORITHMS LAB

B.TECH SEMESTER V	SESSIONAL: 25
L T P	THEORY EXAM: 25
0 0 4	TOTAL: 50

Hands-on experiments related to the course contents of PCC-IT-307G

Course code	LC-CSE-327G				
Category	Engineering Science Course				
Course title	Programming in Java Lab				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25Marks				
Exam	75Marks				
Total	100Marks				
Duration of Exam	03Hours				

List of Experiment

1. Create a java program to implement stack and queue concept.
2. Write a java package to show dynamic polymorphism and interfaces.
3. Write a java program to show multithreaded producer and consumer application.
4. Create a customized exception and also make use of all the5 exception keywords.
5. Convert the content of a given file into the upper case content of the same file.
6. Develop an analog clock using applet.
7. Develop a scientific calculator using swings.
8. Create an editor like MS-word using swings.
9. CreateaservletthatusesCookiestostorethenumberoftimesauserhasvisited your servlet.
10. Create a simple java bean having bound and constrained properties.

Course code	PCC-CSE-304G				
Category	Professional Core Course				
Course title	Artificial Intelligence				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

1. To provide historical perspective of AI and its foundation.
2. To provide the most fundamental knowledge to the students so that they become familiar with basic principles of AI towards problem solving, inference, knowledge representation and learning.
3. Explore application of AI techniques in Expert systems, Neural Networks.
4. Explore the current trends, potential, limitations, and implications of AI.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: Definition of AI, History of AI, nature of AI problems, examples of AI problems.

Problem solving by search: *Uninformed Search*: Depth First Search (DFS), Breadth First Search (BFS). *Informed Search*: Best First Search, A*. *Local Search*: Hill Climbing. *Problem Reduction Search*: AO*. *Population Based Search*: Ant Colony Optimization, Genetic Algorithm. *Game Playing:* MinMax Algorithm, Alpha-Beta Pruning.

Unit: 2

Knowledge Representation: Types of Knowledge, Knowledge Representation Techniques/schemes: Propositional Logic, Predicate Logic, Semantic nets, Frames. Knowledge representation issues. Rule based systems.

Unit: 3

Reasoning under Uncertainty: Basics of Probability Theory, Probabilistic Reasoning, Bayesian Reasoning, Dempster-Shafer Theory.

Planning: Introduction to Planning, Representation of Planning, Partial-order Planning.

Unit: 4

Learning: Introduction to Learning, Types of Learning: Learning by Induction, Rote Learning, Symbol Based Learning, Identification Trees, Explanation Based Learning, Transformational Analogy, Introduction to Neural Networks, Expert Systems, Current trends in Artificial Intelligence

Suggested books:

1. Artificial Intelligence: A Modern Approach Third Edition Stuart Russell and Peter Norvig, 2010, Pearson Education.

References:

1. Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill, latest edition
2. Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI., latest edition
3. Artificial intelligence, Patrick Henry Winston, Addition Wesley latest edition

Course Outcomes

1. Display the understanding of the historical perspective of AI and its foundation.
2. Apply basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.
3. Demonstrate fundamental understanding of various application of AI techniques in Expert systems, Neural Networks.
4. Demonstrate an ability to share in discussion of AI, it's the current trends, limitations, and implications of AI.

Course code	ESC -CSE -308G				
Category	Professional Elective Course				
Course title	Mobile and wireless communication				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes

1. Understand the wireless/cellular radio concepts such as frequency reuse, handoff and interference between mobiles and base stations.
2. Identify the techno-political aspects of wireless and mobile communications such as the allocation of the limited wireless spectrum by regulatory agencies.
3. Understand the information theoretical aspects such as channel capacity, propagation effects, modeling the impact of signal bandwidth and motion in mobile systems.
4. Describe the current and future Mobile Communication Systems, GSM, Satellite, Broadcasting, Bluetooth, Wireless LANs, Mobile Adhoc Networks.
5. Describe the mobility support mechanism, WWW and WAPs.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- 1

Introduction: Application, History, Market Scenario, Reference Model and Overview, Wireless Local Loop and Cellular system.

Wireless Transmission: Frequencies, Signals, Antennae, Signal Propagation, Multiplexing, Modulation, Spread Spectrum.

MAC Layer: Specialized MAC, SDMA, FDMA, TDMA – Fixed TDM, Classical ALOHA, Slotted, ALOHA, CSMA, DAMA, PKMA, Reservation TDMA. Collision Avoidance, Polling, Inhibit Sense Multiple Access, CDMA.

Broadcasting: Unidirectional Distribution Systems, Digital Audio Broadcasting, Digital Video Broadcasting, Convergence of Mobile and Broadcasting Techniques.

UNIT 2

GSM: Mobile Services, Architecture Radio, Interface, Protocol, Localization, Calling Handover, Security, New data services.

Wireless LAN: IEEE 802 11- System and Protocol Architecture, Physical Layer, MAC Layered Management.

Bluetooth: User scenarios, Physical layer, MAC Layer, Networking, Security and Link Management.

UNIT 3

Mobile Network Layer: Mobile IP-Goals, Assumptions, Requirement, Entities, Terminology, IP Packet delivery, Agent Advertisement and Discovery, Registration, Tunneling, Encapsulation, Optimization, Reserve Tunneling, Security, IPv6 , DHCP.

Mobile Adhoc Networks: Routing, Destination Sequence Distance Vector, Dynamic Source Routing, Hierarchical algorithms, Performance Metrics.

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping, TCP, Mobile TCP, Fast- retransmission TCP, Transaction oriented TCP.

UNIT 4

Satellite Systems: History, Applications, GEO, LEO, MEO, Routing, Localization, Handover in Satellite System.

Support for Mobility: File System, WWW, HTML, System Architecture.

WAP: Architecture, Wireless Datagram, Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Application Environment, Telephony Applications.

References:

1. Jochen Schiller, “MobileCommunication”, Pearson Education, latest edition
2. LEE, “Mobile Cellular Telecommunications”, McGRAW-Hill, latest edition
3. Theodore S Rappaport, “Wireless Communications”, Pearson Education.

Course Outcomes

- Explain the principles and theories of mobile computing technologies.
- Describe infrastructures and technologies of mobile computing technologies.
- List applications in different domains that mobile computing offers to the public, employees, and businesses.
- Describe the possible future of mobile computing technologies and applications.
- Effectively communicate course work through written and oral presentations

PCC-IT-304G **CLOUD COMPUTING**

L T P	SESSIONAL: 25
3 0 0	THEORY EXAM: 75
	TOTAL : 100

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

INTRODUCTION TO CLOUD COMPUTING:

Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing .

Unit-II

CLOUD COMPUTING ARCHITECTURE:

Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise .

Unit-III

SECURITY ISSUES IN CLOUD COMPUTING

Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security Identity and Access Management Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

SECURITY MANAGEMENT IN THE CLOUD

Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS Privacy Issues Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations

Unit-IV

AUDIT AND COMPLIANCE

Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud.

DATA INTENSIVE COMPUTING

Map-Reduce Programming Characterizing Data-Intensive Computations, Technologies for Data- Intensive Computing, Storage Systems, Programming Platforms, MapReduce Programming, MapReduce Programming Model, Example Application

COURSE OUTCOMES:

After completion of course, students would be able to:

a. Identify security aspects of each cloud model
b. Develop a risk-management strategy for moving to the Cloud
c. Implement a public cloud instance using a public cloud service provider

REFERENCES

1. **"*Cloud Computing Explained: Implementation Handbook for Enterprises*", John Rhoton, Publication Date: November 2, 2009**
2. **"*Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)*", Tim Mather, ISBN-10: 0596802765,O'Reilly Media, September 2009**

ADVANCED JAVA

Course code	PCC-CSE-306G				
Category	Professional Course Code				
Course title	Advanced Java				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Classwork	25Marks				
Exam	75Marks				
Total	100Marks				
Duration of Exam	03Hours				

Objectives of the course:

1. Programming in the Java programming language,
2. Knowledge of object-oriented paradigm in the Java programming language,
3. The use of Java in a variety of technologies and on different platforms.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Servlet: Servlet introduction, web terminology, servlet API, servlet Interface, generic servlet, Http servlet, servlet lifecycle, servlet with IDE (eclipse, My eclipse, Net beans), servlet request, servlet collaboration, servlet configuration, context, attribute in servlet, session technique in servlet, event and listener, servlet filter, CRUD, pagination, input output stream, annotation, single thread model, SSI;

JSP: Lifecycle of JSP, JSPAPI, scripting elements, 9Implicit Objects, directive elements,

Exceptions, action elements, expression language, MVC in JSP, JSTL, custom tags, pagination, CRUD,JSTL function, formatting, XML, SQL tags,

UNIT 2

Struts: Introduction, features, models, components, struts2 architecture, action, configuration, interceptors, validation method, aware Interfaces, stuts2withI18N, zero configuration, struts2withtiles, hibernate with struts2, spring with struts2, UI tags;

Mail API: java mail introduction, methods of sending email, sending mail by Gmail, receiving email, sending attachment, receiving attachment, sending html, forwarding, deleting email;

UNIT3

Hibernate(HB): Introduction, architecture, HB with IDE, HB Log4j, inheritance mapping, HB mapping, transaction management, HB query language, HB criteria query language, named query, HB caching, integration, HB lifecycle;

Spring: Introduction, modules, spring with IDE, dependency injection methods, spring AOP, spring Jdbc template, spring ORM, SPEL, MVC tag library, applications, spring remoting, spring OXM, spring web, security models, spring boot, spring with angular;

UNIT 4

Android: Introduction, history & versions, architecture, building blocks, emulator, android widgets, activity and intents, android fragments, android menu, android service, SQLite, XML & JSON, android speech, multimedia, telephony, maps;

Design Pattern: java design pattern, creational, structural, behavioral, J2EE patterns, presentation layers,

Course Outcome:

1. Knowledge of the structure and model of the Java programming language, (knowledge)
2. Use the Java programming language for various programming technologies (understanding)
3. Develop software in the Java programming language,

Suggested Text Books:

1. Patrick Naught on and Herbertz Schidt, “Java-2 the complete Reference”,TMH
2. Sierra & bates, “Head First Java”, O’Reilly.

Suggested Reference Books:

1. E. Balaguruswamy, “Programming with Java”,TMH
2. Horstmann, “Computing Conceptswith Java2 Essentials”, John Wiley.
3. Decker & Hirsh field, “Programming.Java”, Vikas Publication.

Course code	PROG-CSE-322G				
Category	Professional Elective Course				
Course title	PROJECT				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-326G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Artificial Intelligence Lab Using Python</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2"></td></tr>
<tr><td></td><td>0</td><td>3</td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Practical

1. Write a Program to Implement Breadth First Search using Python.
2. Write a Program to Implement Depth First Search using Python.
3. Write a Program to Implement Tic-Tac-Toe game using Python.
4. Write a Program to Implement 8-Puzzle problem using Python.
5. Write a Program to Implement Water-Jug problem using Python.
6. Write a Program to Implement Travelling Salesman Problem using Python.
7. Write a Program to Implement Tower of Hanoi using Python.
8. Write a Program to Implement Monkey Banana Problem using Python.
9. Write a Program to Implement Missionaries-Cannibals Problems using Python.
10. Write a Program to Implement 8-Queens Problem using Python.

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-328G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Advanced JAVA Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2"></td></tr>
<tr><td></td><td>0</td><td>3</td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course code	MC-317G			
Category	Mandatory Course			
Course title	**Constitution of India**			
Scheme and credits	L	T	P	Credits
	2	0	0	0

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit – I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

Unit – II

Federal structure and distribution of legislative and financial powers between the Union and the States

Unit – III

Organs of Governance: President – Qualification and Powers of the President, Governor- Qualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

Unit – IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Right to equality , Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score minimum 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

Course code	PEC CSE-311G				
Category	Professional Elective Course				
Course title	Software Engineering				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

- Be successful professionals in the field with solid fundamental knowledge of software engineering
- Utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams
- Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: The process, software products, emergence of software engineering, evolving role of software, software life cycle models, Software Characteristics, Applications, Software crisis.

Software project management: Project management concepts, software process and project metrics Project planning, project size estimation metrics, project estimation Techniques, empirical estimation techniques, COCOMO- A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management, project scheduling and tracking

Unit: 2

Requirements Analysis and specification requirements engineering, system modeling and simulation Analysis principles modeling, partitioning Software, prototyping: , Prototyping methods and tools; Specification principles, Representation, the software requirements specification and reviews Analysis Modeling: Data Modeling, Functional modeling and information flow: Data flow diagrams, BehavioralModeling; The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the control and process specification; The data dictionary; Other classical analysis methods.

System Design: Design concepts and principles: the design process: Design and software quality, design principles; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

Unit: 3

Architectural Design: Software architecture, Data Design: Data modeling, data structures, databases and the data warehouse, Analyzing alternative Architectural Designs, architectural complexity; Mapping requirements into a software architecture; Transform flow, Transaction flow; Transform mapping: Refining the architectural design.

Testing and maintenance: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, white box testing, basis path testing: Control structure testing: Black box testing, testing for specialized environments, architectures and applications. Software Testing Strategies: Verification and validation, Unit testing, Integration testing, Validation testing, alpha and beta testing; System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, the debugging process debugging approaches. Software re-engineering, reverse engineering, restructuring, forward engineering.

Unit: 4

Software Reliability and Quality Assurance :Quality concepts, Software quality assurance , SQA activities; Software reviews: cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting and record keeping, review guidelines; Formal approaches to SQA; Statistical software quality assurance; software reliability: Measures of reliability and availability ,The ISO 9000 Quality standards: The ISO approach to quality assurance systems, The ISO 9001 standard, Software Configuration Management. Computer Aided software Engineering: CASE, building blocks, integrated case environments and architecture, repository.

Suggested books:

- Software Engineering – A Practitioner‟s Approach, Roger S. Pressman, 1996, MGH.

References:

- Fundamentals of software Engineering, Rajib Mall, PHI Software Engineering by Nasib Singh Gill, Khanna Book Publishing Co (p) Ltd
- Software Engineering by Ian sommerville, Pearson Edu, latest edition, AW,
- Software Engineering – David Gustafson, T.M.H
- Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson JW&S,
- An Integrated Approach to software engineering by Pankaj jalote, Narosa,

Course Outcomes

1. How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
2. An ability to work in one or more significant application domains
3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software
4. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle
5. Demonstrate an ability to use the techniques and tools necessary for engineering practice

Course code	PEC CSE-313G				
Category	Professional Elective Course				
Course title	System Programming and System Administration				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

1. Evolution of the components of system programming.
2. To learn working and different stages of complitaion process.
3. To learn basic of assembler and loading schemes.
4. To learn basics of file structure.
5. To know about filters and pipeline.
6. To learn shell programming

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Evolution of Components Systems Programming, Assemblers, Loaders, Linkers, Macros, Compilers. software tools, Text editors, Interpreters and program generators, Debug Monitors, Programming environment.

Compiler: Brief overview of compilation process, Incremental compiler, Assembler: Problem statement, symbol table; Loader schemes, compile and go Loader, general loader schemes, absolute loader, Reallocating loader, Direct linkage Loader, Binders, overlays.

Unit: 2

Theoretical Concept of Unix Operating System: Basic features of operating system; File structure: CPU scheduling; Memory management: swapping, demand paging; file system: block and fragments, inodes, directory structure; User to user communication

Unit: 3

Getting Started with Unix: User names and groups, logging in; Format of Unix commands; Changing your password; Characters with special meaning; Unix documentation; Files and directories; Current directory, looking at the directory contents, absolute and relative pathnames, some Unix directories and files; Looking at the file contents; File permissions; basic operation on files; changing permission modes; Standard files, standard output; Standard input, standard error; filters and pipelines; Processes; finding out about processes; Stopping background process; Unix editor vi.

Unit-4

Shell Programming: Programming in the Borne and C-Shell; Wild cards; Simple shell programs; Shell variables; interactive shell scripts; Advanced features.

System Administration: Definition of system administration; Booting the system; Maintaining user accounts; File systems and special files; Backups and restoration; Role and functions of a system manager. Overview of the Linux operating system

Suggested books:

1. Systems Programming by Donovan, TMH.
2. The unix programming environment by Brain Kernighen& Rob Pike, 1984, PHI & Rob Pike.
3. Design of the Unix operating system by Maurich Bach, 1986, PHI.
4. Introduction to UNIX and LINUX by John Muster, 2003, TMH.

References:

1. Advanced Unix programmer's Guide by Stephen Prato, BPB
2. Unix- Concept and applications by Sumitabha Das, T.M..H

Course Outcomes

1. To understand various file statistics.
2. To work on wildcards.
3. To know about shell programming and AWK utitliy.

Course Code	PEC-CSE-315G				
Category	Elective				
Course title	Digital Image Processing				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition method

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

Unit: 2

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms.
Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering

Unit: 3

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

Unit-4

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors.

Suggested books:

1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition,2010.
2. Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.

References:

1. Kenneth R. Castleman, Digital Image Processing Pearson, latest edition
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB Pearson Education, Inc., latest edition
3. D,E. Dudgeon and RM. Mersereau, Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, latest edition
4. William K. Pratt,Digital Image Processing John Wiley, New York, latest edition
5. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, latest edition

Course Outcomes

1. Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
2. Operate on images using the techniques of smoothing, sharpening and enhancement.
3. Understand the restoration concepts and filtering techniques.
4. Learn the basics of segmentation, features extraction, compression and recognition methods for color models

Course code	PEC-CSE310G				
Category	Professional Elective Course				
Course title	Advance Database Management System				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objective of the course:

1. To understand DBMS Components, Advantages and Disadvantages.
2. Understanding Data modeling: ER, EER, Network, Hierarchical and Relational data models.
3. Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
4. To understand transaction concept, schedules, serializability, locking and concurrency control protocols.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Architecture, Advantages, Disadvantages, Data models, relational algebra, SQL, Normal forms.

Query Processing: General strategies for query processing, transformations, expected size, statistics in estimation, query improvement. Query evaluation, view processing, query processor.

Unit-II

Recovery: Reliability, Transactions, recovery in centralized DBMS, reflecting updates, Buffer management logging schemes, disaster recovery.

Concurrency: Introduction, Serializability, Concurrency control, Locking schemes, Timestamp based ordering, Optimistic, Scheduling, Multiversion techniques, Deadlocks.

Unit-III

Parallel and Distributed Databases: Distributed Data Storage – Fragmentation & Replication, Location and Fragment.
Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

Unit-IV

Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases

Suggested Text Book:

1. Elmarsi, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", 4^{th} Edition, Pearson Education,2007
2. Garcia, Ullman, Widom, "Database Systems, The complete book", Pearson Education, 2007
3. R. Ramakrishnan, "Database Management Systems", McGraw Hill International Editions, 1998

Suggested References Books:

1. Date, Kannan, Swaminathan, "An Introduction to Database Systems", 8th Edition Pearson Education, 2007
2. Singh S.K., "Database System Concepts, design and application", Pearson Education, 2006.
3. Silberscatz, Korth, Sudarshan, "Database System Concepts", Mcgraw Hill, 6th Edition, 2006
4. W. Kim, "Modern Database Systems", 1995, ACM Press, Addision Wesley,

Course Outcomes:

1. Students will get understanding of DBMS Components, Its advantages and disadvantages.
2. Understanding about various types of Data modeling: ER, EER, Network, Hierarchical and Relational data models.
3. Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
4. Understanding transaction concept, schedules, serializability, locking and concurrency control protocols.

Course code	PEC-CSE-312G				
Category	Elective				
Course title	Mobile applications development				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

- Introduce the students with the various "Next Generation Technologies" in the area of mobile computing
- Assist students understand the various Mobile operating Systems
- Explore the findings using Andriod Technologies

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

Unit: 2

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

Unit: 3

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

Unit-4

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment.

iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment

Suggested books:

1. Anubhav Pradhan, Anil V Deshpande, “ Mobile Apps Development” Edition:
2. Jeff McWherter, Scott Gowell “Professional Mobile Application Development”, John Wiley & Sons, 2012.
3. Barry Burd, “Android Application Development All in one for Dummies”, Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS

References:

1. Neal Goldstein, Tony Bove, “iPhone Application Development All-In-One For Dummies”, John Wiley & Sons
2. Henry Lee, Eugene Chuvyrov, “Beginning Windows Phone App Development”, Apress, latest edition.
3. Jochen Schiller,“Mobile Communications”, Addison-Wesley, latest edition
4. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002, ISBN 0471419028.

Course Outcomes

1. Explain the principles and theories of mobile computing technologies.
2. Describe infrastructures and technologies of mobile computing technologies.
3. List applications in different domains that mobile computing offers to the public, employees, and businesses.
4. Describe the possible future of mobile computing technologies and applications.
5. Effectively communicate course work through written and oral presentations

Course code	PEC-CSE-314G				
Category	Professional Elective Course				
Course title	Computer Graphics				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

1. To have basic understanding of the core concepts of Computer Graphics.
2. Understand scan conversion, 2D, 3D – transformation and viewing.
3. To be able to create interactive computer Graphics with understanding of shading, image processing and illumination model.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT1

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software; Two dimensional Graphics Primitives: Points and Lines, Scan Conversion: Point, Line, Circle; Region Filling: Scanline algorithm, Polygon filling algorithm, boundary filled algorithm.

UNIT 2

Two dimensional transformations: Geometric, Coordinate and, composite transformation.
Two Dimensional Viewing: window to view port mapping; Clipping: point, line, polygon, curve and text clipping

UNIT 3

Three-dimensional transformations: Three dimensional graphics concept, Geometric and Coordinate transformations, **Viewing in 3D:** Projection, Taxonomy of projection,
Hidden surface removal: Introduction to hidden surface removal, The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.

UNIT 4

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, B-Spline curves. Parametric representation of surfaces; Interpolation method.
Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency, image processing.

Suggested Text Books:

1. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
2. Computer Graphics by Donald Hearn and M.Pauline Baker, 2 Edition, 1999, PHI
3. Computer Graphics by Z. Xiang, R. Plastock, 2nd Edition, TMH Education.

References:

1. Procedural Elements for Computer Graphics – David F. Rogers, T.M.H latest Edition
2. Fundamentals of 3-Dimensional Computer Graphics by Alan Watt, Addision Wesley.
3. Computer Graphics: Secrets and Solutions by Corrign John, BPB
4. Graphics, GUI, Games & Multimedia Projects in C by Pilania&Mahendra, Standard Publ.
5. Computer Graphics Secrets and solutions by Corrign John, BPV
6 Introduction to Computer Graphics by N. Krishanmurthy T.M.H latest edition

Course Outcomes:

1. Understanding of the software, hardware and applications of Computer Graphics.
2. Understanding of Scan conversion, 2D, 3D – transformation and viewing.
3. To be able to implement picture on screen using projection, shading, image processing and illumination model.

PEC-IT-302G **INFORMATION RETRIEVAL**

B.TECH SEMESTER V	SESSIONAL: 25
L T P	THEORY EXAM: 75
3 0 0	TOTAL: 100

Course Objectives:

1. To build an understanding of the fundamental concepts of Information Retrieval
2. To understand the elements of Web Search Engines and Crawlers
3. To familiarize students with the basic taxonomy and terminology of Indices and to understand Heap's Law for estimation and Zipf's law for modeling distribution of terms
4. To understand dictionary compression and posting list compression and to introduce the scoring , tf-idf weighting and vector space model for scoring

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Information retrieval problem, an inverted index, Processing Boolean queries, The extended Boolean model versus ranked retrieval, an inverted index, Bi-word indexes, Positional indexes, Combination schemes

UNIT-II

Search Engines: Basic Building Blocks and Architecture, Text Acquisition, Text Transformation, Index Creation, User Interaction, Ranking, Evaluation.

CRAWL AND FEEDS: Crawling the Web, Retrieving Web Pages, The Web Crawler, Freshness, Focused Crawling, Deep Web, Crawling Documents and Email, Storing the Documents, Detecting Duplicates

UNIT-III

INDEX CONSTRUCTION AND COMPRESSION: Hardware basics, Blocked sort-based indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic indexing

Index compression: Statistical properties of terms in information retrieval, Heaps' law: Estimating the number of terms, Zipf's law: Modeling the distribution of terms, Dictionary compression, Dictionary as a string, Blocked storage, Postings file compression

UNIT-IV

SCORING, TERM WEIGHTING AND THE VECTOR SPACE MODEL : Parametric and zone indexes, Weighted zone scoring, Learning weights, The optimal weight, Term frequency and weighting, Inverse document frequency, Tf-idf weighting, The vector space model for scoring , Computing scores in a complete search system.

Course Outcomes:

After taking the course, students will be able to:

a. Understand basic Information Retrieval Systems and learn how Boolean queries are processed.
b. understand the basic concept of Search Engines their architecture and its various functional components and understand the basic concept of Web crawlers and their architecture
c. identify the different types of indices: inverted index, positional index, bi-word index and be able make estimations and model distribution of terms and compressions
d. enumerate various types of indices and also understand the concept of efficient storage of indices and learn tf-idf scoring and vector space model scoring for ranking

REFERENCES

1. **C.D.Manning, P. Raghavan and H.Schutze "*Introduction to Information Retrieval*", Cambridge University Press, Latest Edition**
2. **B.Croft, D.Metzler, T.Strohman, "*Search Engines : Information Retrieval in Practice*", AddisionWesley, Latest Edition**

PEC-IT-304G **SOFT COMPUTING**

B.TECH SEMESTER VI	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL :	100

Course Objectives

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide students an hand-on experience on MATLAB to implement various strategies.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

UNIT-I

INTRODUCTION TO SOFT COMPUTING:

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

UNIT-II

FUZZY LOGIC:

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-III

NEURAL NETWORKS:

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT-IV

GENETIC ALGORITHMS:

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.

Matlab:

Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

Course Outcomes

After completion of course, students would be able to:

a. Identify and describe soft computing techniques and their roles in building intelligent Machines.
b. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
c. Apply genetic algorithms to combinatorial optimization problems.
d. Evaluate and compare solutions by various soft computing approaches for a given problem.

REFERENCES:

1. **George J. Klir and Bo Yuan, "*Fuzzy Sets and Fuzzy Logic: Theory and Applications*", PHI**
2. **Satish Kumar, "*Neural Networks: A classroom approach*" Tata McGraw Hill.**
3. **Haykin S., "*Neural Networks-A Comprehensive Foundations*", PHI**
4. **Anderson J.A., "*An Introduction to Neural Networks*", PHI**
5. **M.Ganesh, "*Introduction to Fuzzy sets and Fuzzy Logic*" PHI.**
6. **N P Padhy and S P Simon, " *Soft Computing with MATLAB Programming*", Oxford University Press**

PEC-IT-304G **INTERNET OF THINGS**

B.TECH SEMESTER VII		SESSIONAL:	25
L T P		THEORY EXAM:	75
3 0 0		TOTAL :	100

Pre-requisites: Internet and web Technology, Computer Networks Course Objectives:

1. Student will be able to learn the basics of IOT.
2. Student will be able to analyse basic protocols of wireless and MAC.
3. Students will get familiar with web of things.
4. Students will get basic knowledge of resource management.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

Unit-I

INTRODUCTION TO IOT

Introduction to IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs ,IoT & M2M Machine to Machine, Difference between IoT and M2M, Software define Network, Challenges in IoT(Design ,Development, Security).

Unit-II

NETWORK AND COMMUNICATION ASPECTS

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit-III

WEB OF THINGS

Web of Things vs Internet of things, two pillars of web, Architecture and standardization of IoT, Unified multitier-WoT architecture, WoT portals and Business intelligence, Cloud of things: Grid/SOA and cloud computing, Cloud middleware, cloud standards

Unit-IV

RESOURCE MANAGEMENT IN IOT

Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications Clustering, Synchronization, Software agents.
Course Outcomes:

On successful completion of the course, the student will:

a. Understand the concepts of Internet of Things
b. Analyze basic protocols network
c. Understand the concepts of Web of Things
d. Design IoT applications in different domain and be able to analyze their performance

TEXT/REFERENCE BOOKS:

1. **Vijay Madisetti, Arshdeep Bahga, "*Internet of Things: A Hands-On Approach*"**
2. **Waltenegus Dargie, Christian Poellabauer, "*Fundamentals of Wireless Sensor Networks: Theory and Practice*"**

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION
B.TECH (Electrical Engineering)
SEMESTER 5th AND 6th
Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Electrical Engineering) – 5th Semester
w.e.f. 2020-21

Sl. No.	Course Code	Course Title	Teaching Schedule L	T	P	Marks of class work	Examination marks Theory	Practical	Total Marks	Credit	Duration of examination in hour
1.	PCC-EE-301G	Power Systems–I	3	0	0	25	75	0	100	3	3
2.	LC -EE-303G	Power Systems–I Laboratory	0	0	2	25	0	25	50	1	2
3.	PCC -EE-305G	Control System	3	0	0	25	75	0	100	3	3
4.	LC-EE-307G	Control System LAB	0	0	2	25	0	25	50	1	2
5.	PCC -EE-309G	Microprocessor& Microcontroller	3	0	0	25	75	0	100	3	3
6.	LC -EE-311G	Microprocessor & Microcontroller Lab	0	0	2	25	0	25	50	1	2
7.	PCC-EE-313G	Computer Aided Electrical Machine Design	3	1	0	25	75	0	100	3	3
8.	LC-EE-315G	Computer Aided Electrical Machine Design Lab	0	0	2	25	0	25	50	1	2
9.	PEC-I	Professional Elective Courses (PEC): Refer List-I	3	0	0	25	75	0	100	3	3
10.	OEC-I	Open Elective Courses: Refer List –II	3	0	0	25	75	0	100	3	3
11.	HSMC-01G	Economics for Engineers	3	0	0	25	75	0	100	3	3
12.	PT-EE317G	Practical Training-1	-	-	-	-	-	-	* Refer Note 1		
	Total								900	25	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

List-I

Sr. No	Code	Subject	Credit
1	PEC-EE-01G	Wind and Solar Energy System	3
2	PEC-EE-03G	Electrical Drives	3
3	PEC-EE-05G	HVDC Transmission System	3
4	PEC-EE-07G	High Voltage Engineering	3

List-II

Sr.No	Code	Subject	Credit
1	OEC-EE01G	Electrical Engineering Materials	3
2	OEC-EE03G	Nano Electronics	3
3	OEC-EE05G	Intelligent Instrumentation	3
4	OEC-EE07G	Power Plant Engineering	3

Scheme of Studies and Examination
B.TECH (Electrical Engineering) – 6th Semester
w.e.f. 2020-21

Sl. No.	Course Code	Course Title	Teaching Schedule L	T	P	Marks of class work	Examination marks Theory	Practical	Total Marks	Credit	Duration of examination in hour
1.	PCC -EE-302G	Power Systems–II	3	0	0	25	75	0	100	3	3
2.	LC -EE-304G	Power Systems–II Laboratory	0	0	2	25	0	25	50	1	2
3.	PCC -EE-306G	Power Electronics	3	0	0	25	75	0	100	3	3
4.	LC -EE-308G	Power Electronics Laboratory	0	0	2	25	0	25	50	1	2
5.	LC -EE-310G	Electronics Design Laboratory	1	0	4	25	50	25	100	3	3
6.	PEC-II	Professional Elective Courses (PEC): Refer List-III	3			25	75	0	100	3	3
7.	PEC-III	Professional Elective Courses (PEC): Refer List-IV	3			25	75	0	100	3	3
8.	OEC-II	Open Elective Courses: Refer List –V	3			25	75	0	100	3	3
9.	HSMC - 02G	Organisational Behaviour	3			25	75	0	100	3	3
	Total								800	23	

Note:

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

List-III

PROGRAMME ELECTIVE (Semester-VI)			
Sr. No	**Code**	**Subject**	**Credit**
1.	PEC-EE-04G	Digital Signal Processing	3
2.	PEC-EE-06G	Power System Protection	3

List-IV

PROGRAMME ELECTIVE (Semester-VI)			
3.	PEC-EE-18G	Advance Electric Drives	3
4.	PEC-EE-08G	Power Quality and FACTS	3

List-V

OPEN ELECTIVE-I [Semester-VI]			
Sr.No	Code	Subject	Credit
1.	OEC-EE-04G	VHDL and DIGITAL DESIGN	3
2.	OEC-EE-06G	Distributed Energy Integration	3
3.	OEC-EE-08G	Conventional and Renewable Energy Resources	3
4.	OEC-EE-10G	Soft Computing	3

POWER SYSTEM-I

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PCC- EE-301G		
Category	Program Core Course		
Course title	Power System-I (Theory)		
Scheme	**L**	**T**	**P**
	3		**-**

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the concepts of power systems.
- Understand the various power system components.
- Evaluate fault currents for different types of faults.
- Understand basic protection schemes and circuit breakers.
- Understand concepts of HVDC power transmission and renewable energy generation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

Basic concepts : Introduction, Review of Three-phase systems. Analysis of simple three-phase circuits. Single-phase representation of balance three-phase network, The one-line diagram and the impedance or reactance diagram, Per unit (PU) system, Complex power, The steady state model of synchronous machine, Transmission of electric power, Representation of loads.

Section-B

Fault Analysis : Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults.Representation of generators, lines and transformers in sequence networks.Computation of Fault Currents.Neutral Grounding.

Section-C

Switchgear and protection: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application

Section-D

Introduction to DC Transmission & Solar PV systems: DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission.

Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines. Permanent Magnetic Synchronous Generators and Induction Generators.

Text/References:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
4. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012
6. EHV-AC/DC Transmission System ;S.Rao : Khanna Pub.
7. C.L Wadhwa, " Electrical Power system" new age publication.
8. Power System Protection & Switchgear By B. Ram, McGraw Hill
9. https://nptel.ac.in/courses/108/106/108106160/ by Prof. Krishna S, IIT Madras.
10. https://nptel.ac.in/courses/117/105/117105140/ by Prof. D. Das, IIT, Khahargpur.

Power System-I Laboratory

Class Work: 25
Exam : 25
Total : 50

Course Code	LC-EE-303G		
Category	Program Core Course		
Course title	Power system-I (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

LIST OF EXPERIMENTS:

(A) Hardware Based:

1. To determine negative and zero sequence reactances of an alternator.
2. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
3. To study the IDMT over current relay and determine the time current characteristics
4. To study percentage differential relay
5. To study Impedance, MHO and Reactance type distance relays
6. To study ferranti effect and voltage distribution in H.V. long transmission line using transmission line model.
7. To study operation of oil testing set.
8. To understand PV modules and their characteristics like open circuit voltage, short circuit current, Fill factor, Efficiency,
9. To understand I-V and P-V characteristics of PV module with varying radiation and temperature level
10. To understand the I-V and P-V characteristics of series and parallel combination of PV modules.
11. To understand wind energy generation concepts like tip speed, torque and power relationship, wind speed versus power generation

(B) Simulation Based Experiments (using software)

12. To obtain steady state, transient and sub-transient short circuit currents in an alternator
13. To perform symmetrical fault analysis in a power system
14. To perform unsymmetrical fault analysis in a power system

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups are strictly discouraged/disallowed.

3.

Control system

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PCC-EE-305G		
Category	Program Core Course		
Course title	Control Systems		
Scheme	**L**	**T**	**P**
	03	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the modellingof linear-time-invariant systems using transfer function and state-space representations.
- Understandthe concept of stability and its assessment for linear-time invariant systems.
- Design simple feedback controllers.

Section-A

Introduction to control problem (4 hours)

Industrial control examples, Mathematical models of physical systems, Control hardware and their models, Transfer function models of linear time-invariant systems.

Feedback Control: Open-Loop and Closed-loop systems, benefits of feedback, block diagram algebra, signal flow graphs.

Time Response Analysis (10 hours)

Standard test signals. Time response of first and second order systems for standard test inputs.Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability.Routh-Hurwitz Criteria.Relative Stability analysis.Root-Locus technique.Construction of Root-loci.

Section-B

Frequency-response analysis (6 hours)

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Section-C

Introduction to Controller Design (10 hours)

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems.Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design.Application of

Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs.Analog and Digital implementation of controllers.

Section-D

State variable Analysis (6 hours)

Concepts of state variables.State space model.Diagonalization of State Matrix.Solution of state equations.Eigenvalues and Stability Analysis.Concept of controllability and observability.

Text/References:

1. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.
2. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.
3. I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009.
4. B.S.Manke, “Linear Control Systems: with MATLAB application”, Khanna Publication.
5. https://nptel.ac.in/courses/107/106/107106081/ by Prof.C.S Shankar Ram, IIT Madras.

Control Systems Laboratory

Theory :	25
Class Work :	25
Total :	50

Course Code	LC-EE-307G		
Category	Program Core Course		
Course title	Control Systems Laboratory		
Scheme	**L**	**T**	**P**
	-	**-**	**02**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS: ANY SIX EXPERIEMENTS

1. To study speed Torque characteristics of

a) A.C. servo motor b) DC servo motor.

2. (a) To demonstrate simple motor driven closed loop DC position control system.

(b) To study and demonstrate simple closed loop speed control system.

3. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.

4. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.

5. To implement a PID controller for temperature control of a pilot plant.

6. To study behavior of 1^{st} order, 2^{nd} order type 0, type 1 system.

7. To study control action of light control device.

8. To study water level control using a industrial PLC.

9. To study motion control of a conveyor belt using a industrial PLC

Software Based (ANY FOUR EXPT.)

10. Introduction to software (Control System Toolbox), Implement at least any

- Different Toolboxes in software, Introduction to Control Systems Toolbox.
- Determine transpose, inverse values of given matrix.
- Plot the pole-zero configuration in s-plane for the given transfer function. Plot unit step response of given transfer function and find peak overshoot, peak time.
- Plot unit step response and to find rise time and delay time.

- Plot locus of given transfer function, locate closed loop poles for different values of k.
- Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discuss stability.
- Plot bode plot of given transfer function and find gain and phase margins Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.

Microprocessor and Microcontroller

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PCC-EE-309G		
Category	Program Core Course		
Course title	Microprocessor and Microcontroller		
Scheme	**L**	**T**	**P**
	03	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Objective:

1. To develop an in-depth understanding of the operation of microprocessors.
2. To master the assembly language programming using concepts like assembler directives, procedures, macros, software interrupts etc.
3. To create an exposure to basic peripherals, its programming and interfacing techniques
4. To understand the concept of Interrupts and interfacing details of 8086.
5. To impart the basic concepts of serial communication in 8086.

Section-A

8086 MICROPROCESSORS

Introduction to 8086 Architecture, Features, Signals, I/O & Memory Interfacing, Addressing Modes, Interrupts, Minimum Mode & Maximum Mode Operation, Instruction Set, Assembly Language Programming.

Section-B

PERIPHERAL DEVICES

Parallel Peripheral Interface (8255), A/D & D/A Interface, Timer / Counter (8253), Keyboard and Display Controller (8279), USART (8251), Interrupt Controller (8259), DMA Controller (8237)

Section-C

INTRODUCTION OF MICROCONTROLLER

Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : clocking, i/o pins, interrupts,timers, peripherals.

Section-D

8051 ARCHITECTURE

Microcontroller 8051- Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing, Instruction Set, Assembly Language Programming, Real Time Applications of Microcontroller- Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors.

Reference Books:

1. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.
2. A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
3. D. V. Hall: Microprocessors and Interfacing, TMH
4. Programming and Customizing the 8051 Microcontroller :Predko ; TMH.

Microprocessor and Microcontroller Lab

Theory :	25
Class Work :	25
Total :	50

Course Code	LC-EE-311G		
Category	Program Core Course		
Course title	Microprocessor and Microcontroller Lab		
Scheme	**L**	**T**	**P**
	-	**-**	**02**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.
(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
(iii) Group of students for practical should be 15 to 20 in number.

List of Experiments:

1. Write a program using 8085 and verify for :
   a. Addition of two 8-bit numbers.
   b. Addition of two 8-bit numbers (with carry).
2. Write a program using 8085 and verify for :
   a. 8-bit subtraction (display borrow)
   b. 16-bit subtraction (display borrow)
3. Write a program using 8085 for multiplication of two 8- bit numbers by repeated addition method. Check for minimum number of additions and test for typical data.
4. Write a program using 8085 for multiplication of two 8- bit numbers by bit rotation method and verify.
5. Write a program using 8086 for finding the square root of a given number and Verify.
6. Write a program using 8086 for copying 12 bytes of data from source to destination and verify.
7. Write a program using 8086 and verify for:
   a. Finding the largest number from an array.
   b. Finding the smallest number from an array.
8. Write a program using 8086 for arranging an array of numbers in descending order and verify.
9. Write a program using 8086 for arranging an array of numbers in ascending order

and verify.

10. Write a program to interface a two digit number using seven-segment LEDs. Use 8085/8086 microprocessor and 8255 PPI.
11. Write a program to control the operation of stepper motor using 8085/8086 microprocessor and 8255 PPI.
12. To study implementation & interfacing of Display devices Like LCD, LED Bar graph& seven segment display with Microcontroller 8051/AT89C51
13. To study implementation & interfacing of Different motors like stepper motor, DC motor & servo Motors.
14. Write an ALP for temperature & pressure measurement
15. Write a program to interface a graphical LCD with 89C51

COMPUTER AIDED ELECTRICAL MACHINE DESIGN

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PCC-EE-313G		
Category	Program Core Course		
Course title	COMPUTER AIDED ELECTRICAL MACHINE DESIGN		
Scheme	**L**	**T**	**P**
	03	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

COURSE OUTCOMES:

- To understand the features and limitations of electrical machine design.
- To understand the specified limits for Specific electric and magnetic loading.
- To understand the basic design procedure for transformer, d.c. machine, induction motor and synchronous machine individually.
- To explain the complete detailed design of all static and rotating machine and their performance with problems.
- To understand about the computerization of the design procedure.
- Analyze the design procedure and performance of various algorithms.
- Synthesize efficient algorithm and make a flow chart for all static and rotating machine.
- Analyze the optimization technique and their application to design problem.

SECTION A

FUNDAMENTAL ASPPECTS OF ELECTRICAL MACHINE DESIGN: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.

BASIC DESIGN PRINCIPLES: Output equation and output coefficient, Specific electric and magnetic
loading. Relation between rating and main dimension of rotating machine, Effect of size and ventilation/Factors affecting size of a rotating machine.

SECTION B

DESIGN OF INDUCTION MOTORS: Three Phase Induction Motor: Standard specifications, output equations, choice of specific loadings, main dimensions, conductor size and turns, air gap length, no. of slots, slot design, stator core depth, rotor design, rotor bars& slots area, end rings .

SECTION C

DESIGN OF TRANSFORMER: Output Equations of Single Phase and Three Phase Transformers, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, Main Dimensions - kVA output for single and three phase transformers, Window space factor, Design of core, yoke and winding, overall dimensions.

DESIGN OF SYNCHRONOUS MACHINE: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding.Design of Salient and non- salient Pole Rotors.Magnetic Circuit and Field Winding, design difference between turbo alternator & salient pole generators.

SECTION D

DESIGN OF DC MACHINES: Output equation, choice of specific loadings, choice of poles and speed, Design of core length, armature diameter, depth of armature core,air gap length, cross section of armature conductors, armature slots ,design of field system field poles, field coils, commutator.

COMPUTER AIDED DESIGN: Computerization of design Procedures. Development of Computer program and performance prediction. Optimization techniques and their applications to design Problems.

TEXT BOOKS:

1. A course in Electrical Machine Design by A.K. Sawhney, Khanna Pub.
2. Princilplesof Electrical Machine Design by R. K. Aggarwal.

REFERENCE BOOKS:

1. Theory, performance and Design of alternating current machines by MG Say, ELBS, 15th Ed. 1986.
2. Theory, Performance and Design of Direct Current machines by A.E. Clayton, 3rd Ed. 1967.
3. Optimization Techniques, S.S. Rao

COMPUTER AIDED ELECTRICAL MACHINE DESIGN LAB

Theory :	25
Class Work :	25
Total :	50

Course Code	LC-EE-315G		
Category	Program Core Course		
Course title	COMPUTER AIDED ELECTRICAL MACHINE DESIGN LAB		
Scheme	**L**	**T**	**P**
	-	**-**	**02**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS

1. To study about design factors and its limitations.
2. To study about CAD of rotating electrical machine.
3. To study of computer aided design of transformer.
4. Write a program to measure the main dimension of an induction motor.
5. Write a program for stator design of an induction motor.
6. Write a program for rotor design of an induction motor.
7. Write a program to measure the losses and the efficiency of an induction motor.
8. Write a program to design the armature of a D.C. motor.
9. Write a program to measure the slot design of a synchronous machine.
10. Write a program to measure the core and yoke design of transformer.
11. Write a program to measure the losses in a transformer.

References for software:

1. SPEED
2. MOTORSOLVE
3. FLUX, MAGNET
4. AANSYS RMxprt/Maxwell 2D/3D
5. Motor Design Limited

Wind and Solar Energy Systems

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC- EE-01G		
Category	PROGRAMM ELECTIVE		
Course title	Wind and Solar Energy Systems		
Scheme	**L**	**T**	**P**
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the energy scenario and the consequent growth of the power generation from renewable energy sources.
- Understand the basic physics of wind and solar power generation.
- Understand the power electronic interfaces for wind and solar generation.
- Understand the issues related to the grid-integration of solar and wind energy systems.

Section-A

Introduction to Wind Power: History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

The Solar Resource: Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Section -B

Wind generator topologies: Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Induction Generators, Doubly-Fed Induction Generators and their characteristics, Permanent Magnet Synchronous Generators, Power electronics converters. Generator-Converter configurations, Converter Control.

Section -C

Solar photovoltaic: Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Solar thermal power generation: Technologies, Parabolic trough, central receivers, parabolic dish, Fresnel, solar pond, elementary analysis

Section -D

Network Integration Issues: Overview of grid code technical requirements. Fault ride-through for wind farms - real and reactive power regulation, voltage and frequency operating limits, solar PV and wind farm behaviour during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems.

Text / References:

1. T. Ackermann, “Wind Power in Power Systems”, John Wiley and Sons Ltd., 2005.

2. G. M. Masters, “Renewable and Efficient Electric Power Systems”, John Wiley and Sons, 2004.

3. S. P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, McGraw Hill, 1984.

4. H. Siegfried and R. Waddington, “Grid integration of wind energy conversion systems” John Wiley and Sons Ltd., 2006.

5. G. N. Tiwari and M. K. Ghosal, “Renewable Energy Applications”, Narosa Publications, 2004.

6. J. A. Duffie and W. A. Beckman, “Solar Engineering of Thermal Processes”, John Wiley & Sons, 1991.

Electric Drives

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EE-03G		
Category	PROGRAMM ELECTIVE		
Course title	Electrical Drives		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the characteristics of dc motors and induction motors.
- Understand the principles of speed-control of dc motors and induction motors.
- Understand the power electronic converters used for dc motor and induction motor speed control.

SECTION-A

Electrical drives

Introduction, Classification, advantages, choice of electrical drive machines, status of ac and dcdrives.

DC motor characteristics

Review of emf and torque equations of DC machine, review of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, example load torque-speed characteristics, operating point, armature voltage control for varying motor speed, flux weakening for high speed operation.

Closed-loop control of DC Drive

Control structure of DC drive, inner current loop and outer speed loop, closed-loop speed control of multi-motor drives, microprocessor-based control of electric drives, current controller specification and design, speed controller specification and design.

SECTION-B

Multi-quadrant DC drive

Review of motoring and generating modes operation of a separately excited dc machine, four quadrant operation of dc machine, single-quadrant, two-quadrant and four-quadrant choppers, steady-state operation of multi-quadrant chopper fed dc drive, regenerative braking.

Selection of motor power rating

Heating and cooling, determination of motor rating, continuous, short time and intermittent duty rating, load equalization and determination of moment of inertia of the flywheel.

SECTION-C

Chopper fed DC drive

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper, efficiency of dc drive, smooth starting.

Induction motor characteristics

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torquespeed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency, typical torque-speed curves of fan and pump loads, operating point, constant flux operation, flux weakening operation.

SECTION-D

Scalar control or constant V/f control of induction motor

Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, speed drop with loading, slip regulation.

Control of slip ring induction motor

Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, power electronic based rotor side control of slip ring motor, slip power recovery.

Text / Reference Books:

1. G. K. Dubey, “Power Semiconductor Controlled Drives”, Prentice Hall, 1989.
2. R. Krishnan, “Electric Motor Drives: Modeling, Analysis and Control”, Prentice Hall, 2001.
3. G. K. Dubey, “Fundamentals of Electrical Drives”, CRC Press, 2002.
4. W. Leonhard, “Control of Electric Drives”, Springer Science & Business Media, 2001.

High Voltage Engineering

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EE-07G		
Category	PROGRAMM ELECTIVE		
Course title	High Voltage Engineering		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Objective: To impart knowledge on the following Topics

- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination

Section A

Conduction and Breakdown in Gases:
Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges.

Conduction and Breakdown in Liquid Dielectrics:
Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.

Breakdown in Solid Dielectrics:
Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.

Section B

Generation of High Voltages and Currents:
Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators.

Measurement of High Voltages and Currents:
Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements.

Section C

Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems:

National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems.

Non-Destructive Testing of Materials and Electrical Apparatus:

Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.

Section D

HV Testing of Electrical Apparatus:

Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment.

Graduate Attributes (As per NBA)

Engineering Knowledge, Problem Analysis, Design/ Development of Solutions, Modern Tool Usage, Ethics, Individual and Team Work, Communication, Life-long Learning.

Course outcomes:

At the end of the course the student will be able to:

- Explain conduction and breakdown phenomenon in gases, liquid dielectrics.
- Analyse breakdown phenomenon in solid dielectrics.
- Explain generation of high voltages and currents
- Analyse measurement techniques for high voltages and currents.
- Discuss overvoltage phenomenon and insulation coordination in electric power systems.
- Perform non-destructive testing of materials and electric apparatus and high-voltage testing of electric apparatus

Reference Books

- High Voltage Engineering M.S. Naidu, V.Kamaraju McGraw Hill ‘Latest Eddition’.
- High Voltage Engineering Fundamentals E. Kuffel, W.S. Zaengl, J. Kuffel Newnes ‘Latest Eddition’
- High Voltage Engineering Wadhwa C.L. New Age International ‘Latest Eddition’
- High-Voltage Test and Measuring Techniques Wolfgang Hauschild • Eberhard Lemke Springer ‘Latest Eddition’
- High Voltage Engineering Farouk A.M. Rizk CRC Press ‘Latest Eddition’

HVDC Transmission Systems

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EE-07G		
Category	PROGRAMM ELECTIVE		
Course title	HVDC Transmission Systems		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Objective: To impart knowledge on the following Topics

- DC power transmission technology Analysis of HVDC converters
- Converter and HVDC system control
- Converter faults and protection
- Smoothing reactor and DC line
- Reactive power control
- Component models for the analysis of ac/dc systems
- Power flow analysis in AC/DC systems

Section A

BASIC CONCEPTS

Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

ANALYSIS OF HVDC CONVERTERS

Choice of Converter configuration – analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star –star mode – their performance.

Section B

CONVERTER & HVDC SYSTEM CONTROL

Principal of DC Link Control – Converters Control Characteristics – Firing angle control Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

REACTIVE POWER CONTROL IN HVDC

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

Section C

POWER FLOW ANALYSIS IN AC/DC SYSTEMS

Modelling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC load flow – P.U. System for d.c. quantities-solution of AC-DC Power flow-Simultaneous method-Sequential method.

CONVERTER FAULT & PROTECTION

Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

Section D

HARMONICS

Generation of Harmonics –Characteristics harmonics, calculation of AC Harmonics, Non-Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics

FILTERS

Types of AC filters, Design of Single tuned filters –Design of High pass filters.

Course Outcome

After the completion of the course, the students will be able to:

1. Choose intelligently AC and DC transmission systems for the dedicated application(s).
2. Identify the suitable two-level/multilevel configuration for high power converters.
3. Select the suitable protection method for various converter faults.
4. Identify suitable reactive power compensation method.
5. Decide the configuration for harmonic mitigation on both AC and DC sides.

REFERENCES:

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar,
New Age International (P) Limited, and Publishers.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao.
3. HVDC Transmission – J.Arrillaga.
4. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
5. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications.
6. Arrillaga, J., HVDC Transmission, IEE Press ‘Latest Edition’.

ELECTRICAL ENGINEERING MATERIALS

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC-EE-14G		
Category	OPEN ELECTIVE		
Course title	ELECTRICAL ENGINEERING MATERIALS		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

COURSE OUTCOME:

After the completion of the course, the students will be able to:

- Learn the basics of materials used in electrical engineering.
- Realize the dielectric properties of insulators in static and alternating fields.
- Explain the importance of magnetic properties and superconductivity.
- Explain the behavior of conductivity of metals and classifications of semiconductor material.

SECTION A

Conductivity of Metal: Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.

SECTION B

Dielectric Properties: Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, dielectric losses, significance of the loss tangent, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity

SECTION C

Magnetic properties of Materials: Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.

SECTION D

Semiconductors: energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials.

REFERENCE BOOKS

[1] C.S.Indulkar and S. Thiruvengadam, S., “An Introduction to Electrical Engineering
[2] Kenneth G. Budinski,, “Engineering Materials: Prentice Hall of India, New Delhi

Nano Electronics

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC-EE-04G		
Category	Open Elective		
Course title	Nano Electronics (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material

Section-1

Introduction to nanotechnology, Basics of Quantum Mechanics: Wave nature of particles and wave-particle duality, Pauli Exclusion Principle, wave functions and Schrodinger's equations, Density of States, Band Theory of Solids, Particle in a box Concepts,

Section-I1

Shrink-down approaches: CMOS scaling: advantages and limitations. Nanoscale MOSFETs, FINFETs, Vertical MOSFETs, system integration limits (interconnect issues etc.)

Section-II1

Nanostructure materials, classifications of nanostructure materials, zero dimensional, one dimensional, two dimensional and three dimensional, properties and applications Characterization techniques for nanostructured materials: SEM, TEM and AFM

Section-1V

Nano electronis devices : Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Text/Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic

Materialand Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University
Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

Intelligent Instrumentation

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC- EE-302G		
Category	Open Elective Course		
Course title	Intelligent Instrumentation (Theory)		
Scheme	**L**	**T**	**P**
	3		**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. The basic characteristic of intelligent instrumentation system includes the knowledge of new sensor technology.
2. Able to understand the data acquisition system.
3. Able to understand the signal amplification & attenuation

Section-A

Intelligence, features characterizing intelligence, intelligent instrumentation system: features of intelligent instrumentation, components of intelligent instrumentation, block diagram of intelligent instrumentation.

Section-B

Signal amplification & attenuation (OP-AMP based), instrumentation amplifier (circuit diagram, high CMRR & other features), signal linearization(different types such as diode resistor combination, OP-AMP based etc.), bias removal signal filtering (output from ideal filters, output from constant – k filters, matching of filter sections, active analog filters).

Section-C

OP-AMP based voltage to current converter, current to voltage conversion, signal integration, voltage follower (pre amplifier), voltage comparator, phase locked loop, signal addition, signal multiplication, signal transmission, description of spike filter.

Smart sensors: Primary sensors, excitation, compensation, information coding/processing, data compensation, standard for smart sensor interface.

Section-D

Interfacing instruments and computers: basic issues of interfacing address decoding; data transfer control, A/D convertor, D/A convertors, sample & hold circuit, other interface considerations.

Text Books:

1. Principles of measurements and instrumentation by Alan S Morris, PHI
2. Intelligent instrumentation by Bamay, G.C.Prentice Hall

Reference Books :

1. Sensors and transducers by Parranabis, PHI
2. Introduction to digital signal processing: MGH

Power Plant Engineering

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC-EE07G		
Category	OPEN ELECTIVE		
Course title	Power Plant Engineering		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

1. Describe and analyze different types of sources and mathematical expressions related to thermodynamics and various terms and factors involved with power plant operation.
2. Analyze the working and layout of steam power plants and the different systems comprising the plant and discuss about its economic and safety impacts
3. Able to know about the different types of cycles and natural resources used in power plants and their application.
4. Discuss and analyze the mathematical and working principles of different electrical equipments involved in the generation of power.

Section-A

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam andheating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems

Section-B

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

Section-C

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

Section-D

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems

Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Text Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

ECONOMICS FOR ENGINEERS

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	HSMC-01G		
Category	HS		
Course title	ECONOMICS FOR ENGINEERS		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Objectives:

1. Acquaint the students to basic concepts of economics and their operational significance.
2. To stimulate the students to think systematically and objectively about contemporary economic problems.

COURSE OUTCOMES:

1. The students will able to understand the basic concept of economics.
2. The student will able to understand the concept of production and cost.
3. The student will able to understand the concept of market.
4. The student will able to understand the concept of privatization, globalization and banks.

UNIT-1

Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, **Elasticity of Demand**- meaning, factors effecting it, its practical application and importance.

UNIT-2

Production- Meaning of Production and factors of production, Law of variable proportions, Returns to scale, Internal and external economies and diseconomies of scale.

Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Real cost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-3

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT-4

Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), **Privatization -** meaning, merits and demerits.

Globalization of Indian economy - merits and demerits.

Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions, Difference between Commercial & Central Bank.

REFERENCES:

1. Jain T.R., Economics for Engineers, VK Publication.
2. Chopra P. N., Principle of Economics, Kalyani Publishers.
3. Dewett K. K., Modern economic theory, S. Chand.
4. H. L. Ahuja., Modern economic theory, S. Chand.
5. Dutt Rudar & Sundhram K. P. M., Indian Economy.
6. Mishra S. K., Modern Micro Economics, Pragati Publications.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
8. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
9. Micro Economic Theory – M.L. Jhingan (S.Chand).
10. Micro Economic Theory - H.L. Ahuja (S.Chand).
11. Modern Micro Economics : S.K. Mishra (Pragati Publications).
12. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co).

POWER SYSTEM-II

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PCC- EE-302G		
Category	Program Core Course		
Course title	Power System – II (Theory)		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to;

- Use numerical methods to analyse a power system in steady state.
- Understand stability constraints in a synchronous grid.
- Understand methods to control the voltage, frequency and power flow.
- Understand the basics of power system economics

SECTION-A

Power Flow Analysis : Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations.

Section -B

Economic Operation of Power Systems: Distribution of loads between units within a plant. Distribution of loads between plants, Transmission loss equation, Classical Economic dispatch with losses.Optimal unit commitment problems and their solutions.

Section -C

Voltage and Load Frequency Control: Introduction to control of active and reactive power flow, control of voltage, Excitation systems. Introduction to Load Frequency Control and Automatic generation control, Single area and modelling of AGC, Concept of multi area AGC.

Section -D

Power System Stability: Concepts, steady state and transient stability, swing equations, equal area criterion. Solution of Swing Equation, Transient stability algorithm using modified Euler‘s method and fourth order RungeKutta method,– multi-machine stability analysis

Text/References:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
4. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.
6. https://nptel.ac.in/courses/117/105/117105140/ by Prof. D. Das, IIT, Khahargpur.

Power system-II (Lab)

Theory :	25
Class Work :	25
Total :	50

Course Code	PCC-EE-304G		
Category	Program Core Course		
Course title	Power system-II(Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS:

1. Draw the flow chart and develop the computer program for the formation of the Y Bus of a generalized network.
2. Draw the flow chart and develop the computer program for the formation of the Z Bus of a generalized network.
3. To plot the swing curve and observe the stability.
4. To perform load flow analysis using Gauss Seidel method.
5. To perform load flow analysis using Newton-Raphson method.
6. To study comparison of different load flow methods
7. To develop the program for stability analysis.
8. To observe transmission losses and efficiency with variations in power for the given example.
9. Simulation study on LFC of two area interconnected power system.
10. Simulation study on voltage control in multi area interconnected power system.

Power Electronics

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-306**		
Category	**Engineering Science Course**		
Course title	**Power Electronics**(Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course students will demonstrate the ability to

- Understand the differences between signal level and power level devices.
- Analyse controlled rectifier circuits.
- Analyse the operation of DC-DC choppers.
- Analyse the operation of voltage source inverters.

Section-A

INTRODUCTION : Role of power electronics, review of construction and characteristics of power diode, Shottky diode, power transistor, power MOSFET, DIAC, Triac, GTO, IGBT & SIT.

Section-B

SCR: construction and characteristics of SCR,Ratings and protections, series and parallel connections, R, RC and UJT firing circuit and other firing circuits based on ICs and microprocessors, pulse transformer and opto-coupler, commutation techniques.

Section-C

THYRISTOR RECTIFIER: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

CONVERTERS : One, two, three, six and twelve pulse converters, fully and half controlled converters, load voltage waveforms, output voltage equation, continuous and discontinuous modes of operation, input power factor of converter, reactive power demand, effect of source inductance, introduction to four quadrant / dual converter, power factor improvement techniques, forced commutated converter

Section-D

INVERTERS : Basic circuit, 120 degree mode and 180 degree mode conduction schemes, modified McMurray half bridge and full bridge inverters, McMurray -Bedford half bridge and bridge inverters, brief description of parallel and series inverters, current source inverter (CSI)

CHOPPERS : Basic scheme, output voltage control techniques, one, two, and four quadrant choppers, step up chopper, voltage commutated chopper, current commutated chopper

TEXT BOOK:

1. P.S Bhimra, “Power Electronics”, Khanna publication.
2. MH Rashid, “Power Electronics “, PHI
3. Bose, “Power electronics”,Elsevier

REFERENCE BOOKS :

1. MH Rashid, “Handbook of power electronics “, Elsevier

2. PC Sen, “Power Electronics”, TMH
3. HC Rai, “Power Electronics”, Galgotia
4. GK Dubey, “Thyristorised Power Controllers”,PHI
5. A.K.Gupta and L.P.Singh, “Power Electronics and Introduction to Drives”,.Dhanpat Rai

Power Electronics Laboratory

Class Work:	25
Exam :	25
Total :	50

Course Code	PCC-EE-308		
Category	Engineering Science Course		
Course title	Power Electronics (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

(iv) At least 10 experiments are to be performed by students in the semester.

(v) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(vi) Group of students for practical should be 15 to 20 in number.

List of Experiments

1. Static Characteristics of Power diode &Shottky diode and to study reverse recovery of Power Diode &Shottky diode.
2. Characteristics of IGBT & GTO
3. To study R, RC and UJT firing Circuit with Pulse transformer
4. To study of Firing Circuit based on ICs NE555, 7408 & 3140
5. To Study of Pulse transformer & optocoupler technique
6. To Study of SCR Communication Technique Class A-E.
7. Speed control of small motor using Single Phase Half wave & Full wave fully controlled Converter
8. Speed control of small motor using Single Phase Dual Converter (Continuous and discontinuous Control)
9. Study of Mc Murray - Bed ford Half & Full Bridge Inverter
10. To study Parallel Inverter to drive small AC Induction motor
11. Speed control of a small DC motor using MOSFET based Chopper with output voltage control technique
12. Speed control of small AC induction motor using Single Phase non circulating type bridge by frequency conversion.

Electronics Design (Integrated)

Class Work:	25
Exam :	75
Total :	100

Course Code	**PCC -EE-310G**		
Category	**Engineering Science Course**		
Course title	**Electronics Design (** Integrated)		
Scheme	**L**	**T**	**P**
	1	**-**	**4**

Notes:

- Understand the practical issues related to practical implementation of applications.
- Choose appropriate components, software and hardware platforms.
- Design a Printed Circuit Board, get it made and populate/solder it with components.
- Work as a team with other students to implement an application.

Section-A

Basic concepts on measurements; Noise in electronic systems; Sensors and signal conditioning circuits

Section-B

Introduction to electronic instrumentation and PC based data acquisition; Electronic system design, Analog system design, Interfacing of analog and digital systems

Section-C

Embedded systems, Electronic system design employing microcontrollers, CPLDs, and FPGAs, PCB design and layout; System assembly considerations.

Section-D

Groupprojects involving electronic hardware (Analog, Digital, mixed signal) leading to implementation of an application.

Text/Reference Books

1. A. S. Sedra and K. C. Smith, "Microelectronic circuits", Oxford University Press, 2007.
2. P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1997.
3. H.W.Ott, "Noise Reduction Techniques in Electronic Systems", Wiley, 1989.
4. W.C. Bosshart, "Printed Circuit Boards: Design and Technology", Tata McGraw Hill, 1983.
5. G.L. Ginsberg, "Printed Circuit Design", McGraw Hill, 1991.

*The experiments will be performed on the basis of above contents.

Digital signal processing

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EE-04G		
Category	Program Elective		
Course title	Digital Signal Processing (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations, Convolution and Correlation.
2. To Study the basics, mathematical analysis and applications of DFT and FFT
3. To study the design and implementation of Digital Filters.
4. To impart practical knowledge of signal processing operations by using software.

UNIT I

Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z- transforms, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

UNIT II

Frequency Representation of Signal and Systems: Frequency Domain analysis concept, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Parsevals Identity.

UNIT III

Design of Digital Filter : Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.

UNIT IV

Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks.

Text/Reference Books:

1 John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.

2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.

3. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH

4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH

5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.

6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.

7. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

Power system protection

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PEC-EE-06G**		
Category	**Program Elective**		
Course title	**Power system protection** (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the different components of a protection system.
- Evaluate fault current due to different types of fault in a network.
- Understand the protection schemes for different power system components.
- Understand the basic principles of digital protection.
- Understand system protection schemes, and the use of wide-area measurements.

Section A

Introduction and Components of a Protection System

Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers ,

Generator Protection: External and internal faults – differential protection – biased circulating current protection – self balance system – over-current and earth fault protection – protection against failure of excitation.

Section B

Faults and Over-Current Protection: Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection and overcurrent relay co-ordination.

Transformer protection: Differential protection – self-balance system of protection – over-current and earth fault protection – buchholz' s relay and its operation.

Section C

Equipment Protection Schemes: Directional, Distance, Differential protection. Bus bar Protection, Bus Bar arrangement schemes.

Modeling and Simulation of Protection Schemes : CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing.

Section D

System Protection

Effect of Power Swings on Distance Relaying.System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

Text/References :

1. J. L. Blackburn, “Protective Relaying: Principles and Applications”, Marcel Dekker, New York, 1987.

2. Y. G.Paithankar and S. R. Bhide, “Fundamentals of power system protection”, Prentice Hall, India, 2010.3. A. G. Phadke and J. S. Thorp, “Computer Relaying for Power Systems”, John Wiley & Sons, 1988.

4. A. G. Phadke and J. S. Thorp, “Synchronized Phasor Measurements and their Applications”, Springer, 2008.

5. D. Reimert, “Protective Relaying for Power Generation Systems”, Taylor and Francis, 2006.

Advance Electric Drives

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PEC-EE-18G**		
Category	**Program Elective**		
Course title	**Advance Electric Drives** (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the operation of power electronic converters and their control strategies.
- Understand the vector control strategies for ac motor drives
- Understand the implementation of the control strategies using digital signal processors.

Section A

Power Converters for AC drives

PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.

Section B

Induction motor drives

Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC)

Section C

Synchronous motor drives

Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

Permanent magnet motor drives

Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

Section D

Switched reluctance motor drives

Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.

DSP based motion control

Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.

Text / Reference Books:

1. B. K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education, Asia, 2003.

2. P.C. Krause, O. Wasynczuk and S.D. Sudhoff, “Analysis of Electric Machinery and Drive Systems”, John Wiley & Sons, 2013.

3. H. A. Taliyat and S. G. Campbell, “DSP based Electromechanical Motion Control”, CRC press, 2003.
4. R. Krishnan, “Permanent Magnet Synchronous and Brushless DC motor Drives”, CRC Press, 2009.

Power quality and FACTS

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EE-08G		
Category	**Program Elective**		
Course title	**Power quality and FACTS**(Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Understand the characteristics of ac transmission and the effect of shunt and series reactive Compensation.
2. Understand the working principles of FACTS devices and their operating characteristics.
3. Understand the basic concepts of power quality.
4. Understand the working principles of devices to improve power quality.

Section A

Transmission Lines and Series/Shunt Reactive Power Compensation: Introduction to power quality and their issues, Basics of AC Transmission. Analysis of uncompensated AC transmission lines.Passive Reactive Power Compensation.Shunt and series compensation at the mid-point of an AC line.Comparison of Series and Shunt Compensation.

Thyristor-based Flexible AC Transmission Controllers (FACTS): Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch. Configurations/Modes of Operation, Harmonics and control of SVC and TCSC. Fault Current Limiter.

Section B

Voltage Source Converter based (FACTS) controllers: Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs. Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. STATCOM: Principle of Operation, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller (UPFC): Principle of Operation and Control. Working principle of Interphase Power Flow Controller. Other Devices: GTO Controlled Series Compensator. Fault Current Limiter.

Section C

Application of FACTS: Application of FACTS devices for power-flow control and stability improvement. Simulation example of power swing damping in a single-machine infinite bus system using a TCSC. Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.

Power Quality Problems in Distribution Systems: Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-offsets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve.

Section D

DSTATCOM: Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents.Current Control Techniques in for DSTATCOM.

Dynamic Voltage Restorer and Unified Power Quality Conditioner: Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies. Series Active Filtering.Unified Power Quality Conditioner (UPQC): Working Principle.Capabilities and Control Strategies.

Text/References

1. N. G. Hingorani and L. Gyugyi, “Understanding FACTS: Concepts and Technology of FACTS Systems”, Wiley-IEEE Press, 1999.
2. K. R. Padiyar, “FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Ltd. 2007.
3. T. J. E. Miller, “Reactive Power Control in Electric Systems”, John Wiley and Sons, New York, 1983. 4. R. C. Dugan, “Electrical Power Systems Quality”, McGraw Hill Education, 2012.

VHDL AND DIGITAL DESIGN

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC-EE03G		
Category	OPEN ELECTIVE		
Course title	VHDL and Digital Design		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objective:

1. To understand the modelling & simulation & its role in digital evaluation.
2. To learn basic concepts of VHDL language, its different architecture, designing of various Combinational & sequential circuits.
3. To study various PLDs & detail study of FPGAs and implementation of various combinational & sequential logic circuits on FPGAs.

UNIT-1

INTRODUCTION: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioral dataflow and structural models.

UNIT- 2

VHDL STATEMENTS: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

UNIT -3

COMBINATIONAL & SEQUENTIAL CIRCUIT DESIGN:VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

UNIT-4

DESIGN OF MICROCOMPUTER & PROGRAMMABLE DEVICE: Basic components of a computer, specifications, architecture of a simple microcomputer system, and implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

REFERENCE BOOKS:

1. Ashenden - Digital design,Elsevier
2. IEEE Standard VHDL Language Reference Manual (1993).
3. Digital Design and Modelling with VHDL and Synthesis: KC Chang; IEEE Computer Society Press.
4. "A VHDL Primmer" : Bhasker; Prentice Hall 1995.
5. "Digital System Design using VHDL" : Charles. H.Roth ; PWS (1998).
6. "VHDL-Analysis & Modelling of Digital Systems" : Navabi Z; McGraw Hill.
7. VHDL-IV Edition: Perry; TMH (2002)
8. "Introduction to Digital Systems" : Ercegovac. Lang & Moreno; John Wiley (1999).
9. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH (2000)
10. Modern Digital Electronics- III Edition: R.P Jain; TMH (2003).
11. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier

Distributed Energy Integration

Course Code	OEC-EE-06G		
Category	**Open Elective**		
Course title	**Distributed Energy Integration** (Theory)		
Scheme	**L**	**T**	**P**
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. To introduce the concept of distributed generation, microgrids, electric vehicles and energy storage.
2. To familiarize the students with renewable generation system modelling and their grid integration issues.
3. To impart an understanding of economics, policies and technical regulations for DG integration.

Section A

Distributed Generation

Reasons for growth, extent of DGs, Issues with DGs, Policy/institutional issues, market/financial issues, social/environmental issues, DG Plant Types, DG Machinery & its control, Integration issues, Technical impacts of DGs, Economic impact of DGs, Impact on transmission and generation systems, Security and reliability, International DG integration experience.

Wind/PV System Modelling: Wind/PV variability and uncertainty, Forecasting methods and applications.

Section-B

System studies

Power flow studies, Fault studies, Stability studies, Transient studies, Inertia and Frequency Response studies.

System balancing & imbalance handling: Flexibility Issues, Ramping issues, Inertia and Frequency Response Issues, Role of storage and DR and related issues, Large scale storage for grid stability / Backup.

Electric Vehicles

Technology, Components of EV and their modelling, Charging and Discharging Mechanisms, Driving & Plug-in pattern analysis, Scheduling issues, Challenges in EV integration, Bulk Electric Vehicles, Ancillary Services from EVs.

Section-C

Technical regulations for the interconnection of DGs to the power systems

Overview of technical regulations, Active power control, Frequency control, Voltage control, Technical solutions for new interconnection rules. Protection of DGs. Feasibility of integrating Large-Scale Grid Connected DG, Policy, Market and Regulatory Interventions, Regulatory challenges, Viability of DG integration in deregulated electricity market.
Energy Storage: Type and modelling of storage systems. Scheduling issues, Ancillary services from energy storage, Role in Energy Security, Reliability and Stability.

Section-D

Economics of DG

Value of power from DGs, Market value of power from DGs, Loss reduction, Investment reduction, Connection costs and charges, Distribution use of system charges, Allocation of losses in distribution networks with DG, Alternative framework for distribution tariff development.
DGs in areas of limited transmission capacity.DGs in distribution networks.Active Management of Distribution systems. Ancillary Services with DGs, Markets for Ancillary Services. DER Management, Virtual Power Plants.

Micro Grids

Concept, Design, Modelling, Operation and Analysis. Role in Energy Reliability, Cold Load Pick Up and Sustainability.

Reference Books:

•Math H. Bollen, Fainan Hassan, "Integration of Distributed Generation in the Power System", WileyIEEE Press, 2011.
• Willis H. Lee and Scott W. G., "Distributed Power Generation Planning and Evaluation", Marcel Dekker, Inc, New York, 2000.
• B. Fox, D. Flynn L. Bryans, N. Jenkins, M. O' Malley, R. Watson and D. Milborrow, "Wind Power Integration: Connection and System Operational Aspects" IET, 2007.
• Loi Lei Lai, Tze Fun Chan, "Distributed Generation: Induction and Permanent Magnet Generators" Wiley-IEEE Press, 2007.
• Komarnicki, Przemyslaw, Lombardi, Pio, Styczynski, Zbigniew , "Electric Energy Storage Systems", Springer, 2017.
• Garcia-Valle, Rodrigo, Peças Lopes, João A, "Electric Vehicle Integration into Modern Power Networks", Springer, 2012.

Conventional and Renewable Energy Resources

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**OEC-EE-08G**		
Category	**Open Elective**		
Course title	**Conventional and Renewable Energy Resources** (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Objective:

- The course will provide understanding of power generation technology using conventional and non conventional energy sources which will be useful for understanding the operation and working of power plants.
- Students will learn basics of Tariff structure for energy production.
- Students will understand the operation, maintenance and working of substations.

Section-A

INTRODUCTION: Energy sources, their availability, recent trends in Power Generation, Amount of generation of electric power from Conventional and non conventional sources of energy in Haryana, India and some developed countries of the world. Interconnected Generation of Power Plants.

Section-B

POWER GENERATION PLANNING: Load forecasting, load curves, load duration curve, Base load and Peak load Power Plants, connected Load, maximum demand, demand factor, Group diversity factor, load factor, significance of load factor, plant factor, capacity factor, selection of unit size, No. of Units, reserves, cost of power generation, Depreciation, tariff.

Section-C

CONVENTIONAL ENERGY SOURCES: Selection of site, capacity calculations, classification, Schematic diagram and working of Thermal Power Stations(TPS), Hydro Electric Plant and Nuclear Power Plant .

NON-CONVENTIONAL ENERGY SOURCES: Selection of site, capacity calculations, Schematic diagram and working of Wind, Solar, fuel cell, Magneto Hydro Dynamic (MHD) system.

Section-D

ELECTRIC ENERGY CONSERVATION & MANAGEMENT: Energy management, Energy Audit, Energy Efficient Motors, Co-generation.

Course Outcomes:

After learning the course the students should be able to:

1. Describe the working of thermal power station using single line diagram and state the functions of the major equipment and auxiliaries of a TPS.

2. Explain hydro energy conversion process with block diagrams and identify the appropriate site for it.
3. Explain the working of Nuclear power station.
4. Describe the working of Solar Power station and wind power plant.
5. Compare various economic aspects of different types of Tariffs.
6. Classify various substations and describe working of its equipments.
7. Compare various generating systems.

REFERENCES:

1. Renewable Energy Sources and Emerging Technologies : D.P Kothari, K.C.Singla, Rakesh Ranjan- PHI Publications, 'Latest Edition'.
2.Electric Power Generation, B.R.Gupta, 'Latest Edition'.
3. Power Generation, Operation and Control, Wood and Wollenberg, John Wiley & Sons,'Latest Edition'.
4. A Course in Electric Power System, Soni, Gupta, Bhatnagar, Dhanpat Rai & Sons, 'Latest Edition'.
5. Power System Engineering, Nagrath & Kothari, Tata Mc-Graw Hill, New Delhi, 'Latest Edition'.
6. Power Plant Engg: G.D. Rai, 'Latest Edition'.
7. Electric Power: S.L. Uppal (Khanna Publishing), 'Latest Edition'.

Soft Computing

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**OEC-EE-10G**		
Category	**Open Elective**		
Course title	**Soft Computing** (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. To understand the concepts of soft computing.
2. To introduce the ideas of fuzzy logic, Artificial Neural networks, genetic algorithm.
3. To introduce the concepts of hybrid intelligent systems.
4. To introduce application areas of soft computing and the criteria to select appropriate soft computing

Section A

Soft Computing: Introduction, requirement, different soft computing techniques and their characteristics, comparison with hard computing, applications.

Section B

Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, properties of fuzzy sets, operations on fuzzy sets, Extension principle, Fuzzy relations, Linguistic variables, linguistic terms, Linguistic hedges, Fuzzy reasoning, Mamdani and TSK fuzzy inference systems, Applications, fuzzy controllers, Theoretical and implementation issues.

Section C

Artificial Neural Network: Introduction, comparison with biological neural network, basic models of artificial neuron, different architectures of ANN, Learning techniques, ANN based system modeling, ANN based controller design, theoretical and implementation issues, Applications.

Section D

Evolutionary algorithms and hybrid systems: Genetic Algorithm (GA), different operators of GA, convergence of Genetic Algorithm, Particle swarm optimization algorithm, Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design, Fuzzy Logic design, other Applications of GA.

References :

1. Neuro Fuzzy & Soft Computing - J.-S.R.Jang, C.-T.Sun, E.mizutani, Pearson Education
2. Neural Networks and Fuzzy Systems: Dynamical Systems Application to Machine Intelligence - Bart Kosko, Prentice Hall
3. T.J. Ross, "Fuzzy Logic Control", TMH Publications.
4. S. Hekins, "Comprehensive Neural Networks", Pearson Publications.
5. S. Rajsekharan, VijayalaxmiPai, "Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications", Prentice Hall
6. V. Kecman, "Learning and Soft Computing", MIT Press. B.Tech. (Electrical Engineering) BOS 24-05-2017
7. D. Ruan, "Intelligent Hybrid Systems", Kluwer Academic Publisher.

ORGANIZATIONAL BEHAVIOUR

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	HSMC-02G		
Category	HS		
Course title	ORGANIZATIONAL BEHAVIOUR		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Objectives:

The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

COURSE OUTCOMES:

1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change.

UNIT - 1

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Management and social responsibility, difference between management and administration.

UNIT - 2

Introduction of organization:-

Meaning and process of Organization, Management v/s Organization;

Fundamentals of Organizational Behavior: Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB.

Individual Processes and Behavior-Personality- Concept, determinants and applications; **Perception-** Concept, process and applications, **Learning**- Concept ,theories ; **Motivation-** Concept, techniques and importance.

UNIT - 3

Interpersonal Processes- **Teams and Groups**- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict-** Concept, sources, types, management of conflict; **Leadership:** Concept, function, styles & qualities of leadership.

Communication – Meaning, process, channels of communication, importance ,barriers and overcome of communication.

UNIT - 4

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; **Organizational culture -** Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

REFERENCES:

1. **Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.**
2. **Stoner, J et. al, Management, New Delhi, PHI, New Delhi.**
3. **Satya Raju, Management – Text & Cases, PHI, New Delhi.**
4. **Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.**
5. **Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.**
6. **Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.**
7. **Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.**
8. **Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi.**

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Biotechnology Engineering)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Biotechnology Engineering) – 5th Semester
w.e.f. 2020-21

S N.	Category	Course Code	Course Title	(Hours per week) L	T	P	Total Contact Hrs per Week	Credits	Examination Schedule: Internal Assessment	External Examination	Practical	Total	Duration of Examination (Hours)
1	Professional Core Courses	PCC-BT 301 G	Industrial Microbiology	3	0	0	3	3	25	75		100	3
2	Professional Core Courses	PCC-BT 303 G	Genetic Engineering	3	0	0	3	3	25	75		100	3
3	Professional Core Courses	PCC-BT 305 G	Bio Analytical Techniques	3	0	0	3	3	25	75		100	3
4	Professional Elective Courses	PEC-BT	Elective-I Annexure-1	3	0	0	3	3	25	75		100	3
5	Open Elective Courses	OEC-BT	Open Elective-I Annexure-2	3	0	0	3	3	25	75		100	3
6	Humanities and Social Science Including Management Courses	HSMC-01 G	Economics for Engineers	3	0	0	3	3	25	75		100	3
7	Mandatory course	MC-317G	Constitution of India	2	0	0	2	0					
8	Professional Core Courses	LC-BT 307 G	Industrial Microbiology Lab.	0	0	3	3	1.5	25		25	50	3
9	Professional Core Courses	LC-BT 309 G	Genetic Engineering Lab	0	0	3	3	1.5	25		25	50	3
10	Training	PT-BT-311 G	Practical Training-I									Refer *Note- 1	
Total Credits								**21**				800	

***Note**
1. The evaluation of the Practical Training- I will be based on seminar, viva-voce, report submitted by student. According to performance, the students are awarded grades A, B, C, F. The student who is awarded ‘F’ grade is required to repeat Practical Training.
A- Excellent, B- Good, C- Satisfactory, F- Not satisfactory

ANNEXURE-1

PROFESSIONAL ELECTIVE COURSES [PEC-BT]

Sr No.	Code	Subject	Semester	Credits
		ELECTIVE-I	5	3
1	PEC-BT 311 G	Bioreactor Analysis and Design		
2	PEC-BT 313 G	Developmental Biology		
3	PEC-BT 315 G	Medical Microbiology		

ANNEXURE-2

OPEN ELECTIVE COURSES [OEC-BT]

Sr No.	Code	Subject	Semester	Credits
		OPEN ELECTIVE-I	5	3
1	OEC-BT 301 G	Enzyme Technology		
2	OEC-BT 303 G	Diagnostic Techniques		
3	OEC-BT 305 G	Soft Skill & Interpersonal Communication		
4	OEC-BT 307 G	History of Science & Engineering		

Scheme of Studies and Examination
B.TECH (Biotechnology Engineering) – 6th Semester
w.e.f. 2020-21

S N.	Category	Course Code	Course Title	Teaching schedule (Hours per week)			Total Contact Hours /week	Credits	Examination Marks				Duration of Examination (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Professional Core Courses	PCC-BT 302 G	Plant Biotechnology	3	0	0	3	3	25	75		100	3
2	Professional Core Courses	PCC-BT 304 G	Animal Biotechnology & Stem Cells	3	0	0	3	3	25	75		100	3
3	Professional Core Courses	PCC-BT 306 G	Environmental Biotechnology	3	0	0	3	3	25	75		100	3
4	Professional Elective Courses	PEC-BT	Elective-II Annexure-3	3	0	0	3	3	25	75		100	3
5	Professional Elective Courses	PEC-BT	Elective-III Annexure-4	3	0	0	3	3	25	75		100	3
6	Mandatory course	MC-315G	Essence of Indian Traditional Knowledge	2	0	0	2	0					
7	Professional Core Courses	LC-BT 308 G	Plant Biotechnology Lab.	0	0	3	3	1.5	25		25	50	3
8	Professional Core Courses	LC-BT 310 G	Environmental Biotechnology Lab	0	0	3	3	1.5	25		25	50	3
9	Open Elective Courses	OEC-BT	Open Elective-II Annexure- 5	3	0	0	3	3	25		75	100	3
Total Credits								**21**				800	

PROFESSIONAL ELECTIVE COURSES [PEC-BT]

Sr No.	Code	Subject	Semester	Credits
	ANNEXURE-3	**ELECTIVE-II**	6	3
1	PEC-BT 312 G	Food Biotechnology		
2	PEC-BT 314 G	Protein Engineering		
3	PEC-BT 316 G	Cancer Biology		
	ANNEXURE-4	**ELECTIVE-III**	6	3
1	PEC-BT 318 G	Downstream Processing		
2	PEC-BT 320 G	RNAi Biology		
3	PEC-BT 322 G	Human Genetics		

ANNEXURE-5
OPEN ELECTIVE COURSES [OEC-BT]

Sr No.	Code	Subject	Semester	Credits
	ANNEXURE-5	**OPEN ELECTIVE-II**	6	3
1	OEC-BT 302 G	Biosensor		
2	OEC-BT 304 G	Fermentation Technology		
3	OEC-BT 306 G	Biofuels		
4	OEC-BT 308 G	Cyber Law & Ethics		

Course code	PCC-BT-301G				
Category	Professional Core Course				
Course title	**Industrial Microbiology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3			**3**	
Branches (B. Tech.)	**Biotechnology**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Basics of Industrial Microbiology: An overview, history, scope and applications of industrial microbiology.
Fermentation: Basic principle, component, range and types of fermentation.
Isolation and Screening of Industrially Important Microorganisms: Characteristic of an ideal producer strain, Isolation methods utilizing and not utilizing selection of desired characteristics, Screening for new product- primary and secondary screening.

UNIT-II

Strain Development: Need, Strain improvement**,** Improvement of industrial microorganisms using Mutant Selection- Isolation of auxotrophhs, revertant and resistant mutants, Recombination and Recombinant DNA technology approaches.

UNIT-III

Fermentation Medium: Characteristics of an ideal fermentation medium. Types of medium used in fermentation industry. Types of raw materials used as major carbon and nitrogen sources in fermentation medium. Antifoam agents, Special compounds- precursors, inducers and inhibitors.
Sterilization of medium, Sterilization of air, Sterilization of fermenters.
Inoculum Development: Development of inocula for yeast processes, for bacterial processes, for fungal processes, for vegetative fungi.

UNIT-IV

Production of Microbial Metabolites: Industrial production of amino acid-glutamic acid, Industrial production of Alcoholic beverages -beer, wine, Industrial production of enzymes - amylases, proteases
Industrial production of antibiotics- penicillin, tetracycline, Industrial production of vitamin B12, organic acids -citric acid, acetic acid and Biopesticides.

References:
1. Biotechnology: a handbook of Industrial Microbiology: W. Cruger & , Panima, latest edition
2. Industrial Microbiology: L.E Casida, Wiley Eastern Ltd., latest edition
3. Principles of Fermentation Technology,P F Stanbury and A Whitaker, Pergamon Press
4. Industrial Microbiology: Prescott & Dunn, CBS Publisher, latest edition
5. Introduction to Biochemical Engineering D G Rao latest edition

Course code	PCC-BT-303G				
Category	Professional Core Course				
Course title	**Genetic Engineering**				
Scheme and credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of exam	03 Hours				

Course Objectives:
At the end of the course, student will be able to:
1. Familiarize with the basic concepts and principles of utilization of different expression vectors for cloning in prokaryotic and eukaryotic organisms.
2. Understand the different strategies of gene cloning and construction of genomic and cDNA libraries for applications of recombinant DNA technology.
3. Understand the principles and applications of advanced techniques like PCR, Sequencing and hybridization.
4. Appreciate gene expression in heterologous systems to solve problems ethically.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Basics of DNA cloning: Genetic Engineering: Introduction, scope, milestones and guidelines.
Gene cloning methodologies, restriction enzymes and nucleic acid modifying enzymes, TA cloning, topoisomerase-based cloning, ligation independent cloning, GATEWAY technology; Vectors for gene cloning - plasmids, phages, phagemids, cosmids, shuttle vectors, artificial chromosomes, plant viruses and other advanced vectors; Methods for selection and screening of recombinant clones, selection and screening of clones (marker genes, reporter genes, positive and negative selection, insertion inactivation, alpha-complementation) Bacterial transformation methods.

UNIT II:

Gene Libraries and gene expression
Gene cloning: Construction of Gene libraries, gene probes, screening of libraries, analysis of gene expression, site directed Mutagenesis, microarrays and DNA chips.
Gene Expression: Vector and host engineering, expression in bacteria, yeasts, mammalian cells and plants.

UNIT III:

DNA sequencing, hybridization and amplification:
Principles of DNA sequencing: DNA sequencing methods (Maxam-Gilbert, Sanger, automated sequencing, Next Generation Sequencing or NGS platforms); Introduction to mapping and sequencing of genomes (whole genome shotgun and clone-by-clone approach of genome sequencing).
Labeling of nucleic acids: Random priming - Nick translation - End labeling - RNA labeling - Non-isotopic labeling methods, Blotting techniques
DNA amplification: Polymerase chain reaction: Concept and enzymes employed, optimization of PCR, types of PCR, alternative techniques and applications of PCR

UNIT IV

Gene expression and function, regulatory issues:
Gene Expression -- Gene expression analyses at transcriptional level Northern blotting and its variants, real-time PCR, S1 nuclease mapping, in situ hybridization, RNase protection, nuclear run-on assays, DNA microarrays), translational level (Western blotting, ELISA and immunofluorescence assays). Processing of recombinant proteins.
Applications and ethics of Recombinant DNA Technology -- Production of useful recombinant molecules, improving agronomic traits, diagnostic and therapeutic applications in human diseases.

References:

1. Brown, T. A. Gene Cloning and Analysis: An Introduction. Wiley-Blackwell Publishing, UK., latest edition
2. Glick B. R., Pasternak J. J. and Patten C. L. Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press, USA. latest edition
3. Primrose, S. B. and Twyman, R. M. Principles of Genetic Manipulation and Genomics. Blackwell Publishing, UK. latest edition
4. Dale J. W., Schantz M. V. and Plant N. From Genes to Genomes: Concepts and Applications of DNA Technology. John Wiley & Sons, UK. latest edition
5. Wilson, K. and Walker, J. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press, USA. latest edition
6. Green M. R. and Sambrook J. Molecular Cloning: A Laboratory Manual. CSHL Press, USA. latest edition

Course outcomes:

1.The course work will provide knowledge of principles and applications of the basic as well as advanced tools and techniques in recombinant DNA technology.

2. Students will be familiar with designing experiments and analysing experimental data.

3. The course will not only help in developing molecular/technical skills but also create interest in research.

4. It will also provide a foundation to enable students to understand the advanced courses in the succeeding semesters.

Course code	PCC-BT-305G				
Category	Professional Core Courses				
Course title	**Bio Analytical Techniques**				
Scheme and Credits	**L**	**T**	**P**	**Credit s**	**Semester-V**
	3	**0**		**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

- Understanding of analytical techniques to be used in examinations of biological samples.
- Understanding fundamental of microscopy, centrifugation, chromatography, spectroscopy and electrophoresis.
- Understanding of advanced analytical techniques such as radioisotope techniques

UNIT – I

Microscopy: History of microscopy, Principle of microscopy, Sample Preparation for light microscopy. Limit of resolution, magnification power. Technical arrangement, principle and working of instrument: Light Microscopy- Bright Field, Dark Field and Phase Contrast microscopy, Fluorescence microscopy, Electron microscopy- Scanning & Transmission.

UNIT – II

Centrifugation: Basic principles of sedimentation, Basic instrumentation of centrifuges, types of rotors, types of centrifuges and their applications. Care and safety aspects of centrifuges. Preparative centrifugation and analytical centrifugation. Density Gradient centrifugation, Ultracentrifugation, Sub-Cellular Fractionation.

UNIT – III

Chromatography: General principles. Partition chromatography, Ion-exchange chromatography, Affinity Chromatography, High Pressure Liquid Chromatography, Gas Chromatography, Paper Chromatography and thin layer chromatography.

Electrophoresis: Principles of Electrophoresis, support media, electrophoresis of proteins and nucleic acids, Isoelectric Focusing, Two-dimensional gel Electrophoresis.

UNIT – IV

Spectroscopy: Basic Concepts of spectroscopy, λmax. Principle, instrumentation and applications of various spectroscopic techniques; UV/ Visible Spectroscopy, spectrophotometer, fluorescence spectroscopy, X-ray Spectroscopy, Circular Dichorism Spectroscopy, Infra Red and Raman Spectroscopy, Nuclear Magnetic resonance.

Radioisotope Techniques: Nature of radioactivity, properties of radioactive radiations. Detection and measurement of radioactivity; Geiger Muller and Scintillation counting, Auto-radiography, Safety aspects and radio-waste management.

Course Outcomes

- Students will be able to understand basic principles of techniques used in analysis of biological samples
- Students will be able to understand working of various instruments used in biotechnology.
- Students will be able to operate the basic instruments used in biotechnology laboratories such as spectrophotometer, microscope, HPLC, gel electrophoresis etc.

References:

1. Principles and Techniques of Biochemistry and Molecular Biology, Keith Wilson, John Walker, latest edition, Cambridge University Press

2. Biological Spectroscopy, ID Campbell and RA Durek, Benjamin/Cummings Pub. Co.

3. Spectroscopy for the Biological Sciences, Gordon G. Hammes, Wiley

Course code	LC-BT-307G				
Category	Professional Core Course				
Course title	**Industrial Microbiology Lab.**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	0	**0**	**3**	**1.5**	
Branches (B. Tech.)	**Biotechnology**				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

LIST OF EXPERIMENTS/PRACTICALS

1. Collection of soil samples.
2. Isolation of industrially important microorganisms.
3. Maintenance of pure culture of isolates.
4. Morphological identification of isolates.
5. To compare the enzymatic activity of different isolates.
6. Revival /Isolation of yeast culture.
7. To plot a growth curve of yeast culture.
8. Fermentation of carbohydrates by yeast culture.
9. Production of alcohol from molasses.
10. Recovery of alcohol by distillation.
11. To isolate antibiotic producing microorganisms from soil.
12. To determine the antimicrobial spectrum of the isolated antibiotic producing microorganisms.
13. Industrial Visit.

Course Outcome

Students will be able to
Carry out sampling.
Isolate, maintain pure culture of isolates both bacterial and yeast culture .
Morphologically identify isolates.
Study growth of yeast culture and fermentation of different carbohydrates by yeast.
Carry out alcohol production in shake flask and its recovery by distillation.
Isolate antibiotic producing microbes and study antimicrobial spectrum .

References:

1. Microbiology A Laboratory Manual: Cappuccino James. & Sheeman Natalie,latest Edition ,Pearson Education Ltd, United Kingdom.
2. Experiment in Microbiology, Plant Pathology, Tissue Culture & Microbial Biotechnology: Aneja K.R, latest Edition, New Age International Publishers, New Delhi.
3. Practical Microbiology: Dubey R.C & Maheshwari D.K , 2011, S. Chand & Company Ltd., New Delhi.

<table>
<tr><td>Course code</td><td colspan="5">LC-BT-309G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Genetic Engineering Lab</td></tr>
<tr><td rowspan="2">Scheme and credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester
V</td></tr>
<tr><td></td><td></td><td>3</td><td>1.5</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of experiments:

1. Isolation of plasmid DNA from bacteria
2. Isolation of genomic DNA from blood/ leaf.
3. Elution of DNA from agarose gel.
4. Construction of RE map of plasmid DNA.
5. Restriction endonuclease digestion of λ DNA.
6. To perform ligation of DNA fragments using T_4 DNA ligase
7. To prepare competent cells for genetic transformation
8. To perform transformation of E. coli cells with pDNA
9. Isolation of protein and analysis by SDS-PAGE.
10. To amplify the given DNA by PCR.
11. To perform southern hybridization of DNA

References:

1. Green M. R. and Sambrook J. Molecular Cloning: A Laboratory Manual. CSHL Press, USA.

<u>Learning Outcomes:</u> At the end of the course the students shall be able to:

CO1 - Students will be able to isolate and quantify genomic DNA from eukaryotic tissue and bacterial cells as well extract DNA from agarose gels.

CO2 - Students will be able to perform the restriction digestion of lambda DNA with restriction enzymes and analyse the restriction pattern by agarose gel electrophoresis.

CO3 - Students will be able to ligate DNA fragments and also transform it into host cells

CO4 - Students will learn advanced techniques like PCR, Southern hybridization and analysis of gene expression by SDS-PAGE

Course code	HSMC-01 G				
Category	Humanity and social Science including Management				
Course title	**Economics for Engineers**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3	**0**		**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objectives:

1. **Acquaint the students to basic concepts of economics and their operational significance.**
2. **To stimulate the students to think systematically and objectively about contemporary economic problems.**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, **Elasticity of Demand**- meaning, factors effecting it, its practical application and importance.

UNIT-II

Production- Meaning of Production and factors of production, Law of variable proportions, Returns to scale, Internal and external economies and diseconomies of scale.

Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Real cost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-III

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT-IV

Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), Privatization - meaning, merits and demerits.

Globalization of Indian economy - merits and demerits.

Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions, Difference between Commercial & Central Bank.

COURSE OUTCOMES:

1. The students will able to understand the basic concept of economics.
2. The student will able to understand the concept of production and cost.
3. The student will able to understand the concept of market.
4. The student will able to understand the concept of privatization, globalization and banks.

REFERENCES:

1. Jain T.R., Economics for Engineers, VK Publication.
2. Chopra P. N., Principle of Economics, Kalyani Publishers.
3. Dewett K. K., Modern economic theory, S. Chand.
4. H. L. Ahuja., Modern economic theory, S. Chand.
5. Dutt Rudar & Sundhram K. P. M., Indian Economy.
6. Mishra S. K., Modern Micro Economics, Pragati Publications.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
8. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
9. Micro Economic Theory – M.L. Jhingan (S.Chand).
10. Micro Economic Theory - H.L. Ahuja (S.Chand).
11. Modern Micro Economics : S.K. Mishra (Pragati Publications).
12. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co).

Course code	MC-317G			
Category	Mandatory Course			
Course title	**Constitution of India**			
Scheme and credits	L	T	P	Credits
	2	0	0	0

Course Objectives:
Students will be able to:
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit – I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

Unit – II

Citizenship: Meaning, Citizenship at the commencement of the Constitution, Termination of citizenship, Common wealth citizenship, Modes of acquisition of Citizenship:

Unit – III

Organs of Governance: President – Qualification and Powers of the President, Governor-Qualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

Unit – IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Right to equality , Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

Course Outcomes:
Students will be able to:
1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score minimum 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

ANNEXURE – 1

Course code	PEC-BT 311 G				
Category	Professional Elective Course				
Course title	**Bioreactor Analysis and Design**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3	**0**	0	**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To learn the basics introduction to bioreactor.
2. To learn the concept of ideal and non-ideal reactors.
3. To learn the concept of maintaining aseptic conditions in fermenters.
4. To learn about the instrumentation and controlling the various parameters.

Unit I

Introduction to Bioreactor: Basic functions of a fermenter, Overall containment categorization, Body construction, Construction materials, Temperature control. Types of Bioreactors – STR, Air lift reactor, bubble column reactor, PBR, FBR, TBR, Hollow fiber reactor.

Unit II

Concept of ideal and non-ideal reactors: residence time distribution, models of non-ideal reactors- plug flow with axial dispersion, tanks-in-series model.

Aeration and agitation: The agitator (impeller), Stirrer glands and bearings, The stuffing box (packed-gland seal), The mechanical seal, Magnetic drives, Baffles, The aeration system (sparger), Porous sparger, Orifice sparger, Nozzle sparger, Combined sparger-agitator.

Unit III

The achievement and maintenance of aseptic conditions: Sterilization of the fermenter, Sterilization of the air supply, Sterilization of the exhaust gas from a fermenter, The addition of 17nalyzing, nutrients and other, supplements, Sampling, Feed ports, Sensor probes.

Monitoring and control of various parameters: Valves and steam traps: Gate valves, Globe valves, Piston valves, Needle valves, Plug valves, Ball valves, Butterfly valves, Pinch valves, Diaphragm valves, Check valves, Pressure-control valves, Pressure-reduction valves, Pressure-retaining valves, Safety valves, Steam traps.

Unit IV

Instrumentation and Control: Methods of measuring process variables like Temperature, Mercury-in-glass thermometers, Electrical resistance thermometers, Thermistors.
Flow measurement and control, Gases, Liquids, Pressure measurement, Pressure control, Safety valves, Agitator shaft power, Rate of stirring, Foam sensing and control.
Weight, Microbial biomass, Measurement and control of dissolved oxygen, Inlet and exit-gas analysis, Ph measurement and control, Redox, Carbon dioxide electrodes.
Control systems: Manual control, Automatic control, Two-position controllers (on/off), Proportional control, Components of a computer-linked system, Data logging, Data analysis, Process control.

COURSE OUTCOMES:

1. Students will be able to understand the basic concept of bioreactor and their types.
2. Students will be able to understand about aeration and agitation process in ideal and non- ideal reactor models.
3. Students will be able to understand maintaining aseptic conditions, controlling the reactor and 18nalyzing different parameters with data analysis.

REFERENCES

1. Biochemical Engineering fundamentals, Bailey and Ollis, Mcgraw Hill Pub.
2. Priciples of fermentation technology, PF stanbury and A Whitaker, Pergamon press
3. Unit Operation of Chemical Engineering, McCabe, Smith and Hariot, Mc Graw Hill Pub.
4. Bioprocess Engineering Principles, Pauline M. Doran, Academic Press, Harcourt Brace & Company.

Course code	PEC-BT-313G				
Category	Professional Elective Course				
Course title	**DEVELOPMENTAL BIOLOGY**				
Scheme and credits	L	T	P	Credits	Semester
	3	0		3	V
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

- To understand of the concepts of early animal development.
- To study the process of embryonic development in animals with reference to model systems.
- To appreciate the role of developmental biology in evolution and the importance of stem cells

Unit I

History & Basic concepts of development: Introduction to animal development. Stages of development- zygote, blastula, gastrula, neurula. Cell fate & commitment – potency- concept of embryonic stem cells, differential gene expression, terminal differentiation ,lineages of three germ layers, fate map

Unit-II

Mechanisms of differentiation- cytoplasmic determinants, embryonic induction, concept of morphogenesis, mosaic and regulative development. Pattern formation- axis specification, positional identification (regional specification). Morphogenetic movements

Unit-III

Model organisms:

Early Development in invertebrate /vertebrate models**:** Xenopus, human
Cleavage, gastrulation, Axis specification (Dorsoventral, anterior posterior), & body plan patterning, left right asymmetry in vertebrates

Unit-IV

Late Development in invertebrate /vertebrate models: Organogenesis- development of central nervous system in vertebrates. Germ cell specification& migration.

Developmental mechanism of evolutionary change. Stem cells.

Text & Reference Books

- Developmental Biology, Eighth Edition" by Scott F Gilbert $9^{th}/10^{th}$ edition
- Essential Developmental Biology by Jonathan Slack
- Developmental Biology, Werner A Muller

Course Objectives: At the end of course students will be able to

- understand of the concepts of early animal development.
- understand the process of embryonic development in animals with reference to model systems.
- understand the role of developmental biology in evolution and the importance of stem cells

Course code	PEC-BT-315G				
Category	Professional Elective Course				
Course title	**MEDICAL MICROBIOLOGY**				
Scheme and credits	L	T	P	Credits	Semester
	3	0		3	V
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

- To study various diseases caused by microbes
- To understand the epidemiology of the disease

Unit- I

Infections of the Gastrointestinal Tract Amoebiasis; Giardiasis and cryptosporidiosis; Intestinal infection by nematodes; Intestinal infection by cestodes (taeniasis and H.nana infection); Trematodes; Bacterial food poisoning(toxic and infective); E.coli Diarrhoea; Cholera; Bacillary dysentery; Hepatitis

Unit –II

Infections of the Respiratory system Streptococcal infections; Viral infections; Diphtheria; Whooping cough; Bacterial pneumonias (Haemophilus and GNB, Pneumococcus/Legionella/ etc); Tuberculosis

Unit –III

Pyrexial Illness Malaria; Kala-azar; Leishmaniasis; Filaria; Enteric fever; Brucellosis; Rickettsial diseases; Leptospirosis and relapsing fever; Viral Hemorragic fever Unit IV Infections of the Nervous System Viral encephalitis and Aseptic meningitis; Rabies; Cysticercosis and other CNS parasitic infections; Tetanus

Unit –IV

Sexually Transmitted Diseases and Congenital Infections Herpes Simplex virus infections; HIV infection and AIDS; Chlamydial infection; Syphilis; Mycoplasma and Ureaplasma infection; Gonorrhea and other bacterial STD; Congenital viral infections; Toxoplasmosis

Texts/References

1. Betty Forbes, Daniel Sahm, Alice Weinfield, Bailey-Scott's Diagnostic Microbiology, 12th Edition, Mosby. 2007.
2. Gerald Collee J, Andrew G Fraser, Barrie P Marmion, Mackie and McCartney's Practical Medical Microbiology, Elsevier. 2006.
3. Elmer W Koneman et al., Koneman's, Color Atlas and Text Book of Diagnostic Microbiology, 6th Edition, Lippincott Williams and Wilkins,2005.

ANNEXURE - 2

Course code	OEC-BT-301G				
Category	Open Elective Courses				
Course title	**Enzyme Technology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3	**0**		**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

- Understanding basics concept of enzymes
- Understanding general characteristics of enzymes and enzyme kinetics
- Understanding of immobilization of enzymes
- Understanding of industrial applications of enzymes

UNIT – I

Introduction of enzymes: General properties of enzyme and significance, classification and nomenclature. Terms and definition in enzymology: enzyme activity, turnover number, active site, isoenzyme, multienzyme complex, extracellular enzymes, extremozymes, allosteric enzyme, abzymes, ribozymes. Free energy concept in enzyme catalyzed reactions, Cofactors for enzymes.

UNIT – II

Enzyme kinetics: Factor affecting enzyme activity: pH, Temperature, substrate concentration etc. Model for Enzyme substrate binding, Steady rate kinetics, Derivation of Michaelis-Menten equation using steady state/equilibrium kinetics, plots of Lineweaver-Burke. Significance of Km and Vmax, Kcat/Km, Mechanism of multi-substrate enzyme catalyzed reaction. Inhibition of enzyme activity; Competitive, noncompetitive and irreversible inhibition.

UNIT – III

Immobilized Enzymes: Free vs immobilized enzymes, Economic argument for immobilization, Methods of enzyme immobilization. Concept of heterogeneous mass transfer, Concentration gradient in solid catalyst . Kinetics and effect of solute partition and diffusion on it, enzymes deactivation. Bioreactors using immobilised enzymes

UNIT - IV

Application of enzymes: Isolation and purification of enzymes. Enzyme used as detergents, use of proteases in food, leather and wool industries, production of glucose syrup from starch. Lactose in dairy industry, glucose oxidase and catalase in food industry. Application of enzymes in industry, Enzyme engineering, Enzyme based nanostructure,

Course Outcomes

After studying the course, the student will be able to:

- Students will be able to understand the general characteristics of enzymes
- Students will be able to understand the factor effecting enzyme activity
- Students will be able to understand the kinetics of enzymes and its attributes
- Students will be able to understand the importance of immobilization of enzymes and application of enzymes in various factors.

References:

1) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H.
John Wiley and Sons

2) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company

3) Enzymes: Biochemistry, Biotechnology, Clinical Chemistry, P L Bonner and T Palmer, Elsevier

4) Biochemistry, Berg JM,Tymoczko JL, and Stryer L, published by W.H. Freeman and Company

Course code	OEC-BT-303G				
Category	Open Elective Courses				
Course title	**DIAGNOSTIC TECHNIQUES**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-V**
	3	**0**		**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction: Comparison of the methods to diagnose bacterial & parasitic infections. Immunological Diagnostic Procedures:

Basic considerations: Antigen-antibody reactions. Signal amplification systems. Isolation and characterization of antibodies. Immuno assay systems. Assay development, evaluation and validation. Reagent formulation and their shelf life evaluation.

UNIT-II

Enzyme-Linked Immunosorbent Assay (ELISA) system: Applications in clinical diagnosis and prognosis of various diseases.

Membrane based Rapid Immuno assays.

Monoclonal Antibodies: Formation and selection of Hybrid cells. Screening for specific antibodies producing Hybrid cell lines.

UNIT-III

Applications of Monoclonal Antibodies: Detection of Polypeptide hormones, Tumor Markers and Cytokines. Diagnosis of infectious diseases and Drug monitoring. Detection of Miscellaneous targets e.g. Thyroxin, Vit B_{12}, Ferritin

Degradation products, Tau Protein etc.

UNIT-IV

DNA Diagnostic Systems: **Nucleic acid hybridization assay systems:** Basic considerations. Production of various types of hybridization probes. Diagnosis of *Plasmodium faliciparum, Mycobactrium tuberclosis, Trypanosoma cruzi* and Sickle cell by DNA hybridization.

Non-radioactive Hybridization procedures: Use of Chromogenic or chemiluminesent substrates and specific enzymes for detecting signal amplification.

DNA Finger Printing and Random Amplified Polymorphic DNA (RAPD) as Diagnostic tools.

Present methods for diagnosis of Specific diseases like Tuberculosis, Malaria and AIDS

References:

1. Essentials of Diagnostic Microbiology by Lissa Anne Shimeld.
2. Diagnostic Microbiology by Balley and Scott
3. Recombinant DNA. By James D Watson and Michael Gilman latest Edition
W. H Freeman and Company NY.

Course code	OEC-BT-305G			
Category	Open Elective Course			
Course title	**Soft Skills & Interpersonal Communication**			
Scheme and credits	L	T	P	Credits
	3	0		3
Class work	25 Marks			
Exam	75 Marks			
Total	100 Marks			
Duration of exam	03 Hours			

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

- To understand the scope of personality and its development.
- To develop core skills for development of self.
- To cultivate interpersonal skills for successful life.

UNIT I

Self-Development Skills: Introduction to Personality, Self-Esteem and Self-Confidence Know Thyself/ Understanding Self Introduction to Soft skills-Self discovery-Developing positive attitude-Improving perceptions-Forming values

UNIT II

Thinking and Problem Solving Skills. Stress Management. Time management SWOT Analysis and Goal-Setting

UNIT III

Interpersonal Skills: Hard Skills and Soft Skills. Effective Communication Understanding Others. Improved work relationship

UNIT IV

Developing interpersonal relationship-Team building-group dynamics-Net working. Skills for successful interview. Leadership. Social Empathy

TEXT BOOKS:

Meena.K and V.Ayothi (2013) A Book on Development of Soft Skills (Soft Skills : A Road Map to Success), P.R. Publishers & Distributors, No, B-20 & 21, V.M.M. Complex, Chatiram Bus Stand, Tiruchirappalli- 620 002. (Phone No: 0431-2702824: Mobile No: 94433 70597, 98430 74472)

Alex K. (2012) Soft Skills – Know Yourself & Know the World, S.Chand & Company LTD, Ram Nagar, New Delhi- 110 055. Mobile No : 94425 14814 (Dr.K.Alex)

REFERENCES:

(i) Developing the leader within you John c Maxwell (ii) Good to Great by Jim Collins (iii) The seven habits of highly effective people Stephen Covey (iv) Emotional Intelligence Daniel Goleman (v) You can win Shive Khera (vi) Principle centred leadership Stephen Covey

Course code	OEC-BT-307G			
Category	Open Elective Course			
Course title	**History of Science & Technology in India**			
Scheme and credits	L	T	P	Credits
	3	0		3
Class work	25 Marks			
Exam	75 Marks			
Total	100 Marks			
Duration of exam	03 Hours			

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

- To understand the history of developments in field of science and technology.
- To have knowledge of ancient and modern technologies related to medicine and agriculture.
- To understand impact of technological developments in the current scenario.

Unit-I

Concepts and perspectives: Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

Unit –II

Science and technology in ancient India : Technology in pre-historic period. Beginning of agriculture and its impact on technology. Science and Technology during Vedic and Later Vedic times.

Unit-III

Science and technology in medieval India: Legacy of technology in Medieval India, Interactions with Arabs. Development in medical knowledge, interaction between Unani and Ayurveda and alchemy. SCIENCE AND TECHNOLOGY IN COLONIAL INDIA Science and the Empire Indian response to Western Science Growth of techno-scientific institutions

Unit-IV

Science and technology in a post-independent India

Science, Technology and Development discourse. Shaping of the Science and Technology Policy Developments in the field of Science and Technology. Science and technology in globalizing India. Social implications of new technologies like the Information Technology and Biotechnology

B. TECH. BIOTECH. 6TH SEM

Course code	PCC-BT-302G				
Category	Professional Core Courses				
Course title	**Plant Biotechnology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	**0**	0	**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objectives:

- The goal of this course is to introduce biotechnology methods in plants.
- The objective of the course is to give students knowledge of modern plant biotechnology processes including plant tissue culture.
- Understanding plant transformation methods and characterization of transgenic plants.
- Knowledge of production of transgenic plants for improved agronomic traits.
- Applications of plant biotechnology for commercial production of pharmaceutical and industrial compounds. Knowledge of IPRs in agriculture.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Plant tissue culture—its history, development and applications, Plant tissue culture media, Types of cultures. Micropropagation: Techniques and various steps involved in micropropagation, Production of disease free plants, Commercial aspects and limitations of micropropagation. Callus cultures, Cell and suspension cultures, Single cell clones, Protoplast culture and somatic hybridization. Embryo culture. Haploids. Germplasm conservation.

UNIT-II

Genetic Transformation--Various transformation methods; Agrobacterium-mediated gene delivery; Disarming the Ti plasmid; Principles of vector designing; Screenable and selectable markers, Generation of marker-free transgenic methods, chloroplast transformation.

UNIT-III

Transgenic Crops for Resistance to Biotic/abiotic Stresses and Quality Improvement -- Viral resistance, fungal resistance, insects and pathogens resistance, drought, salinity, heat stress, low temperature stress, flooding and submergence stress, post-harvest bioengineering, concept of biofactories, herbicide resistance, engineering other traits. Terminator technology. Commercial transgenic crops.

UNIT-IV

Molecular farming: of Alkaloids, Useful enzymes, Therapeutic proteins, custom- made Antibodies, Edible vaccines. Secondary metabolite extraction: Primary vs secondary metabolites, Production of secondary metabolites and other compounds using plant cell culture, Hairy root culture, Immobilized cell system, Elicitation and Biotransformation.
Introduction to Molecular markers and marker assisted selection. Biosafety and IPR-related issues -- Production and acceptance of transgenic crops; Public and private sectors in plant

biotechnology Intellectual property rights (IPR), Plant breeders rights (PBRs) and farmers rights.

References:

1. Razdan, M.K., Introduction to Plant Tissue Culture, Science Publishers (2003) 2nd ed.
2. Slater, A., Scott, N.W., and Fowler, M.R., Plant Biotechnology, Oxford University Press (2008) 2nd ed.
3. Plant Biotechnology and Genetics: Principles, Techniques & Applications Edited by C. Neal Stewart Jr. Publisher John Wiley & Sons New Jersey 2008
4. Biotechnology in Agriculture & Forestry Volume 64 Genetic Modification of Plants Eds. Frank Kempken & Christian Jung Publisher Springer- Verlag Heidelberg 2010
5. Hudson T Hartmann: Plant Propagation-Principle and Practices
6. Principles of Plant Biotechnology- An Introduction of Genetic Engineering in Plants by S.H. Mantell, J.W. Mathews and R.A. Mckee, Blackwell Scientific Publications.
7. Hamish A, Collin & Sue Edwards: Plant Cell Culture

Learning Outcomes: At the end of the course the students shall be able to:

- Apply knowledge of modern plant biotechnology techniques used for commercial purposes and preservation of plant germplasm.
- The students will have knowledge of methods of plant genetic engineering, selection systems and detection and characterization of transgenic plants.
- Understand the strategies of plant genetic engineering employed for crop improvement for introduction of agronomically important traits like biotic and abiotic stress tolerance, commercial transgenic crops.
- Understand industrial applications of plant biotechnology and IPRs in agriculture

<table>
<tr><td>Course code</td><td colspan="5">PCC-BT-304G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Animal Biotechnology and Stem Cells</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Biotechnology Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: History and scope of animal biotechnology.

Basic technique of animal cell culture & their applications. Balanced salt solutions and simple growth media. Serum quality and cell culture.

Preservation and maintenance of animal cell lines. Cryo preservation and transport of animal germ plasm (i.e. semen, ovum and embryos)

Unit-II

Transgenic animals; Methodology – retroviral vector method, DNA microinjection method and engineered embryonic stem cell method. Cloning by nuclear transfer. Yeast artificial chromosome transgenesis.

In Vitro fertilization and embryo transfer.

Unit-III

Molecular biological techniques for rapid diagnosis of genetic diseases and gene therapy. Molecular maps of animal genomes. Chemical carcinogenesis. Transfection. Oncogenes and antioncogenes.

Unit-IV

Gene cloning techniques for mammalian cells, Establishment of immortal cell lines, cloning in mammalian cells, expression of mammalian genes in prokaryotic and eukaryotic systems. Extinction of gene function by antisense RNA and DNA.

References:

1. *Molecular Biotechnology* by Old and Primrose.
2. *Molecular Biotechnology: Principles and Applications of recombinant* DNA By Bernard R. Glick, Jack. J. Pasternak, latest Edition. ASM press Washington DC.
3. *Animal Cell biotechnology:* R.E. Spier and J.D Griffiths Academic press.

4. Living resources for Biotechnology, Animal cells: A. Doyle, R. Hay and B.E. Kirsop, Cambridge University Press, cambridge.

Course code	PCC-BT-306G				
Category	Professional Core Courses				
Course title	**Environmental Biotechnology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	**0**	0	**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objectives:

1. Understand the applications of biotechnology for Environment Conservation/Protection and various types of pollutions.
2. Understand the various waste water treatment processes
3. Understand the global environmental problems and novel techniques
4. Legislative measures for environment protection

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Environment: Introduction, Current status of biotechnology in environment protection.
Environment Pollution: Types of pollution (Air, Water and Soil), sources of pollution, effects and treatment.

UNIT-II

Sewage and Waste water Treatment: Primary, Secondary and Tertiary treatments.
Biological treatment: Aerobic biological treatment and Anaerobic biological treatment.
Treatment schemes for Waste Water of dairy, distillery, tannery and sugar industries.
Biotechnology for Hazardous Waste Management: Xenobiotic compounds and Biodegradation of xenobiotics

UNIT-III

Bioremediation: Introduction, types and applications.
Global Environmental Problems: Ozone depletion, Green house effect, Acid rain, their impact and management, Climate change.
Novel Methods of Pollution Control: Vermitechnology, Waste water treatment using aquatic plants, Root zone treatment.

UNIT-IV

Environmental Laws: Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, Environment (Protection) Act, 1986, Wild Life Protection Act, 1972, Indian Forest Act, 1927.

References:

1. “Waste water Engineering Treatment and Disposal and Reuse” by Metcalf & Eddy.
2. “Water Pollution Management hand Book” by Lepathak.
3. “Waste Water Management” by Arceivala.
4. “Environment Biotechnology”by C.F. Forster and D.A. J. Wase.
5. “New Processes of Waste water treatment and recovery” by G. Mattock (ED) Ellis Horwood.

Course Outcomes:

CO1-Obtain knowledge of various pollutions and technologies of decontamination of persistent organic pollutants.
CO2- Obtain knowledge of physico-chemical technologies and waste water treatment processes.
CO3-Understand about global environmental problems and the technologies such as Vermitechnology
CO4- Understand about various legal measures for controlling environmental problems

Course code	LC-BT-308G				
Category	Professional Core Course				
Course title	**Plant Biotechnology Lab**				
Scheme and credits	L	T	P	Credits	Semester
			3	1.5	VI
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of exam	03 Hours				

List of experiments:

1. Study of laboratory equipments used in plant tissue culture lab and sterilization techniques in plant tissue culture.
2. Preparation of Stocks solutions and Plant Tissue Culture Media.
3. Explant selection, treatment and inoculation
4. Induction of callus in cultured explants
5. Meristem culture
6. Subculture of initiated cultures
7. Acclimatization of cultures
8. Agrobacterium- mediated genetic transformation
9. Extraction of DNA/RNA from plants and its estimation
10. Extraction of phytochemicals from plants
11. Analysis of phytochemicals present in plant extracts

Learning Outcomes: **The students shall be able to:**

- Understand the specific requirements and laboratory operations of Plant Biotechnology lab.
- To carry out initiation and maintenance of plant tissue cultures under *in vitro* conditions.
- Study the effect of different plant growth regulators and acclimatize the in vitro grown plants
- Learn basic plant transformation techniques, extraction and analysis of phytochemicals from plant sources.

Course code	PCC-BT-310G				
Category	Professional Core Course				
Course title	**Environment Biotechnology Lab**				
Scheme and credits	L	T	P	Credits	Semester
			3	1.5	VI
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of exam	03 Hours				

List of Experiments:

1. Determination of Chlorides in water sample
2. Determination of hardness of water sample
3. Determination of calcium in water sample
4. Determination of Magnesium in water sample
5. Determination of total alkalinity of water sample
6. Determination of chlorides in soil sample
7. Determination of total alkalinity in soil sample
8. To study/ demonstration cultivation of mushroom.
9. To study/ demonstration life-cycle of earthworms i.e Vermitechnology
10. To determine the Chemical Oxygen Demand (COD) of Water sample.

Course Outcomes

CO1-Students will be able to carry out determination of alkalinity, hardness, Chlorides

CO2- Students will earn the estimation of heavy metals and Calcium, Magnesium in water samples.

CO3-Students will learn the estimation of Chlorides and alkalinity in soil samples

CO4-Students will be able to carry out determination of chemical oxygen demand (COD) of sewage samples

CO5-Students will be able to carry out demonstration of Vermitechnology and Mushroom culture

ANNEXURE- 3

Course code	PEC-BT 312 G				
Category	Professional Elective Course				
Course title	**FOOD BIOTECHNOLOGY**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	3	**0**	**0**	**3**	
Branches (B. Tech.)	**Biotechnology**				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Historical Background: history of Microorganisms in food, Historical Developments.

Sources, types, Incidence, and behaviour of Microorganisms in Foods: The Role and significance of Microorganisms, Primary sources of Microorganisms found in foods

Production of culture for food fermentations, Microbial, Intrinsic and Extrinsic parameters of foods. Industrial units involved in production of fermentated foods

Unit-II

Determine Microorganisms and their products in foods: Culture, Microscopic and Sampling Methods, Conventional, SPC, Membrane Filters, Microscopic Colony Counts, Agar droplets, Dry films, MPN, DMC, Dye reduction, Roll Tubes, Microbiological Examination of surfaces and sampling, Metabolically Injured Organism, Enumeration and Detection of food borne Organisms. Physical, Chemical and Immunological Methods and Bioassay.

Unit-III

Food additives: Need for food additives, types of food additives. Development of novel food and food ingredients; SCP, polysaccharides, low calorie sweeteners, naturally produced flavor modifier, food coloring agent, food supplements and Nutraceuticals.

Unit-IV

Food Spoilage: General principle of spoilage, factors affecting spoilage; Spoilage of fruits and Vegetables, Spoilage of Miscellaneous Foods, Food preservation, Characteristics of

Radiations of Interest in Food Preservation, Destruction of Microorganisms and Applications, Radappertization, Radicidation and Radurization of food legal status of food irradiation. **Storage and Stability of irradiated foods Preservation:** High and Low Temperature, Drying, Pathogens, Psychrotrophs, thermophiles and radiation resistance Microorganisms

References:

1. *Modern Food Micro-Biology* by J.M. Jay Van Nostrand Reinhold company New York.

Course code	PEC-BT-314 G				
Category	Professional Elective Course				
Course title	**Protein Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	2	**1**		**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To learn introduction of proteins, protein and engineering.
2. To analyze proteins by various methods.
3. To know about different stabilizing forces, present in the proteins and computational approaches.

UNIT-I

Introduction to Protein engineering: Definition, Protein Structures, Features and characteristics of proteins that can be engineered; structural changes in proteins due to change in parameters such as pH, temperature and amino acid sequence, aggregation propensities, etc.

.UNIT-II:

Measuring Protein Stability: Spectroscopic methods to study physicochemical properties of proteins: UV/Vis, Circular dichroism, Fluorescence, X-ray, Mass. Hydrodynamic properties–viscosity, hydrogen-deuterium exchange; introduction to NMR spectroscopy –emphasis on parameters that can be measured/obtained from NMR and their interpretation.

UNIT-III:

Forces for stabilizing proteins: Van der waals, electrostatic, hydrogen bonding and weakly polar interactions, hydrophobic effects. Experimental methods of protein engineering by mutagenesis: random and site directed mutagenesis.

UNIT-IV:

Computational approaches to protein engineering: sequence and 3D structure analysis of proteins, protein data bases, Data mining, Ramachandran map, Protein engineering by phage display, Colorimetric and Fluorescence-Based Screening.

COURSE OUTCOME:

1. Able to learn about proteins and their structures for modifications.
2. Learn about different methods used for characterization of proteins and their characteristics.
3. Learn about stabilizing forces for proteins and how they are necessary for engineering a protein.
4. Learn about computational approaches for proteins.

References:

1. Edited by T E Creighton, Protein structure: A practical approach, 2nd Edition, Oxford university press, latest edition

2. Edited by T E Creighton, Protein function. A practical approach, 2nd Edition, Oxford university press, latest edition

3. Edited by T E Creighton, Protein function. A practical approach. Oxford university press. latest edition

4. Cleland and Craik, Protein Engineering, Principles and Practice, Vol 7, Springer Netherlands. Press, latest edition
5. Ed. Robertson DE, Noel JP, Protein Engineering Methods in Enzymology, 388, Elsevier Academic Press, latest edition

Course code	PEC-BT-316 G			
Category	Professional Elective Course			
Course title	**CANCER BIOLOGY**			
Scheme and credits	L	T	P	Credits
	3	0		3
Class work	25 Marks			
Exam	75 Marks			
Total	100 Marks			
Duration of exam	03 Hours			

Course Objectives: To impart knowledge of

- basic concepts of cancer biology
- various stages in carcinogenesis, molecular cell biology of cancer, cancer metastasis,
- cancer therapy.

UNIT I

Fundamentals of cancer biology: Regulation of Cell cycle, Mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, Modulation of cell cycle-in cancer. Different forms of cancers, Diet and cancer.

UNIT II

Principles of carcinogenesis: Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis.

UNIT III

Principles of molecular cell biology of cancer: Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth factor and Growth factor receptors that are Oncogenes. Oncogenes / Proto Oncogenes activity.

UNIT IV

Principles of cancer metastasis: Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion.

Cancer therapy: Different forms of therapy, Chemotherapy, Radiation Therapy, Detection of Cancers.

TEXT BOOKS :

1. King R.J.B., Cancer Biology, Addision Wesley Longmann Ltd, U.K., 1996.
2. Ruddon.R.W., Cancer Biology, Oxford University Press, Oxford, 1995.

Course Outcomes: The students will understand aspects of cancer related to

- Molecular basis and stages of cancer
- Cancer detection
- Cancer treatment

ANNEXURE-4

Course code	PEC-BT-318 G				
Category	Professional Elective Course				
Course title	**Downstream Processing**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-VI**
	2	**1**		**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. To learn the basics of fermentation technologies
2. To learn the concept of recovery and purification of fermented products
3. To learn the concept of effluent treatment.
4. To learn the concept of fermentation economics

Unit I

Introduction; Introduction to fermentation process, types of fermentation processes. Fermentation products; enzymes, metabolites, recombinants products. Parts of fermentation process, microbial growth kinetics, introduction to homogeneous and heterogeneous mass transfer, flow sheet. Stoichiometry of cell growth and product formation.

Unit II

Recovery and purification of fermentation products; Removal of microbial cells and solid material, foam separation, precipitation. Filtration; principle, types of filters, batch filters, continuous filters,

Unit III

Recovery and purification of fermentation products; Cell disruption by physical methods, chemical methods and enzymatic methods. Extraction methods; liquid-liquid extraction, liquid-solid extraction, aqueous two-phase extraction, supercritical fluid extraction. Chromatography (affinity, gel filtration, ion exchange, HPLC, GCMS), drying, crystallization.

Unit IV

Effluent Treatment; site survey, treatment of effluents, treatment processes, trickling filters, biologically aerated membranes, activated sludge processes, anaerobic treatment, disposal of effluents, By-products. Fermentation economics.

COURSE OUTCOMES:

1. Students will be able to understand the basic concept of fermentation technology
2. Students will be able to understand the process of recovery product
3. Students will be able to understand the process of isolation of products and analysis methods
4. Students will be able to understand the concept of effluent treatment and economic aspect of fermentation processes

REFERENCES:

1. Belter, P.A. and Cussler, E.L. Hu, W.S, Bioseparation: Downstream processing for Biotechnology, Wiley.

2. Ladisch, M.R., Bioseparation Engineering: Principles, Practice and Economics, Wiley, Interscience.

3. Stanbury, PF, Whitaker A, Hall SJ, Principles of fermentation technologies. Butterworth Heinemann.

Course code	PEC-BT-320G			
Category	Professional Elective Course			
Course title	**RNAi BIOLOGY**			
Scheme and credits	L	T	P	Credits
	3	0		3
Class work	25 Marks			
Exam	75 Marks			
Total	100 Marks			
Duration of exam	03 Hours			

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course objectives:

- To understand the basic aspects of RNA interference.
- To learn use of siRNA and microRNAs for gene silencing,
- RNAi vectors and gene expression
- Knowledge of applications of RNAi in healthcare and agriculture.

UNIT-I

Discovery of RNA interference (RNAi): PTGS, RNAi and related phenomena. Categories of small non-coding RNAs: dsRNAs, siRNAs, shRNAs, piRNAs and miRNAs, Detection of small RNAs.

UNIT-II

Mechanism of RNAi: Different components of RNAi pathway and their evolutionary conservation and role in gene silencing, RNAi-like pathway in bacteria, Molecular basis of RNAi /siRNA /miRNA mediated gene silencing. RNAi in defense and the regulation of chromatin structure and gene expression; RNAi suppressors.

UNIT-III

miRNAs and siRNAs: Pathways, expression and functions of microRNAs, High-throughput analysis of miRNA gene expression; siRNA vectors, RNAi microarrays.
RNA informatics - Computational tools for miRNA discovery, siRNA and miRNA design.

UNIT- IV

Expression of dsRNA in animals and plants, and its applications: RNAi vectors and generation of transgenic animals and plants. Applications of RNAi in the prevention of diseases in animal models and crop improvement; Future prospects of RNAi. in biology, medicine and agriculture.

Text & Reference:

1. The RNA World TEds. T Gesteland et al. CSHL Press
2. RNA Interference Technology: From Basic Science to Drug Development. Eds. Fire et. al. Cambridge University Press,
3. RNAi: A Guide to Gene Silencing. Ed. Gregory J. Hannon CSHL Press
4 RNA Silencing: Methods and Protocols Ed. Gordon G. Carmichael CSHL Press
5. RNA Interference in Practice Ed. Ute Schepers, Wiley-VCH GmbH & Co. KGaA.
6. Genes IX. Lewin B Jones and Barlett Publishers

Course code	PEC-BT-322 G			
Category	Professional Elective Course			
Course title	**HUMAN GENETICS**			
Scheme and credits	L	T	P	Credits
	3	0		3
Class work	25 Marks			
Exam	75 Marks			
Total	100 Marks			
Duration of exam	03 Hours			

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course objectives:

- To understand the basic aspects of human genetics.
- To study mapping of human genomes
- To understand basis of genetic disorders and inborn errors of metabolism
- Knowledge of ethical aspects.

Unit-I

Introduction to Human Genetics: History; Early perception, development and documentation; Genome organization; Chromosome structure, function and implications for disease.
Study tools in Human Genetics: Pedigree analysis- Mendelian inheritance and exceptions; Chromosomal analysis (in vitro, in vivo), Biochemical analysis; Somatic cell genetics (somatic cell hybrids, monochromosome hybrid panels, gene mapping); Molecular genetic analysis.

Unit-II

Human genome mapping methods: Physical mapping: Introduction to physical map markers-Chromosomal, G/Q- banding, radiation hybrid, Fluorescence in situ hybridization, comparative genome hybridization, long range restriction mapping, high resolution mapping-STS/EST/MS/SNP/sequencing;
Genetic mapping: Linkage analysis (RFLP/MS/SNP); Applications of mapping in normal and disease genome analysis; Gene identification using positional and functional cloning approach.

Unit-III

Human genome analysis: Conception, mapping, cloning and sequencing
Genetic variation in health and disease: Human genetic diversity- Methods of study – Biochemical/molecular genetic markers; some examples.

Diseases and disorders: Chromosomal disorders: Structural and numerical; Autosomal/sex chromosomal/sex reversal; Mechanisms – mitotic/meiotic non-disjunction/ chromosomal rearrangements; Some examples (Syndromes/Cancer/Infertility);

Unit-IV

Single gene and disease: Inborn errors of metabolism, Haemoglobinopathies; Multifactorial disorders: Introduction; Methods of study (Epidemiological, Twin/ adoption and Family studies); Etiology - genetic and non-genetic determinants; Common examples. Epigenetics and disease

Ethical, legal and social issues in Human genetics: Prenatal/adult (individual/family/population) screening of mutation/risk factor for genetic diseases; Confidentiality/privacy, Discrimination, Ethical dilemma, Human rights, Surrogate mothers; Human cloning and eugenics; Organ banking and transplantation; Research ethics; Medical ethics in India.

Suggested readings:

1. Human Genetics: Problems and Approaches TVogel F. and. Motulsky A. GT Springer Verlag
2. Human Molecular Genetics Strachan T & Read A Garland Science
3. An Introduction to Human Molecular Genetics: Mechanism of Inherited Diseases Pasternak J Fitzgerald Science Press
4 Chromosome Structural analysis: A Practical Approach (Ed.) W.A. Bickmore Oxford University Press

ANNEXURE-5

<table>
<tr><td>Course code</td><td colspan="5">OEC-BT-302G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Biosensors</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>2</td><td>1</td><td></td><td>3</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Biotechnology Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

COURSE OBJECTIVES:

1. This course helps to understand the use of biomolecules as recognition elements.
2. To familiarize students with biosensor technology, their application in various fields.
3. To know about different materials used foe electrode fabrication.

UNIT-I:

Introduction to Biosensors: Biosensors- History of Biosensors, Advantages and limitations, various components of biosensors, Biocatalysis based biosensors, Bio affinity-based biosensors, Biologically active material and analyte. Types of membranes used for biosensor.

UNIT-II:

Transducers in Biosensors: Types of transducers; principles and applications - Calorimetric, Optical, Potentiometric / Amperometric, Conductometric, Piezoelectric, Impedimetric, Chemiluminiscene - based Biosensors. Nanomaterial based electrodes.

UNIT-III:

Application and Uses of Biosensors: Biosensors in clinical chemistry, medicine and health care, biosensors for veterinary, agriculture and food Low cost - biosensor for industrial processes for online monitoring; biosensors for environmental monitoring. Application of enzymes in analysis; healthcare, food and environment.

UNIT-IV:

Materials used & Characterization Techniques for Biosensor: Materials used for electrode fabrication. UV-Visible spectroscopy, Particle size analyzer, X-Ray diffraction, Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy, Fourier Transform Infrared Spectroscopy.

COURSE OUTCOME:

1. Able to learn about principle of biosensor.
2. Learn about different materials used for biosensor fabrication.
3. Learn about different types of transducers used.
4. Learn about application of biosensors in various fields.

References:

1. Donald G. Buerk - Biosensors Theory and Applications, First Edition Technomic Publishing. Co, Inc, latest edition
2. Brian R Eggins - Biosensors an Introduction, First edition, John Wiley & Sons Publishers, latest edition
3. Loic J Blum, Pierre R Coulet - Biosensors Principles and Applications, First edition, Marcel Dekker, Inc, latest edition
4. Tran Minh Canh - Sensor Physics & Technology - Biosensors, First Edition, Champan & Hall, latest edition

<table>
<tr><td>Course code</td><td colspan="5">OEC-BT-304G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Fermentation Technology</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Biotechnology Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

- Understanding basics concept of fermenters
- Understanding general characteristics of culture medium and its components
- Understanding of Sterilization process
- Understanding of industrial applications of fermentation and product recovery

UNIT – I

Introduction to fermentation technology: History of fermentation, General attributes of fermentation processes; biomass, microbial metabolites, batch fermentation, continuous fermentation, fed batch fermentation, solid state fermentation. Microbial growth kinetics. Selection of microorganism used in fermentation process.

UNIT – II

Development of fermentation process: Different sterilization method, Medium sterilization for batch and continuous cultures, sterilization of fermenter, filter sterilization. Culture medium for fermentation processes; carbon sources, nitrogen sources, minerals, antifoam. Medium formulation, inoculum development and process optimization.

UNIT – III

Fermentation processes for different products: Fermentative production of different products; Single cell protein, enzymes, amino acids, citric acid, penicillin. Bioprocess economics, and Bioproduct regulation. Preservation and improvement in industrially important microorganisms.

UNIT – IV

Recovery and Purification of Fermentation products: Removal of microbial cells and solid matter, precipitation, filtration, centrifugation, cell disruption, product isolation, distillation, whole broth processing, aqueous two-phase separation, liquid-liquid extraction, chromatography. Introduction to effluent treatment.

Course Outcomes

After studying the course, the student will be able to:

- Students will be able to understand the general attributes of fermentation system
- Students will be able to understand the medium formulation and sterilization for fermentation processes,
- Students will be able to understand the development of fermentation process for different product,
- Students will be able to understand the downstream process of fermented products

References:

1. Principles of Fermentation Technology, PF Stanbury, A Whitaker, SJ Hall, Butterworth Heinmann publication

2. Industrial Microbiology: An Introduction, Michael J. Waites, Neil L. Morgan John S. Rockey, Gary Higton, Blackwell science Ltd

3. Biotechnology: A Textbook of Industrial Microbiology, Crueger and Crueger, Sinduer Associates, Inc.,

Course code	OEC-BT-306 G			
Category	Professional Elective Course			
Course title	**BIOFUELS**			
Scheme and credits	L	T	P	Credits
	3	0		3
Class work	25 Marks			
Exam	75 Marks			
Total	100 Marks			
Duration of exam	03 Hours			

OBJECTIVES:

- To give an introduction to biogas technology
- To understand the basics behind the bioethanol and biodiesel production
- To give basic idea for the production of green energy from biomass

UNIT-I

Biogas Technology:

Microbiology of biogas production, Methods to enhance the biogas production, Design parameters affecting the success and failure of biogas plants. Various techniques for increasing gas production in cold region. Effect of heating , insulation and stirring on gas production, Design optimization for biogas production, Multi criteria optimization, Immobilization biogas plant system – principle, Application of immobilization, Modular biogas systems for tropical areas – principle, Prospects of modular biogas systems, Alternate feedstock for biogas production.

UNIT -II

Bio-Ethanol and Bio-Diesel Technology:

Production of Fuel Ethanol by Fermentation of Sugars. Gasohol as a Substitute for Leaded Petrol. - Trans-Esterification of Oils to Produce Bio-Diesel.

UNIT -III

Green Technology – Microbial Fuel Cell:

Types of Biological fuel cells – Working Principle - Applications of biological Fuel cells. A brief study of the principle, construction of different types of fuel cells. Hydrogen production by photosynthetic bacteria, biophotolysis of water and by fermentation; Microbial recovery of petroleum by biopolymers (Xanthum gum), biosurfactants.

UNIT -IV

Energy from Biomass – Introduction – Biomass conversion Technologies – Photosynthesis – Biogas generation – Factors affecting Biodigestion – Classification – Types – Construction Details – Methods of obtaining energy from Biomass – Pyrolysis – Alcohol fuels - Design and operation of Fixed and Fluidized Bed Gasifiers. Combustion of Biomass and Cogeneration Systems:Combustion of Woody Biomass: Theory, Calculations and Design of Equipments. Cogeneration in Biomass Processing Industries. Case Studies: Combustion of Rice Husk, Use of Bagasse for Cogeneration.

TEXT BOOKS :

1. G.D.Rai (2011), *Non-Conventional Energy Sources* , Khanna Publishers.
2. B.H.Khan,(2006*) Non-conventional Energy Sources* , The McGraw Hill Companies.

REFERENCES:

1. Halwagi,(1984) *Biogas Technology - Transfer and Diffusion.* MNES Publication.
2. Chawla, O.P, (1986)*Advances in Biogas technology*. Publications and Information Division, Indian Council of Agricultural Research.

Course code	OEC-BT-308 G			
Category	Open Elective Course			
Course title	**Cyber Law & Ethics**			
Scheme and credits	L	T	P	Credits
	3	0		3
Class work	25 Marks			
Exam	75 Marks			
Total	100 Marks			
Duration of exam	03 Hours			

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives :

1. To understand cyber space and cyber crimes
2. To know the Information Technology Act, 2000 and electronic Governance
3. To understand Jurisdiction issues and cyber law
4. To become aware of cyber ethics

Unit – I

Concept of cyber space: Definition and Meaning of Cyber space

Cyber crimes: Types of cyber crimes, Tempering with Computer Source documents, Hacking with computer system, Publishing of Obscene information in electronic form, Breach of confidentiality and privacy, Publishing of false digital signature certificate, Cyber Terrorism, Cyber defamation

Unit – II

Information technology Act, 2000 : Object and scope of the Information Technology Act, 2000

Electronic Governance: Legal recognition of electronic records, Legal recognition of digital signature and electronic signature, Use of electronic records and digital signatures in Government and its agencies

Unit – III

Jurisdiction Issues in cyber space: Concept of jurisdiction, Personal jurisdiction in cyber space, Indian perspective of Jurisdiction in cyber space

Cyber Law and related issues : Freedom of Speech and Expression in cyber space, India and cyber crimes conventions

Unit – IV

Cyber ethics: copyright infringement, plagiarism, and netiquette.

References :

- SudhirNaib, The Information Technology Act, 2005: A Handbook, OUP, New York, (2011)
- Verma S, K, Mittal Raman,Legal Dimensions of Cyber Space, Indian Law Institute, New Delhi, (2004)
- Chris Reed & John Angel, Computer Law, OUP, New York, (2007). Justice Yatindra Singh,Cyber Laws, Universal Law Publishing Co, New Delhi, (2012).
- JonthanRosenoer, Cyber Law, Springer, New York, (1997).

- Karnika Seth, Computers, Internet and New Technology Laws, Lexis
- S. R. Bhansali, Information Technology Act, 2000, University Book House Pvt. Ltd., Jaipur (2003).
- Vasu Deva, Cyber Crimes and Law Enforcement, Commonwealth Publishers, New Delhi,(2003).

Course Outcomes :

1. Student would be able to understand cyber space and cyber crimes
2. Students will be able to understand Information Technology Act, 2000 and electronic Governance
3. Students would be able to understand Jurisdiction issues and cyber law
4. Students would be able to understand cyber ethics

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Fashion and Apparel Engineering)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Fashion and Apparel Engineering) – 5th Semester
w.e.f. 2020-21

Sr No.	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Internal Assessment	External Examination	Practical	Total	
1	PCC-FAE-301G	Industrial Engineering in Apparel Industries	3	0	0	3	3	25	75		100	3
2	PCC-FAE-302G	Garment Production Machine & equipment	3	0	0	3	3	25	75		100	3
3	PCC-TT/TC/FAE-303G	Textile Testing	3	0	0	3	3	25	75		100	3
4	-	Elective-I	3	0	0	3	3	25	75		100	3
5	-	Open Elective-I	3	0	0	3	3	25	75		100	3
6	-	Open Elective-II	3	0	0	3	3	25	75		100	3
7	LC-FAE-301G	Woven and Knit Design Lab	0	0	2	2	1	25		25	50	3
8	LC-FAE-302G	Pattern Making and Apparel Construction Lab-I	0	0	2	2	1	25		25	50	3
9	LC-TT/TC/FAE-303G	Textile Testing Practical	0	0	2	2	1	25		25	50	3
10	LC-FAE-304G	Apparel Design Lab	0	0	2	2	1	25		25	50	3
Total							**22**				**800**	

ELECTIVE-I

Sr. No.	Course Category	Course Code	Course Title
1	Professional Elective Course (PEC-I)	PEC-FAE-301G	Digital Fabric design and development
2	Professional Elective Course (PEC-I)	PEC-FAE-302G	Woven and Knit Design
3	Professional Elective Course (PEC-I)	PEC-FAE-303G	Textile Coloration Techniques

OPEN ELECTIVE-I

Sr. No.	Course Category	Course Code	Course Title
1	Open Elective Course (OEC-I)	OEC-FAE-301G	Knitting & Knitwear Technology
2	Open Elective Course (OEC-I)	OEC-FAE-302G	Soft Skill and Interpersonal Communication
3	Open Elective Course (OEC-I)	OEC-FAE-303G	Organizational Behavior & HRM

OPEN ELECTIVE-II

Sr. No.	Course Category	Course Code	Course Title
1	Open Elective Course (OEC-II)	OEC-FAE-304G	Textile & Garment Design by Surface Ornamentation
2	Open Elective Course (OEC-II)	OEC-FAE-305G	Introduction to Fashion and Apparel Industries
3	Open Elective Course (OEC-II)	OEC-FAE-306G	Evolution of Clothing and Fashion

Scheme of Studies and Examination
B.TECH (Fashion and Apparel Engineering) – 6th Semester
w.e.f. 2020-21

Sr No.	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Internal Assessment	External Examination	Practical	Total	
1	PCC-FAE-303G	Apparel Production-III	3	0	0	3	3	25	75		100	3
2	PCC-FAE-304G	Automation in Garment Industry	3	0	0	3	3	25	75		100	3
3	-	Elective-II	3	0	0	3	3	25	75		100	3
4	-	Open Elective-III	3	0	0	3	3	25	75		100	3
5	-	Open Elective-IV	3	0	0	5	3	25	75		100	3
6	HSMC-TT/TC/FAE-301G	Merchandising and Export Management	3	0	0	3	3	25	75		100	3
7	LC-FAE-305G	Apparel Draping and Grading Lab	0	0	2	2	1	25		25	50	3
8	LC-FAE-306G	Textile Chemical Processing Lab	0	0	2	2	1	25		25	50	3
9	LC-FAE-307G	Apparel Designing by CAD Lab	0	0	2	2	1	25		25	50	3
10	LC-FAE-308G	Pattern Making and Apparel Construction Lab-II	0	0	2	2	1	25		25	50	3
Total							22				800	

NOTE: At the end of 6th semester each student has to undergo Practical Training of 6 weeks in an Industry/Export/ Professional Organization and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester under the course 'Garment Industry Practice' (Course Code PROJ-FAE-401G).

ELECTIVE-II

Sr. No.	Course Category	Course Code	Course Title
1	Professional Elective Course (PEC-II)	PEC-FAE-304G	Preparatory Wet Processing and Dyeing
2	Professional Elective Course (PEC-II)	PEC-FAE-305G	Visual Merchandising
3	Professional Elective Course (PEC-II)	PEC-FAE-306G	Material Studies

OPEN ELECTIVE-III

Sr. No.	Course Category	Course Code	Course Title
1	Open Elective Course (OEC-III)	OEC-FAE-307G	Indian Colored Textile Heritage
2	Open Elective Course (OEC-III)	OEC-FAE-308G	Fabric Structure and Analysis
3	Open Elective Course (OEC-III)	OEC-FAE-309G	Specialty Yarns and Texturing

OPEN ELECTIVE-IV

Sr. No.	Course Category	Course Code	Course Title
1	Open Elective Course (OEC-IV)	OEC-FAE-310G	Fashion Accessories
2	Open Elective Course (OEC-IV)	OEC-FAE-311G	Jewellry Design & Development
3	Open Elective Course (OEC-IV)	OEC-FAE-312G	Structure and Properties of Textiles

PCC-FAE-301G Industrial Engineering in Apparel Industries

<table>
<tr><td>Course Code</td><td colspan="5">PCC-FAE-301G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course Title</td><td colspan="5">Industrial Engineering in Apparel Industries</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester – V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

PEC-FAE-301G Industrial Engineering in Apparel Industries

Pre–requisites: Apparel Production-I and Apparel Production-II

Course Objectives:

- To understand concept of production planning and control in an apparel industry using work study.
- To familiarize motion study, quick response and various production systems involve in an apparel industry
- To understand and operate different sewing data analysis software (GSD techniques).
- To know the handling of garments between different processes in the apparel industry.
- To understand Industrial Engineering and its application in Apparel Industries

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Introduction to Industrial Engineering, Introduction to production, Operations, Concept of production, Productivity components of production, Production planning & control, its Objective, function & organization of various departments in apparel industry. Role of Industrial Engineering in Apparel Industries.

UNIT -II

Production planning order preparation, material planning, process planning, loading & scheduling in apparel industry. Work measurement: Uses of work measurement, data, and basic procedure of work measurement. Plant Layout and Line Balancing.

UNIT -III

Motion & Time study: Definition & scope of motion & time study, Data for sewing work study, improvement of production efficiency, Production analysis (qualitative & quantitative). Ergonomics: Importance and work place design and fatigue, Applications of Ergonomics. GSD and SAM, SMV calculations in Garment Industries

UNIT -IV

Co-ordination of activities: Layering & marker planning , Cutting room planning, planning of sewing room, Material management in clothing production Quick response in apparel manufacturing . Different production systems. Lean Management, Six Sigma, TQM, Quality Circle, SA8000, ISO, Statistical process Control, AQL, Control Charts, Process Capability, Application of SPSS.

Suggested Reading List:

Title	**Author**
Introduction to clothing production management	A.J. Chutter
Production management in apparel industry	Rajesh Bheda
Industrial Engineering and Management	Op Khanna and A Swarup
Time Study manual for Textile and Garment Industries	NL Enrick

Course Outcomes:

After completion of the course, students will be able to:

- Implement concept of production planning and control in an apparel industry using work study.
- Analyse motion study , quick response and various production systems involve in an apparel industry
- Operate different sewing data analysis software (GSD techniques).
- Implement Industrial Engineering in Apparel Industries

PCC-FAE-302G Garment Production Machines & Equipment

Course Code	**PCC-FAE-302G**				
Category	Professional Core Course				
Course Title	Garment Production Machines & Equipment				
Scheme and Credits	L	T	P	Credits	Semester - V
	3	0	0	3	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Fabric Formation; Apparel Production-I and Apparel Production-II

Course objectives-

- To introduce the basics of garment production machinery and equipment.
- To develop an understanding of processes involved in the garment making right from cutting upto pressing.
- To learn the principles of sewing dynamics.
- To equip with the basics of latest manufacturing practices in the apparel making.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Overview of the Garment Manufacturing processes, Introduction to the latest advancements in the Garment manufacturing processes. Fabric cutting Process: Pre-requisites for the fabric cutting. Tools and equipment needed for the cutting process. Advancements in the fabric cutting technology.

UNIT - II

Garment assembly processes: Basics of sewing, Functional parts of sewing machines (SNLS): Feed mechanisms, Run-in-ratio, Effect of sewing process on the sewing thread strength. Principle, mechanism and utility of following machines: Interlock machine, Overlock machine, Double needle Lock stitch and chain stitch sewing machines, Bar- tacking machine, Feed off the arm, Button attaching and buttonhole making machine and computerized embroidery machines.

.UNIT - III

Study of sewing needle temperature: Factors affecting and remedial measures, Methods for the needle temperature measurement..Study of the measurement of the sewing forces and pressure during sewing. Study of the measurement techniques of the sewing thread tension on the sewing machine: SNLS and overlock machines. Applications of Programmable logic circuits (PLC) in the Garment manufacturing processes. Robotics: Basic analogy, its applications, scope and limitations in the Garment Industry.

UNIT - IV

Pressing and Fusing process and equipment. Handling of garments between different processes in the apparel industry

Suggested Reading List:

Title	Author
Garment Manufacturing Technology	Nayak & Padhey
The Technology of Clothing Manufacture	Carr & Latham
Apparel manufacturing analysis	Jacob Solinger
Apparel manufacturing Handbook: Analysis, Principles & PRACTICES	Jacob Solinger
Industrial Engineering in Apparel Production	V Ramesh Babu
Apparel Manufacturing Technology	Karthik, Ganeshan, Goplakrishnan

Course Outcomes- After completion of the course, students will be able to:

- Implement the advance cutting processes in Garment Industries
- Implement the concepts of various garment assembly processes
- Analysis sewing dynamics
- Handle various types of garments between different processes in the apparel industry

PCC-TT/TC/FAE-303G Textile Testing

<table>
<tr><td>Course code</td><td colspan="5">PCC-TT/TC/FAE-303G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course Title</td><td colspan="5">Textile Testing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology, Textile Chemistry, Fashion and Apparel Engg.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic knowledge of textile fibres, yarns and fabrics.

Course Objectives:

- To familiarize the students about the importance, concept and techniques of sampling
- To familiarize the students about important fibre, yarn and fabric dimensions and characteristics and their measurement techniques
- Comprehending the mechanical behavior of textile materials and its evaluation methods
- To familiarize the students about the evaluation methods of colour fastness
- To familiarize the students about common types of garment testing

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to textile testing - aim and scope. Sampling and Sampling techniques: General requirements; fibre, yarn and fabric sampling techniques.

Measurement of fibre dimensions and characteristics, viz. length, fineness, cotton maturity, neps and trash including principle and operation of equipment in common use.

Relation between R.H. and moisture regain of textile materials; equilibrium regain, hysteresis. Measurement of moisture regain. Official regain and concept of correct invoice weight.

UNIT-II

Measurement of yarn dimensions and characteristics: yarn count/diameter, twist and hairiness including principle and operation of equipment in common use.

Yarn evenness: Terms and definitions, nature of irregularities. Principles and methods of evenness testing, variance-length curves and their interpretation.

Test methods for fabric dimensional and other physical properties like, thickness, weight, crimp, bending and drape including principle and operation of equipment in common use.

UNIT-III

Mechanical behaviour of textiles: Terms and definitions, expression of results, quantities and units. Experimental methods: Principle of CRL, CRT and CRE type tensile testing machines. Fibre strength testing – single fibre strength and bundle strength. Yarn strength testing – single yarn strength and lea strength. Fabric strength testing - tensile, tearing and bursting strength tests. Principle and operation of equipment in common use.

Measurement of fabric abrasion resistance and evaluation of results; measurement of fabric pilling and crease recovery.

UNIT-IV

Measurement of fabric air permeability and water vapour permeability. Introduction to fabric handle.

Introduction to fastness properties of dyed and printed textiles - evaluation methods of colour fastness to Laundering, Crocking, Sunlight, Perspiration, Dry-cleaning and Hot Pressing.

Garment Testing: Testing of Seam Strength, Seam Slippage, Seam Puckering, Button Strength and Zipper or Closer Strength.

Suggested Reading List:

Title	**Author**
Principles of Textile Testing	J. E. Booth
Physical Testing of Textiles	B. P. Saville
Fabric Testing	Jinlian Hu
Physical Properties of Textile Fibres	W. E. Morton & J. W. S. Hearle
Textile Fibres, Yarns and Fabrics	E. R. Kaswell

Course Outcomes:

After completion of the course, students will be:

- able to understand the concept of sampling and sampling techniques for testing of textile materials.
- familiar with the important fibre, yarn and fabric dimensions and characteristics and their measurement techniques.
- familiar with the mechanical behavior of textile materials, different related terms and principles, and its evaluation methods.
- familiar with the evaluation methods of colour fastness
- familiar with the common types of garment testing

PEC–FAE–301G Digital Fabric design and development

Course code	PEC–FAE–301G				
Category	Programme Elective Course (PEC-I)				
Course Title	Digital Fabric design and development				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Computer aided textile designing, Colour & Design Concepts, Fabric Formation

Course Objectives:-

- To understand woven and knit textile design process
- To impart knowledge for textile computerized embroidery technology
- To understand basic vector graphic tools for motif designing
- To understand digital fashion illustration techniques

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Introduction to computer aided design for woven and knit design development, Different principles, modules and options desirable in basic CAD software for textile designing, Latest trends in fabric design and development system employed in industries, Realization of different color and weave design effects using computer, Desirable skill requirements of textile designers, Cost incurred in using CAD systems

UNIT - II

Introduction to machine embroidery: basic embroidery machine and physical components, machine setting and electronic control, Brief about different types of embroidery machines used in different segments of apparel industry, Classifications of Design Stitch type, Common types and formats of available designs in computerized embroidery machine software.

UNIT - III

Introduction to use of computers in fabric print design and development, Introduction to Adobe-illustrator while covering Main Toolbox, Selection tools, editing of multiple objects, drawing and editing tools, vector lines and colour, creative lines , Geometric transformation tool for print design development

UNIT - IV

Brief overview of print and embroidery motifs used in traditional as well as contemporary fashion segments. Design generation using elements of motif design. Digital development in suitable graphic software for geometrical floral motif, cross-stitch effect, engineered prints, block repeat with offset filters, half drop repeats, all over patterns, Gingham patterns, creating stripe and plaid patterns, diamond patterns, complex colour blends. Filters for different effects depicting common textile effects like silk screen, leather etc

Suggested Reading List:

Title	**Author**
Fashion Illustration: Inspiration and Technique	Anna Kiper
How to develop a professional portfolio	Allyn & Bacon
Design Process	A. Karl
Basics Fashion Design -Research and Design	S Simon
Encyclopedia of Machine Embroidery	Val Holmes
Creative Machine Embroidery	Linda Mille
Machine Stitch: Perspectives	*A Kettle and Jane McKeating*

Course Outcomes:

After completion of the course, students will be able to:

- Develop different design parameters for woven and knit fabric
- Develop Practical skills to relate surface ornamentation by machine embroidery
- Develop Practical skills in vector graphic software for print development
- Relate Engineered print of common design styles

PEC-FAE- 302G Woven and Knit Design

<table>
<tr><td>Course code</td><td colspan="5">PEC-FAE-302G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course (PEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Woven and Knit Design</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion & Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Fabric formation, Colour & Design Concepts and Computer Aided Textile Designing

Course Objectives:

- To understand concept of elements of design and its importance in Textile and Apparel design.
- To familiarize concept of principles of design and its importance in Woven and Knit design.
- To understand Woven design and see the effect of colour and surface ornamentation on woven products.
- To know Print design and visualize the effect of colour and surface ornamentation on knitted products

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Elements of Design: Dots, Lines, Shapes, Forms, Colour and Textures. Impact and Application of Elements of design on the woven and knit designs. Type of Motifs and the distribution of motifs.

UNIT-II

Principles of Design: Balance, Proportion, Harmony, Rhythm, Emphasis, Symmetry. Impact and Application of Principles of design on the woven and knit designs. Importance of Elements and Principles designs on woven and knitted garments.

UNIT-III

Basic Woven designs, Simple Weaves: Plain Twill, Satin/Sateen and their derivatives Complex and Compound Weaves: Diamond, Huck-a-back, Mock-Leno, Bedford cord and Pique, Backed and Double Cloth, Towelling and other types of woven products. Surface ornamentation of Woven fabrics.

UNIT-IV

Basic knit designs: Single Jersey, Rib, Interlock, Purl and their derivatives. Complex and Compound Knit designs. Effect of colours on knit designs. Surface ornamentation of knitted fabrics.

Suggested Reading List:

Title	Author
Handbook of Weaving	S Adanur
Woven Fabric Production – I & II	NCUTE Publications
Inside Fashion Design	Sharon Lee Tate
Fashion: From Concept to Consumers	Gini Stephon Frings
Knitting Technology	Spencer
Fabric Structure	Watson
Watson's Advanced woven structure	Grosiciki
Knitting Fundamentals	SC Ray

Course Outcomes:

After completion of the course, students will be able to:

- relate the concept of EOD and POD on woven and knit design.
- comprehend the design development of woven products
- comprehend the design and development of knitted products
- construct colour and weave effects, stripe effects of woven and knit fabrics

PEC-FAE- 303G Textile Coloration Techniques

<table>
<tr><td>Course code</td><td colspan="5">PEC-FAE-303G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course (PEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Textile Coloration Techniques</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion & Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Textile Raw Materials, Yarn Formation, Fabric Formation, Colour & Design Concepts

Course Objectives:

- To understand the elementary knowledge and process line for pre-treatment.
- To learn the concept of dyeing of cellulosic, protein and synthetic textiles.
- To gain knowledge of dyeing and processing machinery.
- To develop skills for application of dyes on fabric and garments.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Elementary knowledge and Process line for pretreatment, Dyeing of textiles, Natural and added impurities in greige cotton fabrics. Overview of sizing, desizing, scouring operations with their objective, principal and mechanism, machinery used, general recipe, drawbacks and advantages. General introduction to bleaching and mercerisation with their objectives, mechanism, machinaries used, drawbacks and advantages.

UNIT-II

General concept of dyeing. Brief about Dye-fibre interaction, dye uptake, shade percentage. General methods of dyeing by important classes of dyes on natural cellulosic (cotton), regenerated cellulose (Viscose, Polynosic, modal, Lyocel), e.g. direct, vat, azoic, sulphur, reactive dyes.

UNIT-III

Pretreatment of wool and silk textiles. Dyeing of protein by acid and basic dyes and man-made (Polyester, Nylon, Acrylic and etc.), yarns, fabrics and garments, by acid, basic and disperse dyes etc., pigment dyeing. Introductory idea of dyeing of fibre, yarn and fabric on different dyeing machines.

UNIT-IV

Dyeing of denim using Indigo dye. Garment dyeing and processing: concept and machine used. Laundering, dry cleaning and Stain removals of textile. Rectifying and Stripping of dyes from substrate. Introduction of CCM and its applications in textile and garment industries

Suggested Reading List:

Title

Author

"Textile Science", CBS Publishers
Gohl E P G and Vilensky LD

"Fundamental and practices in colouration of textiles", Woodhead Publishing,
Chakarverty J N,

Textile Scouring and Bleaching", Griffin, 1968.
Trotman E R

Technology of Bleaching & Mercerising", Sevak Pub., Mumbai
Shenai VA

"Chemical Processing of Silk"
Gulrajani M L

Technology of Dyeing", Sevak Pub., Mumbai
Shenai VA

Dyeing and Chemical Technology of Textile Fibres", B.I.Publications Pvt. Ltd
Trotman E R

Chemical testing of textiles: a laboratory manual, Dept of Textile Engineering, AuburnUniversity, 1981 Hall David M,

Course Outcomes:

After completion of the course, students will be able to:

- Understand the fundamentals of textile colouration and pre-treatments.
- Analyse the textile dyes and techniques for different fibres.
- Apply dyes on fabric and garments.
- Develop the sample of denim using indigo dye.

OEC-FAE- 301G Knitting and Knitwear Technology

<table>
<tr><td>Course code</td><td colspan="5">OEC-FAE-301G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Knitting and Knitwear Technology</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion & Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Fabric Formation; Knitting Technology

Course Objectives:

- To gain knowledge of knitted fabrics & knitted garments and their properties.
- To familiar with knitting machinery and mechanisms.
- To have adequate exposure of knitted fabric and knitwear manufacturing techniques as well as ornamentation.
- To understand the knitting techniques, knitting elements and knitting machines.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Definition of knitting, Type of Knitted fabrics and their characteristics, End-uses of knitted fabrics. Fundamental Stitches and their uses. Stitch diagrams. Knitting cycles of Needles. Basic weft knitted structures and their properties. Ornamentation of knitted fabrics. Derivatives of basic structures like La-coste, Accordian, Half and Full Cardigan, Milano Rib, French Rib, Swiss Rib, Single Pique, Taxi Pique, Pin Tuck.

UNIT - II

Classification of warp and weft knitting machines. Classifications of warp knitting machines. Description of Raschel and Tricot machines. Characteristics of Raschel and Tricot structures Calculations for Tightness factor, fabric cover, stitch density, areal density and knitting machine production

UNIT- III

Introduction to Knitted Garments- types and flowchart including the steps of production. Fully Cut garments – spreading – hand and machine spreading, types of lays. Marking – manual and computerized marking Cutting devices, etc. Cut stitch shaped, Shaping of various garments, etc., Fully fashioned garments – Concepts of use of basic forms i.e., circle, bell, and balloon, triangle, overlays in the generation of a garment shape. Broader classification of integral garments. Fashioning for shaping, fashion frequency. Most commonly used fashion details- Necklines, sleeves, etc

UNIT - IV

Integral garments – Basic techniques as course shaping Wales shaping, tubular knitting, running-on, change of stitch type, casting -off, etc. Machine knitted integral garments as berets,, half hose, upper and lower bodice garments, etc , Sewing of knits,Linking machine and Cup seamer, Quality control of knitted garments.

Suggested Reading List:

Title	**Author**
Knitting Technology	Wignal
Knitting Technology	Azgaonkar
Knitting Technology	Spencer
Knitting fundamentals and advancement	S C Ray
Knitted Clothing Technology	Brackenburry

Course Outcomes:

After completion of the course, students will be able to:

- Analyse knitted fabrics and knitted garments, their properties, manufacturing techniques
- Implement the concepts of fully fashioned garments
- Classify warp and weft knitting machines and Knitted garments machineries
- Implement the quality control of various knitting processes.

OEC–FAE–302G Soft Skill and Interpersonal Communication

<table>
<tr><td>Course code</td><td colspan="5">OEC–FAE–302G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Soft Skill and Interpersonal Communication</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: English and Computer basics

Course Objectives:

- To understand and aware about importance, role and contents of soft skills through instructions, knowledge acquisition, demonstration and practice.
- To possess knowledge of the concept of Self-awareness and Self Development.
- To help the students in building interpersonal skills.
- To develop skill to communicate clearly.
- To learn active listening and responding skills.
- To develop students overall personality.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction to Soft skills, Knowing yourself, Self Assessment, Self Awareness, Thoughtfulness and responsible approach, Self Development: Etiquette & Manners, Emotion, Ego. Handling stress and Failures

UNIT-II

Values and Belief Systems, Positive Attitude and Self Confidence, Art of listening-Art of reading-Art of speaking-Art of writing,

UNIT-III

Communication and Its Interpretation: Definition, Types, Importance, Barriers, Overcoming barriers, Communication skills, Body Language, Interpersonal Skills/ Understanding Others Developing interpersonal relationship-

UNIT-IV

Time Management, Identifying one's strength and failures, Importance of First Impression, Priority Management, Team building-group dynamics-Net working, Improved work relationship, Responsibilities, Prioritize Your Work, Smart Work, Decision Making, Empowering and delegation, Motivating others

Suggested Reading List:

Title	Author
A Book on Development of Soft Skills (Soft Skills : A Road Map to Success), Meena.K and V.Ayothi (2013), P.R. Publishers & Distributors,	
Soft Skills – Know Yourself & Know the World, S.Chand & Company LTD, Ram Nagar, New Delhi	Alex K.,
Developing the leader within you	John c Maxwell
Good to Great	Jim Collins
The seven habits of highly effective people	Stephen Covey
Emotional Intelligence	Daniel Goleman
You can win	Shiv Khera
Principle centred leadership	Stephen Covey
Communication Skills	Sanjay Kumar and Pushpa Lata, Oxford University Press.
Developing Communication Skill	Krishna Mohan, Meera Banerji, McMillan India Ltd.
Thinks and Grow Rich	Napoleon Hill, Ebury Publishing
Awaken the Giant Within	Tony Robbins Harper Collins Publishers,
Change Your Thoughts; Change Your Life	Wayne Dyer, Hay House India,
The Power of Your Subconscious Mind	Dr Joseph Murphy Maanu Graphics
The new Leaders	Daniel Coleman Sphere Books Ltd ,
Personality Development and Group Discussions	Barun K. Mitra, Oxford University Press.

Course Outcomes:

At the end of the course, student will be able to

- Make use of techniques for self-awareness and self-development.
- Develop right attitudinal and behavioural change , Apply business etiquette skills effectively.
- Improve communication, interaction and presentation of ideas.
- Apply the conceptual understanding of communication into everyday practice.
- Implement teamwork and group discussions skills
- Develop time management and stress management.

OEC–FAE–303G Organizational Behavior & HRM

<table>
<tr><td>Course code</td><td colspan="5">OEC–FAE–303G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Organizational Behavior & HRM</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Entrepreneurship and Industrial Engineering**,** Textile Raw Materials, Yarn and Fabric Formation, Apparel Production

Course Objectives:

- To impart knowledge of Organisational Behaviour & HRM
- To introduce the professional ethics and human values in present competitive business environment and competition.
- To learn the different aspect of corporate communication and Leadership
- To develop the techniques of induction programs in corporate environment.
- To familiarize the students with various wages and incentives planning

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Understanding Organisational Behaviour: Definition, Goals of Organisational behaviour. Key forces affecting Organisational Behaviour. Fundamental Concepts of Organisational Behaviour. Motivation: Meaning, Objectives and importance of motivation. Theories of Motivation, Maslow's theory, Mc Greger's Theory Herzberg's theory. Morale: Meaning; Factors affecting morale, types of morale morale and productivity, Evaluation of morale, improving morale.

UNIT - II

Communication: Definition & importance of Communcation; Formal & informal communication, Barriers in communication.

Leadership: Definition & importance, Nature of leadership various approaches to leadership styles.

UNIT - III

Importance of human resources in industry, Definition of human resource management, mechanical approach towards personnel, Paternalism, Social system approach. Need for human resource planning, process of human resource planning, Methods of recruitment, Psychological tests and interviewing, Meaning and importance of placement, Meaning and techniques of induction. Training and development : Concepts of training and development, Importance of training and development, Management development its nature, purpose and method.

UNIT - IV

Significant factors affecting compensation, Methods of wage payment, Wage differentials, Causes of difference in Wages, Types of wage differentials, Wage incentives, Meaning, Objectives, types of incentive plans.

Suggested Reading List:

Title

Author

Human Resource and Personnel Management K. Aswathappa–TMH Publ Company Ltd.
Personnel Management
C.B. Mamoria, Himalaya Publishing House.
Organisational Behaviour
Dr. L.M. Prasad (Sultan Chand & Sons).
Personnel Management & Industrial Relations Dr. T.N. Bhagoliwal: Sahitya Bhawan Agra.
Personnel Management
V.G. Karnik, Jaico Publishing House.
Personnel management & Industrial Relation
Tripathi: Sultan Chand & Sons.
Personnel Management Arun Monappa & Mirza Saiyadain –TMH Publishing Co. Ltd.
Principles of Personnel Management
Edwin B. Flippo (McGraw Hill).
Organisational Behaviour
K. Adwathappa.
Organizational Behaviour John W. Newsstorn & Keith Davis, TMH, New Delhi.

Course Outcomes:
At the end of the course student will be able to:-

- Relate Organisational Behaviour in fashion Industry.
- Analyze corporate communication and Leadership
- Develop the skills, techniques and tools of HRM
- Perform incentive Planning process.

OEC–FAE–304G Textile & Garment Design by Surface Ornamentation

Course code	OEC–FAE–304G				
Category	Open Elective Course (OEC-II)				
Course Title	Textile & Garment Design by Surface Ornamentation				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Fabric formation, Colour & Design Concepts, Computer Aided Textile Designing, Apparel Production, Traditional Textiles

Course Objectives:

- To understand the basic design concepts
- To familiarize concept of Surface Ornamentation.
- To identify fabric characteristics required for effective ornamentation
- To understand techniques of surface ornamentation
- To design textiles, apparels & accessories using various techniques of surface ornamentation.
- To understand application of ornamentation in textiles and garments.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Brief Introduction to basic design concepts and elements of design. Introduction to surface ornamentation of textiles and garments. Significance of surface ornamentation on textiles for value addition. Design enhancement by surface ornamentation. Motif, design and theme selection for surface ornamentation. Designer's inspiration for embellishment. Introduction to designers and brands using different surface ornamentation techniques.

UNIT - II

Classification and styles of surface ornamentation with reference to geographical factors and techniques employed. Factors affecting selection of different surface ornamentation techniques. Introduction to regional embroidery techniques - Phulkari, Kantha, Kasuti, Chikankari etc.

Other techniques of surface ornamentation like crocheting, tatting, smocking, ribbon work, fabric painting, eyelet work, cut work, drawn thread work, applique, fabric manipulation, trim sewing lace work, bead work, zardosi, resist dyeing – tie and dye, shibori, battick, rust dyeing, eco dyeing.

Printing- block, transfer, screen, stencil, digital and inkjet printing techniques as a means for surface ornamentation and value addition.

UNIT - III

Tools, equipment and materials required for surface ornamentation. Materials required for surface ornamentation – textile and non-textile materials, different trims and notions, gimps, braid, passementerie, tassels, sequins etc.

UNIT - IV

Modern techniques of textile and garment surface ornamentation. Intervention of CAD for surface ornamentation. Application of textile and surface ornamentation in home textiles, apparels and accessories. Rendering, sketching and designing of apparels and accessories using surface ornamentation techniques.

Suggested Reading List

Title	Author
Apparel Manufacturing Technology	T. Karthik, P. Ganesan, D. Gopalakrishnan
Know your Fashion Accessories	Celia Stall-Meadows
Embroidery Design	Nirmala C Mistry
Traditional Indian Textiles	John Gillow

Course Outcomes:

After completion of the course, students will be able to:

- Relate significance and techniques of Surface Ornamentation.
- Apply surface ornamentation techniques in textiles and garments.
- Design textiles, apparels & accessories using various techniques of surface ornamentation.

OEC–FAE–305G Introduction to Fashion and Apparel Industries

<table>
<tr><td>Course code</td><td colspan="5">OEC–FAE–305G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-II)</td></tr>
<tr><td>Course Title</td><td colspan="5">Introduction to Fashion and Apparel Industries</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Textile Raw Materials, Yarn and Fabric Formation, Apparel Production, Colour & Design Concepts

Course Objectives:

- To understand the elementary knowledge of Indian and global apparel industries.
- To learn the concept of fashion, components o fashion, fashion cycle, fashion theories.
- To gain knowledge of fashion centres , fashion brands.
- To develop skills for application of fashion promotion, information services and communications

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Introduction to Apparel Industry, Indian Apparel industry scenario and its SWOT Analysis, Status of Structure and working flowchart of various departments of a garment production house. Apparel manufacturing countries: their features, level of technology, product mix. Indian apparel industry- challenges & global scenario.

UNIT - II

Fashion terminology, components of fashion, fashion cycle – its phases, Style classification based on fashion cycle - fad/classic, recurring & interrupted cycles, Consumer identification with fashion cycles- leaders, innovators, followers, victims & laggards. Motives of consumer buying & factors affecting fashion growth & declination. Fashion adaptation theories.

UNIT - III

Major fashion centers of the world: Brief introduction to world fashion centers – Millan, Italy, Paris, Rome, American, European, Japanese. Who’s who of fashion world- national & international designers , their private labels, Luxury brands of apparels & accessories.

General introduction to careers & future opportunities in fashion & apparel sector- export & buying houses, design houses etc.

UNIT - IV

Fashion information services, trend forecasting and auxiliary services. Importance of fashion seasons & fashion calendar in apparel industry.
Introduction to fashion forecasting – significance, purpose of forecasting trends, forecasting tools & techniques and role of fashion forecasters. Fashion promotion and communications- Trade fairs, Fashion shows, exhibitions & promotional events

Suggested Reading List:

Title

Author

The theory of Fashion ",
John Wiley & Sons, 1965.
“Fundamentals of Men's Fashion Design ", Fairchilds publications, 1976.
Kawashima, Masazki,
“The clothing Factory ", The Clothing Institute, Blackwell London, 1972.
Carr, H.C.,
“Inside the Fashion Business ", JWS, 2nd edition, 1974.
Jarnow, J.A., and Judelle B.,
“Advertising Handbook ", Prentice Ha ll Inc, 1956.
Barton, Roger,
“Merchandising of Fashion ", Ronald press, 1942.

Swinney, John B,

Garment Manufacturing Technology

Nayak & Padhey

The Technology of Clothing Manufacture
Carr & Latham

Apparel manufacturing analysis
Jacob Solinger

Apparel manufacturing Handbook: Analysis, Principles and Practices
Jacob Solinger

Apparel Manufacturing Technology
Karthik, Ganeshan, Goplakrishnan

Course Outcomes:

After completion of the course, students will be able to:

- Understand the fundamentals of fashion and apparel industries.
- Analyse the fashion cycles, fad and different styles and fashion theories.
- Apply the work of fashion leaders and brands into practice
- Develop fashion promotion and communication skills .

OEC–FAE–306G Evolution of Clothing and Fashion

<table>
<tr><td>Course code</td><td colspan="5">OEC–FAE–306G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-II)</td></tr>
<tr><td>Course Title</td><td colspan="5">Evolution of Clothing and Fashion</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
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<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Apparel Production-I, Apparel Production-II and Introduction to Fashion

Course Objectives:

- To understand concepts of clothing and costumes.
- To familiarize with fashion capitals, fashion designers, fashion markets and fashion weeks.
- To understand Indian history of costumes.
- To know the Global history of costumes.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Origin of clothing. Objectives of clothing and costumes, Main archetypes of costumes, Principles of history of fashion. Theories of clothing-Protection, adornment, modesty and combined need theory. Fashion and its meaning, Classification of fashion, Fashion product Life cycles. Sources of Fashion Inspiration.

UNIT- II

Fashion terminology, Effect of various factors on fashion movement- accelerating, retarding and recurring factors such as technology, designers, economy, sports etc. on fashion movement. Fashion leadership theories- traditional, reverse and across theory. Important global fashion capitals, National and International fashion designers, National and International fashion markets and fashion weeks.

UNIT- III

Indian history of costumes: Concept and comparison of costumes of all stages of pre-historic and medieval period, Study of Costumes, jewellery, footwear, hairstyles etc. in India in different periods as – Vedic & post Vedic period, Maurian Period, Gupta period, Kushan and Kanishka period.

UNIT- IV

Global history of costumes: Concepts and history of classical costumes in Greek civilization and Roman civilization. History of costumes in Egyptian, French and Byzantine civilization. History of costumes in the western world starting from the origin up to the Reign of Charles and Louis with the emphasis on famous fashion centers and famous fashion designers.

Suggested Reading List:

Title	Author
The guide to historic costumes	Karen Baclaw Ski
Inside Fashion Business	Kitty G.Dickerson
Inside Fashion Design	Sharon Lee Tate
Fashion: From Concept to Consumers	Gini Stephon Frings

Course Outcomes:

After completion of the course, students will be able to:

- Relate significance of clothing and fashion.
- Apply indian costumes in textile and garment designing.
- Design textiles, apparels & accessories using western costume.

LC–FAE–301G Woven & Knit Design Lab

Course code	LC-FAE-301G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Woven & Knit Design Lab				
Scheme and Credits	L	T	P	Credits	Semester–V
	0	0	2	1	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of Weaving and Knitting.

Course Objectives:

- To impart first-hand experience of the procedures of making warp sheet, drawing-in and denting of warp yarns through heald shafts and dents of the reed as per drafting and denting plan and developing woven fabric samples.
- To learn fabric analysis skills .
- To impart first-hand experience of developing basic knit designs on weft knitting machines and analysis.
- To serve as a bridge between theory and practice.

List of Experiments:

1. Study of Warp Patterning through Sectional Warping mechanism
2. Study of Weft Patterning through Drop Box mechanism
3. Study of woven designing through Electronic Dobby or Jacquard mechanism
4. To Produce woven fabric samples of basic weaves (Plain, Twill and Sateen weaves) on desk looms/sample looms
5. To Produce woven fabric samples of basic weave derivatives (Rib. Matt, Pointed twill, herring bone, etc.) on desk looms/sample looms
6. To Produce woven fabric samples of decorative weaves (Mock Leno, Honey comb, Diamond, Crepe, Mock Leno, etc.) on desk looms/sample looms
7. To produce different fabrics on flat double bed weft knitting machine and study their properties
8. To produce knitted fabric samples by combination of knit, tuck and float designs.
9. To analyse woven fabric samples and study their properties and end uses
10. To analyse Knitted fabric samples and study their properties and end uses.

Course Outcomes: After completion of the course, students will be able to:

• Correlate between theory and practice of the concept of Sectional warping machines and looms
• Visualise the mechanisms of Sectional Warping and shuttle weaving machines and comprehend their settings
• Correlate between theory and practice of the concept of woven and knitting machines
• Visualise the mechanisms of knitting machines and comprehend their settings

- Develop practical skills relevant to industrial practice

LC–FAE–302G Pattern making & Apparel Construction Lab-I

Course code	LC-FAE-302G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Pattern making & Apparel Construction Lab-I				
Scheme and Credits	L	T	P	Credits	Semester–V
	0	0	2	1	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of Apparel Production, Garment Manufacturing

Course Objectives:

- To impart first-hand experience of the procedures of making basic patterns for creating garments.
- To learn working with tools and equipment required for pattern making
- To impart first-hand experience of working of different utility/sewing machines and preparation of samples on all the utility machines .
- To serve as a bridge between theory and practice.

List of Experiments (Pattern making):

1. Learning the basics of pattern making techniques.
2. Learning and working with tools and equipment required for pattern making.
3. Learning and using body measurements, garment measurements and specification sheet data for flat pattern making.
4. Learning the fundamentals of fabric calculations according to the flat pattern information.
5. Construction of basic bodice blocks (kids) (front, back, sleeves and trouser).
6. Construction of basic bodice blocks (Adult) (front, back & sleeves with fitting and fashion details).
7. Adaptation of basic blocks into finished pattern (Kids A-line frock etc.)
8. Adaptation of basic blocks into finished pattern (Kids trousers, bottoms etc.)
9. Adaptation of basic blocks into finished garments (Adult kurta, blouse, shirt etc.)
10. Pattern making of fashion details of basic collar, styles of sleeves and basic neckline.

List of Experiments (Apparel construction):

1. Learning the working of different utility machines. Preparation of samples on all the utility machines.
2. Sample preparation of placket types.
3. Sample preparation of pocket types.

4. Sample preparation of techniques to control fabric fullness (pleats, gathers and tucks).
5. Construction of atleast one complete kid's garments.
6. Construction of different types of collars, sleeves and necklines.

Course Outcomes: After completion of the course, students will be able to-

- Understand practically the concepts of basic blocks and developing blocks
- Prepare patterns for kid's garment construction.
- Construct the fashion details for a variety of kid's garments.

LC-TT/TC/FAE-303G Textile Testing Practical

Course code	LC-TT/TC/FAE-303G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Textile Testing Practical				
Scheme and Credits	L	T	P	Credits	Semester–V
	0	0	2	1	
Branch	Textile Technology, Textile Chemistry, Fashion and Apparel Engg.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of textile fibres, yarns and fabrics, Textile Testing.

Course Objectives:

- To impart first-hand experience of the procedures of basic testing of fiber, yarn, fabric and garment.
- To learn presentation of test results in a suitable manner.
- To impart first-hand experience of test result analysis.
- To serve as a bridge between theory and practice.

List of Experiments:

1. Measurement of trash content in raw cotton
2. Measurement of fiber fineness by whole fiber method
3. Measurement of fiber fineness by airflow method
4. Measurement of fiber length parameters by Baer Sorter
5. Determination of fiber bundle strength using Pressley fiber bundle strength tester
6. Determination of fiber bundle strength using Stelometer
7. Measurement of yarn twist
8. Measurement of linear density of sliver, roving and yarn
9. Measurement of C.S.P value of yarn
10. Measurement of fabric tensile properties
11. Measurement of fabric tearing strength
12. Evaluation of washing and rubbing fastness properties of dyed fabrics
13. Evaluation of seam properties (Seam strength and Seam Slippage)

Course Outcomes:

After completion of the course, students will be able to:

- correlate between theory and practice of the concept of textile testing.
- conduct basic testing of fiber, yarn, fabric and garment.
- present the results in graphical and tabular manner.
- analyze the results from the tests.
- develop practical skills relevant to industrial practice.

LC–FAE–304G Apparel Design Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-FAE-304G</td></tr>
<tr><td>Category</td><td colspan="5">Laboratory Course (Professional Core Course)</td></tr>
<tr><td>Course Title</td><td colspan="5">Apparel Design Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic knowledge of Apparel Production, Garment Manufacturing, Apparel design

Course Objectives:

- To impart first-hand experience of the procedures of garment design techniques via dart manipulation method
- To learn style variations of dart manipulation
- To impart first-hand experience of Commercial paper patterns, symbols used in commercial patterns, guide sheet and other relevant information
- To serve as a bridge between theory and practice.

List of Experiments:

1. Principle of dart manipulation by (i) Slash and spread method / Pivotal transfer method
2. Style variations of dart manipulation for
    - Single dart
    - Double dart
    - Dart Cluster of dart equivalents
    - Radiating darts
    - Graduated darts
    - Asymmetric darts
    - Intersecting darts
3. Dart manipulation to other fashion details like shirring and gathers etc.
4. Commercial paper patterns envelopes for pattern prepared via using above manipulations and adaptations

Course Outcomes:

After completion of the course, students will be able to

- Understand practically the concepts of darts in adults bodice block
- Make darts and manipulation of darts.

- Adapt existing design patterns to new styles

PCC-FAE-303G Apparel Production -III

Course Code	**PCC-FAE-303G**				
Category	Professional Core Course				
Course Title	Apparel Production –III				
Scheme and Credits	L	T	P	Credits	Semester - VI
	3	0	0	3	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Fabric Formation, Apparel Production-I and Apparel Production-II

Course Objectives:

- To gain knowledge of commercial sewing machines & associated work aids, etc.
- To familiar with computerised pattern making, 3-D simulation, fabric selection, etc.
- To have adequate exposure of Trims, notions, zippers, Velcro, etc.
- To understand the alternative joining of materials, fusing, pressing, etc..

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Drawbacks of SNLS machine and highlighting need for other commercial sewing machines. Comparison of feed mechanism and components of SNLS machine with other commercial sewing machines – their relative merits and demerits. An introduction to post sewing operations. Description of processes, their objectives and requirements. An introduction to pressing and finishing of garments. Description of different commercial pressing equipment used in garment industries.

UNIT - II

Alternative methods of joining material – fusing, welding, moulding. Description of methods, requirements and equipments employed for fusing. An introduction and classification of trims and notions – the materials, selection criteria and methods of attachment to garments. Designing garments using different trims and notions. An introduction of care labelling instructions for garments. Packing: different types of packing, packing materials, labels and tags.

UNIT- III

Classification and styles of apparels with reference to fabric types, age groups, genders, occasion and application areas. Fabric selection based on classification and styles. Characteristics & desirable properties of Apparel fabrics. Principle of fitting- ease, line, grain, set, balance. Significance of draping for different garment styles. Style adaptation of apparels by various fabric manipulation techniques. Different techniques & their types - like pleats, darts, gathers, shirring, elasticizes shirring, smocking, ruffles etc. Designing different apparel styles using the various fabric manipulation techniques.

UNIT - IV

An introduction to forecasting tools, techniques and importance. Different luxury, high end brands for apparels and concept of fast fashion.

The role of fashion season and fashion calendars in meeting deadlines and reducing lead times in apparel supply chain. Impact of fast fashion on apparel supply chain. Concept and significance of sustainable approach in apparel production.

Suggested Reading List:

Title	Author
Garment Manufacturing Technology	Nayak & Padhey
The Technology of Clothing Manufacture	Carr & Latham
Apparel manufacturing analysis	Jacob Solinger
Apparel manufacturing Handbook:Analysis, Principles & Practices	Jacob Solinger
Industrial Engineering in Apparel Production	V Ramesh Babu
Apparel Manufacturing Technology	Karthik, Ganeshan, Goplakrishnan

Course Outcomes:

After completion of the course, students will be able to:

- Compare merits and demerits of SNLS over latest commercial sewing machines
- Implement the concepts of computerized patterns, 3-D scanners and making garments
- Classify Notions, trims, zippers and other Textile and Non-textile items
- Implement alternative methods of joining fabrics, fusing, etc..

PCC-FAE-304G Automation in Garment Industry

Course Code	**PCC-FAE-304G**				
Category	Professional Core Course				
Course Title	Automation in Garment Industry				
Scheme and Credits	L	T	P	Credits	Semester - VI
	3	0	0	3	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Apparel Production-I , Apparel Production-II, GPME

Course Objectives:

- To gain knowledge of basics of Automation for textile and apparel Industry.
- To introduce the application of automation in different sectors of textile and apparel Industry.
- To learn advanced concepts of process and retail automation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Basics of Automation- Definitions, concept, components of automation, relationship between various automation components, need of automation, levels of automation, strategies of automation, types of automation. Process control- Industrial process controls- continuous & discrete, open loop & closed loop systems; computerized process control; NC & CNC technologies- concept, features and components.

Automation in apparel designing processes- Body scanning, PDS, marker planning, plotting, digital design presentation and Virtual reality. Automation in Operations- Fabric inspection, Spreading, Cutting, Sewing and Pressing.

UNIT - II

Quick Response Technology: Concept, need, strategies, Components of QRT in Textile Industry, Apparel production & Apparel retailing segments. Advantages and Limitations. Latest software solutions as QRT. Computer integrated Manufacturing- Concept, Definitions, Scope of CIM in apparel Industry, Components of CIM, Areas of application of CIM in apparel Industry, Advantages and Limitations.

UNIT- III

Flexible Manufacturing System: Concept, Definitions, Brief history, Need, Objectives, Benefits offered, Types of FMS, Components of FMS, Limitations. Utility Sewing machines- Concept, Need and features of latest apparel sewing utility and artwork Machines.

Automation in Material Handling: Concept, Need, components, Strategies followed to control handing apparels at manufacturing level, Latest techniques to automate material handling in apparel production & retailing.

UNIT - IV

Automation in Apparel Retail: Definitions, concept, need, aspects, areas of application of apparel retail automation. Robotics & PLCs- Definitions, detailed components, classification of robots w.r.t manipulators & controllers, latest applications of robots in apparel production & retailing. PLCs- concept, components, advantages over conventional control systems, applications in textile & apparel Industry. Use of computers at various levels of apparel Supply chain- POS tracking back up to the manufacturing.

Suggested Reading List:

Title	**Author**
Garment Manufacturing Technology	Nayak & Padhey
The Technology of Clothing Manufacture	Carr & Latham
Apparel manufacturing analysis	Jacob Solinger
Apparel manufacturing Handbook:Analysis, Principles & Practices	Jacob Solinger
Industrial Engineering in Apparel Production	V Ramesh Babu
Apparel Manufacturing Technology	Karthik, Ganeshan, Goplakrishnan
Automation, Production Systems and CIM	Mikell P. Groover
Transforming Clothing production into a Demand-Driven , Knowledge- Based, High Tech Industry	Walter & Carsolo
Advance in apparel production	Catherine Fairhurst

Course Outcomes:

After completion of the course, students will be able to:

- Introduce the concepts of automation for textile and apparel Industry
- Implement the application of automation in different sectors of textile and apparel Industry
- Introduce the Flexible Manufacturing systems
- Implement the robotics and PLC’s for textile and apparel Industry

PEC-FAE- 304G Preparatory Wet Processing and Dyeing

<table>
<tr><td>Course code</td><td colspan="5">PEC-FAE-304G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course (PEC-II)</td></tr>
<tr><td>Course Title</td><td colspan="5">Preparatory Wet Processing and Dyeing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion & Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Textile raw materials, yarn and fabric formation, woven and knitted fabrics, colour science

Course Objectives:

- To understand preparatory wet processing and concept of Pre-treatments with relevant machines and procedure.
- To understand dyes, pigments and other auxiliaries used in Textiles and apparels
- To know application procedures of pretreatment and dyeing with various dyes
- To know the dyeing of animal fibres and denim fabrics.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Greige Fabric checking, Preparation of process chart, Elementary knowledge and Process line for pretreatment, Dyeing, printing and finishing of textiles, Natural and added impurities in greige cotton fabrics. Identification of impurities in greige, cotton, wool, silk and synthetics. Identification of size materials on fabric. Recipes, conditions and machinery use for removing impurities from griege fabric, yarn and fibres. Overview of singeing, desizing, scouring operations with their objective, principle and mechanism, general recipe, drawbacks and advantages. Introductory idea of machines used in preparatory wet processing.

UNIT - II

Introduction to different processes (Desizing, Scouring, bleaching, mercerising, milling, etc.) involved for the above and the machinery used Heat and steam setting of synthetic fibres / yarns/ fabrics (polyester, nylon, acrylic, polypropylene, spandex fibre etc.). Physical principles involved in detergency, condition for efficient detergency. Commercial detergents. Dry cleaning, Stain removals. Modern developments in pre-treatments. Continuous processing machinery. Auxiliaries used in Desizing, scouring, bleaching and mercerizing.

UNIT - III

General methods of dyeing. Important classes of dyes. e.g. direct, acid, basic, vat, azoic, sulphur, reactive and disperse dyes etc., Application of dyes on natural, regenerated (Viscose, Polynosic, modal, Lyocell) fibres Application of dyes on Man Made fibres (Polyester, Nylon, Acrylic and etc.), yarns, fabrics and garments. Chemical auxiliaries used in dyeing. Colour measurement and fastness (light, washing, perspiration, sublimation, chlorine, etc.) properties.

UNIT - IV

Dyeing of blends, P/C, P/W, P/V etc. Mass colouration. Pigment dyeing. Dyeing of denim using Indigo dye, Pigment dyeing technology, factors affecting dyes build-up on cellulosic material, continuous Indigo dyeing range, new Indigo vetting and dyeing techniques. Rectifying and Stripping of dyes from substrate, Dyeing concept of textile materials based on protein fibres. Dyeing concept of synthetic textile materials such as Polyester, Nylon, etc (overview). Dyeing of denim using Indigo dye. Garment dyeing and processing: concept and machine used.

Suggested Reading List:

Title	**Author**
Textile Chemistry	RH Peters
Mercerising	JT Marsh
Fundamental and practices in colouration of textiles	J N Chakraborty
Textile Scouring and Bleaching	Trotman E R
Technology of Bleaching & Mercerising	Shenai VA
Technology of Dyeing	Shenai VA
Dyeing and Chemical Technology of Textile Fibres	Trotman E R
Chemical Processing of Silk	ML Gulrajni
A glimpse of the Chemical Technology of Textile Fibres.	R R Chakraverty
Textile processing	N N Mahapatra
“Textile Science”, CBS Publishers.	Gohl E P G and Vilensky LD
Chemical testing of textiles: a laboratory manual, Dept of Textile Engineering	Hall David M

Course Outcomes: After completion of the course, students will be able to:

- Have an idea of preparatory wet processes and equipment used for wet processing of textile and apparel products
- Utilise the concept of Pre-treatments with relevant machines and procedure.
- Apply dyes, pigments and other auxiliaries in Textiles and apparels
- Utilise knowledge for application procedures of pretreatment and dyeing with various dyes

PEC-FAE- 305G Visual Merchandising

<table>
<tr><td>Course code</td><td colspan="5">PEC-FAE-305G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course (PEC-II)</td></tr>
<tr><td>Course Title</td><td colspan="5">Visual Merchandising</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion & Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Woven & Knitted Fabrics, Colour & Design Concepts, Apparel Merchandising

Course Objectives:

- To understand the elementary knowledge of visual merchandising .
- To learn the concept of merchandising mix .
- To gain knowledge of store management .
- To develop skills for store design and display of products.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Introduction to Visual Merchandising- Introduction, Objectives, concept and scope of visual merchandising, VM as a support for retail positioning strategy, prospects and challenges in VM, Techniques to overcome the VM challenges.

UNIT - II

Merchandise Mix: Introduction, Objectives, concept of Merchandise Mix, Merchandise line, assortment, assortment planning, strategies, Role of merchandiser in apparel retail.

Store management: Introduction, Objectives, Types of retail stores, location of a retail store, types of retail locations, planning of a store layout, various types of store layouts- grid, forced path, free form, boutique and combined. Store space allocation.

UNIT - III

Store design and display: Introduction, Objectives, concept of store designs, significance of display planning, display settings, tore designs, Exterior and Interior of a store, Window displays, Merchandise presentation strategies, physical materials used to support the display, Fixtures, shelves, Gondolas, racks, planogramming, replenishes.

UNIT - IV

Store image: Introduction, Objectives, concept of store image, elements of Image mix-merchandise, fixtures, sound/noise, odour, visuals, Employees, elements that levy negative impact on shoppers. Change & strengthening of retail image.

Non-store merchandising- Introduction, Objectives, non-store retail merchandising, Television retailing/ home shopping, e-retailing, e-catalogues, product presentation in non-store retail merchandising.

Suggested Reading List:

Title	Author
Garment Manufacturing Technology	Nayak & Padhey
The Technology of Clothing Manufacture	Carr & Latham
Apparel manufacturing analysis	Jacob Solinger
Apparel manufacturing Handbook:Analysis, Principles & Practices	Jacob Solinger
Industrial Engineering in Apparel Production	V Ramesh Babu
Apparel Manufacturing Technology	Karthik, Ganeshan, Goplakrishnan

Course Outcomes:

After completion of the course, students will be able to:

- Relate knowledge of visual merchandising .
- Apply merchandising mix in Stores .
- Use knowledge of visual merchandising in store management .
- Utilise skills for store design and display of products.

PEC-FAE- 306G Material Studies

Course code	PEC-FAE-306G				
Category	Professional Elective Course (PEC-II)				
Course Title	Material Studies				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Fashion & Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Textile raw materials, yarn formation, woven & Knitted Fabrics, Colour & Design Concepts, Apparel Merchandising

Course Objectives:

- To understand the elementary knowledge of different raw materials, high performance fibres, fancy yarns
- To learn the concept of different types of fabrics used for apparels.
- To gain knowledge of narrow fabrics, braids, laces, nets, lining and interlinings nonwoven fabrics.
- To understand Non-Textile materials like leather, fur, metal, glass, plastics, etc.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Introduction to high performance fibres, advantages, limitations, applications in functional clothing. Fancy Yarns: Concept, applications, general properties, Types of fancy yarns-structures, sub-types, their applications in fashion clothing and apparels.

UNIT - II

Fabrics- Characteristics of Apparel fabrics, Production process, structure, properties and end uses of fabrics as Poplin, Muslin, georgettes, crepe, voile, denim, drill, satin, brocades, tussar, organdie, Bedford cord, velvet/velveteen, gauge & leno, gabardine, organdie, organza, jean.

UNIT - III

Narrow Fabrics: Types of narrow fabrics- Tapes, Ropes, Braids, Laces, Ribbons, Elastics, Belts and their application in garments and fashion accessories.
Lining & Inter lining fabrics: Different types, structure, end uses and application techniques of linings and interlinings. Non-woven fabrics: Manufacturing techniques and applications in the apparel and accessories.

UNIT - IV

Non-textile materials- Leather: Different types of leathers, their properties and end uses. Fur: Different types and their uses. Introduction to nature of miscellaneous materials like metals, glass, shells, plastic and their applications in fashion entities.

Suggested Reading List:

Title	Author
Textile Ropes and Cordages	R Chattopadhyay
Textile Design	Watson
High performance fibre	Preston & Lewin
Non-woven fabrics	N.N.Banerjee
The Technology of Clothing	Carr & Latham

Course Outcome: After completion of the course, students will be able to:

- Create work in the field of high performance fibres, fancy yarns for fashion & apparel industries.
- Analyze the plan and develop different types of fabrics to be used for different types of apparels.
- Evaluate and Promote narrow fabrics, nonwovens, braids, laces in the field of Fashion & Apparel industries.
- Analyze Plan and execute the uses of non-textile material like leather, fur, metals etc for fashion and apparel industry.

OEC–FAE–307G Indian Colored Textile Heritage

<table>
<tr><td>Course code</td><td colspan="5">OEC–FAE–307G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-III)</td></tr>
<tr><td>Course Title</td><td colspan="5">Indian Colored Textile Heritage</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Traditional Indian Textile & Embroideries, Colour & Design Concepts

Course Objectives:

- To familiarize different textile design inspirations in Indian heritage
- To understand design and development process of kalamkari textiles
- To familiarize design and development process of shibori and batik
- Introduction to traditional textile printing techniques

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Fashion inspirations: Basic principles of aesthetics, the specific aesthetics of different art styles e.g. shapes and forms in sculpture, roots and impulses of traditional painting and dyeing techniques. Introduction to shibori, fabrics and colour-combination techniques, dyeing techniques, Folding and clamping resist: accordion, squares, triangle, cones, hollow and solid circles, solid squares, varied clamp and marks, Concept of Arashi via random and planned wrapping and over dyeing. Bound –resist by wrapping and bound objects, stitching and gathering techniques, introduction to shibori knits

UNIT-II

Introduction, synopsis of temple, folk idiom and historic perspective of kalamkari, Natural dyeing: principle, colour combination, colours from nature, different available modrant and treatments, Introduction to hand painted and block –printed styles of kalamkari their major areas and styles, Future trends of kalamkari

UNIT-III

Basic principle for batik, Factors like fabric selection, pre-treatments, brushes, waxes and recipes, canting, colour and design combinations, dyes and dyeing methods followed during batik printing. Reactive, vat, acid and basic dyeing methods, steaming and fixation trends for batik. Latest trends in batik textiles

UNIT-IV

Detailed technique of printing followed commercially in traditional Ajrakh, **Dabu and Bagru,** Mendh ki chhapai **printing.** Synopsis about areas, common motifs, colors and technique for Madhubani, Phadas ,Pichhavai , Bagh, Mural, Pattachitra Kalighaat , **Varak gold and silver leaf printing, Khari gold and silver textile print**ing

Suggested Reading List:

Title	**Author**
Kalamkari and Traditional Design Heritage of India	Shakuntala Ramani
Kalamkari: Figures and Designs	K. Prakash
Homage to Kalamkari	Mulk Raj Anand
Batik : The Art and Craft	Ila Keller
Stitched Shibori: Technique, Innovation, Pattern, Design	Jane Callender
Indian Textiles	John Gillow

Course Outcomes:

After completion of the course, students will be able to:

- Understand major design inspirations in Indian heritage
- Design and develop new styles of kalamkari textiles
- Relate batik and shibori from traditional inspiration
- Design and develop of commercial textile printing system

OEC–FAE–308G Fabric Structure and Analysis

<table>
<tr><td>Course code</td><td colspan="5">OEC–FAE–308G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-III)</td></tr>
<tr><td>Course Title</td><td colspan="5">Fabric Structure and Analysis</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Yarn and Fabric Formation, and Colour & Design Concepts

Course Objectives:

- To understand the basic concepts of fabrics, classification of fabrics.
- To learn the Simple weaves like Plain, Twill and Sateen weaves.
- To gain knowledge of Mock leno, Honeycomb, Huck-a-back weaves
- To develop skills for analysis of fabrics

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Basic Concepts: Importance of fabric structure, Classification of fabrics, Notation of Weave, drafting plan, peg plan and denting. Simple Weaves: plain weave and its derivatives, ornamentation

UNIT - II

Twill weave and its derivatives, ornamentation, effect of twist on prominence of twill lines, Sateen and Satin and their extensions. Crepe weave, diamond

UNIT -III

Mockleno, Cork-screw, honey comb, huck-a-back, bedford cords, welt and pique fabrics.

UNIT -IV..

Decorative Weaves: Extra warp and weft figuring, Backed cloth, Double cloth, treble and multiply belting structures. Draft, peg plan and denting plan for all simple and decorative weaves, Particulars of common varieties of these fabrics. Fabric Analysis

Suggested Reading List:

Title	Author
Textile Design and Color	William Watson
Watson’s Advanced Textile Design	William Watson
Grammer of Textile Design	H Nisbeth
Fabric structure and design	Gokarneshan N

Course Outcomes:

After completion of the course, students will be able to:

- Utilise basic concepts of fabric structure, interlacement of warp and weft.
- Implement various types of weaves, drafting, lifting and denting plan in making fabrics.
- Produce weaves like plain, twill, satin and other decorative weaves.
- Analyse different types of weave structures, etc.

OEC–FAE–309G Specialty Yarn and Texturing

Course code	OEC–FAE–309G				
Category	Open Elective Course (OEC-III)				
Course Title	Specialty Yarn and Texturing				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Textile Raw Materials, Yarn Formation, and Colour & Design Concepts

Course Objectives:

- To understand the various types of specialty yarns.
- To learn the concept of sewing threads.
- To gain knowledge of different types of texturising.
- To develop skills for application of novelty and textured yarns.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Types of Specialty yarns:- Novelty yarns, Grindle yarns, core-spun yarns, Chennile yarns, Corded yarns, Bulky yarns and other types of specialty yarns. Methods of production of novelty yarns, their properties and applications

UNIT - II

Sewing threads: Their manufacturing techniques, special finishes, properties and end-uses

UNIT - III

Different types of texturising – Twist texturing, Air-jet texturising, edge crimping stuffer box crimping, gear crimping, knit-de-knit etc. Detailed discussion on False Twist. texturising process, machine,. Material, process and machine variables – their effect on properties of yarn. Recent developments.

UNIT - IV

Air-jet texturising – detailed discussion of process. Different types of variables and their effect on properties of yarn. Recent developments of airjet texturising machine, jets and process. Methods of assessing and evaluation of textured yarns. Hi-bulk yarns – especially acrylic. Chemical texturising.

Suggested Reading List:

Title	Author
Spun Yarn technology	A Venkatasubramani
Air-jet Texturing	Allan Fellingham
Yarn Texturing technology	J Hearle, L Hollick and D Wilson
Knitting with novelty yarn	ALaura J Bryant
Synthetic Filament Yarn:Texturing technology	Ali Demir

Course Outcomes:

After completion of the course, students will be able to:

i) understand the various types of specialty yarns, novelty and fancy yarns .
ii) learn sewing threads, their types and finishes
iii) know various types of Texturising Processes
iv) understand Air-jet Texturising and its applications

OEC–FAE–310G Fashion Accessories

Course code	OEC–FAE–310G				
Category	Open Elective Course (OEC-IV)				
Course Title	Fashion Accessories				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: AP- I, II and III, Textile Raw materials, Yarn formation, Fabric formation, Fashion Selecion

Course Objectives:

- To impart knowledge of fashion accessories and different aspects involved.
- To understand the art of accessory designing so that they can complement their garment designs with appropriate accessories.
- To develop the skills and techniques of accessory designing and appreciate its commercial values.
- To familiarize the students with various materials used in making jewellery

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Fashion Accessories – definition and classification – wearable, drape able. Different textile and non textile raw materials used - fancy yarns, woven and knitted fabrics, narrow fabrics, leather, fur, beads, metal. Various notion and trims used in fashion accessories – zippers, Velcro, snap fasteners, eyelets, frog closures etc. Product life cycle of fashion accessories. Forecasting & trend analysis for accessories, Major accessory brands and retail outlets.

UNIT - II

Footwear designing – textile and non textile raw materials, trims & notions used for footwear construction. Parts of shoe, brief shoe designing – as last, development last, designer last, pattern making, die-manufacturing, cutting, fitting, assemblage of remaining components, bottoming and finishing. Caring of footwear. Styles of men’s and women footwear – oxford, moccasin, wingtip, ballerinas, stilettoes. Major footwear brands.

UNIT - III

Jewellery Designing: Different metals and stones, faceted cuts used for jewellery designing. Brief production techniques as fusing, soldering, cutting etc, stone settings, Different jewellery styles as rings, bracelets, necklaces, tiara etc. Different stone setting as buttercup, prong, cluster inlay etc.

UNIT - IV

Knitted accessories – pantyhose, socks, gloves, stockings & mittens: Designing, materials, Construction, styles and care. Hats: Designing, construction, styles & care of hats. Drape able accessories- Stoles & scarves: Designing, construction, styles& care.

Suggested Reading List:

Title

Author

"Fashion Sketch Book", Om Publication.
Bina Abling
" Fashion from Concept to Consumer 7th Edition", Pearson.
Frings,
Inside Fashion Design,
Tate
Know your Fashion Accessories, Fairchild books, 2003.
Dorling Kindersley, Meadows Celia Stall,
"Carr and Latham's Technology of Clothing Manufacturing" Blackwell, Scientific Publications, 1988. Tyler,
Fashion Apparel & Accessories and Home Furnishing, Pearsons Prentice Hall, NJ, 2007.
Diamond Ellen and Diamond Jay,

Course Outcomes:

After completion of the course, students will be able to:

- Develop the skills of accessory illustration and visual merchandising.
- Create new accessory designs
- Make the design according to the garments.

OEC–FAE–311G Jewellry Design & Development

Course code	OEC–FAE–311G				
Category	Open Elective Course (OEC-IV)				
Course Title	Jewellry Design & Development				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: AP- I, II and III, Fashion Selecion

Course Objectives:

- To impart knowledge of Jewellry Design and different aspects involved.
- To understand the art of jewellery designing so that they can complement their garment designs with appropriate accessories.
- To develop the skills and techniques of jewellery designing and appreciate its commercial values.
- To familiarize the students with various materials used in making jewellery

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Historical overview of jewelry. An overview of Jewelry types – fine, vintage, estate, costume, bridge, classification, styles and materials. Cultural, emotional and economical factors associated with jewelry selection and buying.Sources of inspiration, theme, color & material selection criteria.

Market analysis, trend analysis and forecasting trends for jewelry design and development.Niche Indian & international market for Jewellry.Major jewelry brands and outlets.

UNIT II

Fundamentals of jewellery design and gemology, drawing & rendering metal forms and gemstones, theme based designing, cost based designing, historical designing. Designing jewellery using textile and non-textile components. Orthographic view, market oriented designing, diamond grading & sorting, men's and youth's jewelry. CAD/CAM technology deployed in jewelry designing.

UNIT III

Different jewellery styles and designing as rings, bracelets, necklaces, tiara etc. Fine jewelry-vintage and estate jewelry, jewelry styles- necklace, necklace length, earings, earing fastening, earrings styles, bracelets, brooches, pins and clips, rings and head pieces

Textile & non –textile materials, trims and notions for jewelry designing. An introduction to metals and stones – plated metals, plated and filled metals, gemstones- precious stones, semi precious stones, faux stones and gems, birthstones. Brief production techniques as fusing, soldering, cutting and stone settings.

UNIT IV

Retailing, online and offline marketing, branding**.** Merchandising trends and techniques- store retailing, internet retailing, catalog retailing for costume and bridge jewelry. Visual merchandising & window display of jewelry. Careers in jewelry design & development

Suggested Reading List:

Title	**Author**
Design Ideas and accessories	RituBhargav
Accessory Design	Aneta Genova
Fashion Design Course: Accessories	Thames & Hudson
Drawing fashion accessories	Steven Thomas Miller

Course Outcomes:

After completion of the course, students will be able to:

- Develop the skills of jewellery illustration and visual merchandising.
- Create new Jewellery designs
- Make the design according to the garments.

OEC–FAE–312G Structure and Properties of Textiles

<table>
<tr><td>Course code</td><td colspan="5">OEC–FAE–312G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-IV)</td></tr>
<tr><td>Course Title</td><td colspan="5">Structure and Properties of Textiles</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Textile Raw Materials, Yarn Formation,

Course Objective:

- To gain knowledge of structure and properties of Ring, Rotor, DREF yarns.
- To understand the various types of cloth setting theories
- To understand Tensile, bending, shear properties of textile material.
- To gain knowledge of Comfort properties of fabrics.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT - I

Structure and Properties of Ring, Rotor, DREF spun yarns, multifilament and textured yarns. Importance of Yarn structure in relation to different mechanical properties of Apparel Fabrics. Cloth setting theories: Ashenhurst's, Armitage's, Law's, Brierley's and Peirce's theory: its basic seven equations and idea of jamming.

UNIT - II

Tensile property of fabrics: tensile curve for fabrics and geometrical changes during tensile deformation, factors affecting tensile strength of fabrics, Bending property of fabrics: Different bending stiffness parameters by cantilever testing, Bending hysteresis testing and different parameters measured by it, Bending hysteresis curve, Factors affecting bending stiffness of fabrics

UNIT - III

Shear stiffness of fabrics: problems during shear testing and their remedies. Shear hysteresis curve, Spring- friction block model of shear behaviour. Creasing of fabrics: Mechanism of creasing, different motions within fabric structure while creasing. Factor affecting crease resistance and crease recovery of fabrics.

UNIT - IV

Comfort of fabrics, different constituents of comfort. Flow of heat, moisture and air through textile material, Factors affecting thermal insulation, moisture propagation and air permeability of fabrics. Drapability of fabrics, Drape testing, drape parameters and factors affecting drape behaviour. Introduction to the term Tailorability and Formability for apparel fabrics. Handle of fabrics. Objective evaluation of fabric handle. Constituent properties of handle.

Suggested Reading List:

Title	**Author**
Textile Yarns-Technology, Structure and Applications	Goswami, etal
Structural Mechanics of Fibres, Yarns and Fabrics	Hearle etal

Course Outcome: After completion of the course, students will be able to:

- Use the knowledge of structure and properties of different types of material for textile and apparel products.
- Estimate Maximum sett of fabrics using different types of cloth setting teories .
- Evaluate tensile, bending and shearing properties of fabrics.
- Analyze comfort and hand properties of fabrics .

HSMC-TT/TC/FAE-301G Merchandising and Export Management

<table>
<tr><td>Course code</td><td colspan="5">HSMC-TT/TC/FAE-301G</td></tr>
<tr><td>Category</td><td colspan="5">Humanities and Social Sciences including Management Courses</td></tr>
<tr><td>Course Title</td><td colspan="5">Merchandising and Export Management</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology, Textile Chemistry, Fashion and Apparel Engg.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic concept of management

Course Objectives:

- To make the students acquainted with various concepts of marketing and different aspects pertaining to marketing which include market segmentation, product life cycle, various stages involved in new product development.
- To make them understand the various pricing strategy and functions of distribution channel.
- To make them understand the importance of export.
- To familiarize them on export procedure, export terms of payment and final assistance provided by government.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Fundamental idea and basic terms and definition in marketing. Definition of marketing. Explanation of various concept of marketing with examples. Types of Marketing: Target marketing and Mass Marketing. Market segmentation. Classification of market based on size. Various stages of new product development and product life cycle.

UNIT-II

Concept and definition of Marketing mix. Variables of market mix: 4Ps Product, Price, Promotion and Place. Distribution channels and various functions performed by the distribution channel. Logistics and its relevance. Promotion mix: various kinds of promotion mix; their scope of applications and their relative merits and demerits. Various factors need to be considered while deciding the price. Pricing decision and strategy.

UNIT-III

Export Management–importance of export. Risk involved in export and remedial measures. Various kind of terms of payment and their relative merits and demerits. Various kinds of document to be prepared and maintained for export. Various steps involved in Export Assistance given for export. Pre shipment and post shipment finance. Common incoterms.

UNIT-IV

Concept and definition of Merchandising. Utility and obsolescence factors in merchandising. Essential qualification criteria of a merchandiser. Types of merchandising. Roles of a merchandiser in an apparel industry. Various activities involved in merchandising: Line Planning, Line Development and Line presentation. Different types of sampling and their importance. Visual Merchandising. Elements of interior, exterior window display, store planning and layout-fixtures, location. Different types of sampling and their importance in merchandising. Brand building: Introduction, strategies, brand expansion, global trends. Introduction to customer relationship.

Suggested Reading List:

Title	**Author**
Marketing Management	Phillip Kotlar
Nabhi's Publication on Export	Govt. Handbook
International Marketing	Hess and Cateora
Export Management	B. S. Rathore

Course Outcomes:

After completion of the course, students will understand:

- the concept of marketing and marketing mix
- the importance and functions of distribution channel
- the use of different promotional tools and their scope of applications
- the various documents required for commercial and legal purpose
- financial assistance provided by government to the exporters and different modes of terms of payment in export business.

Also, the students will be exposed to different components of fashion merchandising and activities involved in product line planning, development and presentation and use of different types of samples during merchandising.

LC–FAE–305G Apparel Draping and Grading Lab

Course code	LC-FAE-305G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Apparel Draping and Grading Lab				
Scheme and Credits	L	T	P	Credits	Semester–VI
	0	0	2	1	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of Apparel Production, Garment Manufacturing, pattern making, drafting

Course Objectives:

- To impart first-hand experience of the procedures of draping, mechanism of draping and grading and their related calculations
  - To give hands on training to students on apparel construction techniques-basic block, dart manipulation.
  - To acquire the knowledge and skills for construction of various garment parts with draping.
  - To appreciate and develop different garment components like types of collars and sleeves.

List of experiments:

- Introduction to draping and dress forms. Preparation of fabric.
- Draping Terminology – Apex, Balance, Plumb line, Trueing, Blocking, Blending, Princess line, Clipping and marking.
- Draping of Bodice Front, Bodice Back and variation.
- Draping of Basic skirt and skirt variations.
- Draping of neckline –Cowl
- Design and construct a final garment applying draping techniques.
- Design Analysis and the three major pattern making principles
  Dart Manipulation – Using Slash and Spread technique and Pivotal Transfer technique (Single dart series – Mid shoulder dart, Center front dart, French dart, mid armhole dart and bust dart.
  Double dart series:
  Slash and Spread Method- Waist & Side Dart, Mid Shoulder& Waist Dart, Mid Armhole& Waist Dart
  Pivotal Method- Shoulder Tip& Waist, Center Front & Waist Dart.
- Introduction about Pattern Grading. Methods of pattern Grading . Advantages and Disadvantages of pattern grading. Grading bodice and sleeve block to various sizes.

Course Outcomes:

At the end of course student will be able to:

- Analyze different pattern making and grading techniques.
- Evaluate different dart manipulation method and able to apply them.
- Create different type of sleeves, collars with draping.
- Create yokes and neckline with draping.

LC–FAE–306G Textile Chemical Processing Lab

Course code	LC-FAE-306G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Textile Chemical Processing Lab				
Scheme and Credits	L	T	P	Credits	Semester–VI
	0	0	2	1	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of preparatory wet processing, scouring, desizing, mercerizing, bleaching

Course Objectives:

- To impart first-hand experience of the procedures of desizing, scouring, bleaching and mercerising
  - To give hands on training to students on dyeing techniques.
  - To acquire the knowledge and skills for dyeing of cotton fabrics by Direct, Reactive, Sulphur, Vat and Azoic dyes.
  - To appreciate and develop dyed wool and silk fabrics .

List of experiments:

1. Desizing of cotton by various methods and determination of desizing efficiency.
2. Scouring and determination of scouring efficiency.
3. Bleaching of cotton using hydrogen peroxide.
4. Mercerization of cotton.
5. Scouring and bleaching of wool.
6. Degumming and bleaching of silk.
7. Dyeing of cellulosic textiles by direct, reactive, sulphur and vat.
8. Dyeing of protein textiles by acid and basic dyes.
9. Dyeing of Polyester with disperse dye.
10. Dyeing of cotton/polyester blend.
11. Tie& dyeing.
12. Computer colour matching: Familiarization with the principles and working of computer colour matching instrument with preparing of database of dyes, shade matching, colour difference and measurement.

Course outcomes:

After completion of the course, students will be able to:

- Apply the practical exposure of textile processing techniques in clothing material.
- Use knowledge of dyes on cellulosic, protein and synthetic fabrics.
- Able to create different fabric samples with different dyes
- Evaluate different wet preparatory and dyeing processes of: wool, cotton and silk.
- Analyze the dyeing affinity with textile fabrics.

LC–FAE–307G Apparel Designing by CAD Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-FAE-307G</td></tr>
<tr><td>Category</td><td colspan="5">Laboratory Course (Professional Core Course)</td></tr>
<tr><td>Course Title</td><td colspan="5">Apparel Designing by CAD Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branch</td><td colspan="5">Fashion and Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic knowledge of Apparel Production, CATD, pattern making, drafting

Course Objectives:

- To impart first-hand experience of the procedures of Computer Aided designing in Textile and Apparel products
  - To give hands on training to students on designing various motifs based on different themes.
  - To acquire the knowledge and skills for developing colour palette and shade card.
  - To appreciate and develop moodboard, storyboard, fashion show logos and various textures .

List of experiments to be performed:

- To design motif based on different themes
- To develop Colour palette and shade card as per season and theme.
- To create different textile textures and effects namely denim, batik, water colour etc.
- To design apparel illustration using different themes.
- To create different fashion accessories namely purses, hats, footwear as per the theme
- To create mood board according to different themes.
- To develop storyboard consisting of different graphics prepared in above experiments.
- To design fashion show logo, invitation or brochures

Course Outcomes:

At the end of the course students will be able to:

- Apply tools and techniques in creating textile prints and patterns.
- Realisation of garment sketch or drawings using CAD software
- Realisation of numerous design variation using CAD software
- Appreciate and acquire skills of graphic software in Fashion.

LC–FAE–308G Pattern Making and Apparel Construction Lab-II

Course code	LC-FAE-308G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Pattern Making and Apparel Construction Lab-II				
Scheme and Credits	L	T	P	Credits	Semester–VI
	0	0	2	1	
Branch	Fashion and Apparel Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of Apparel Production, Garment Manufacturing, pattern making, drafting

Course Objectives: This Lab course is designed to:

- impart first-hand experience of utility of machines for gathers, shirring, picoting etc. as used in garments.
- Developing different garment patterns mainly developing adult garment designs.
- Drafting, Pattern making, marking of patterns on fabrics with the basic and fashion details.
- Learning cutting, sewing, washing, pressing and packaging of garments.

List of experiments: (**Pattern making**)

1. Construction of basic bodice blocks (Adult) (front, back & sleeves with fitting and fashion details).
2. Adaptation of basic blocks into finished patterns (Adult kurta, blouse, shirt etc.)
3. Construction of basic bodice blocks (Adult) (types of lowers/bottoms – plazzo, harem, night suit lower, trouser etc.)
4. Adaptation of basic blocks into finished patterns (Adult lowers etc.)
5. Pattern making adult casual jackets (simple, reversible etc.)
6. Pattern making adult casual/formal shirt (Men's & Women's)

List of experiments: (**Apparel construction)**

1. Construction of Adult upper garments (with special consideration of style, fabric and trim selection, costing of garments etc.)
2. Construction of Adult lower garments.
3. Construction of Adult casual jackets (simple, reversible etc.)
4. Construction of Adult casual/formal shirts (Men's & Women's)

Course outcomes: Students will be able to:

- Construction patterns for the adult garments (Men's wear & women's wear).
- Construction of garments for the adult garments (Men's wear & women's wear).
- Adaptation and manipulation of fashionable garments from the basic garments.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION
B.TECH (Electrical & Electronics Engineering)
SEMESTER 5th AND 6th
Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Electrical & Electronics Engineering) – 5th Semester
w.e.f. 2020-21

Sl. No.	Course Code	Course Title	Teaching Schedule L	T	P	Marks of class work	Examination marks Theory	Practical	Total Marks	Credit	Duration of examination in hour
1.	PCC-EE-301G	Power Systems–I	3	0	0	25	75	0	100	3	3
2.	LC -EE-303G	Power Systems–I Laboratory	0	0	2	25	0	25	50	1	2
3.	PCC - EE-305G	Control System	3	0	0	25	75	0	100	3	3
4.	LC-EE-307G	Control System LAB	0	0	2	25	0	25	50	1	2
5.	PCC - EE-309G	Microprocessor & Microcontroller	3	0	0	25	75	0	100	3	3
6.	LC EE-311G	Microprocessor & Microcontroller Lab	0	0	2	25	0	25	50	1	2
7.	PCC-EEE-313G	Electronic Measurement and Instrumentation	3	1	0	25	75	0	100	3	3
8.	LC-EEE-315G	Electronic Measurement and Instrumentation Lab	0	0	2	25	0	25	50	1	2
9.	PEC-I	Program Elective-I refer in List-I	3	0	0	25	75	0	100	3	3
10.	OEC-I	Open Elective – I refer in List-II	3	0	0	25	75	0	100	3	3
11.	HSMC-01G	Economics for Engineers	3	0	0	25	75	0	100	3	3
12.	PT-EEE317 G	Practical Training-1	-	-	-	-	-	-	* Refer Note 1		
	Total								**900**	**25**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.
   Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

List-I: PROGRAMM ELECTIVE (Semester-V)

Sr. No	Code	Subject	Credit
1	PEC-EEE-01G	Digital system design	3
2	PEC-EEE-03G	Scientific computing	3
3	PEC-EE-05G	HVDC Transmission system	3
4	PEC-EE-07G	High voltage engineering	3
5	PEC-EEE-09G	Biomedical Electronics	3
6	PEC-EEE-11G	Speech and audio processing	3

List-II: OPEN ELECTIVE-V (SEMESTER)

Sr.No	Code	Subject	Credit
1	OEC-EE01G	Electrical Engineering Materials	3
2	OEC-ECE332G	Additive manufacturing	3
3	OEC-EEE05G	Intelligent Instrumentation	3
4	OEC-EE07G	Power plant engineering	3

Scheme of Studies and Examination
B.TECH (Electrical & Electronics Engineering) – 6th Semester
w.e.f. 2020-21

Sl. No.	Course Code	Course Title	Teaching Schedule			Marks of class work	Examination marks		Total Marks	Credit	Duration of examination in hour
			L	T	P		Theory	Practical			
1.	PCC - EE-302G	Power Systems– II	3	0	0	25	75	0	100	3	3
2.	LC -EE-304G	Power Systems– II Laboratory	0	0	2	25	0	25	50	1	2
3.	PCC - EEE-306G	Digital Signal Processing	3	0	0	25	75	0	100	3	3
4.	LC - EEE-308G	Digital Signal Processing Laboratory	0	0	2	25	0	25	50	1	2
5.	PCC - EEE-310G	VLSI Design	3	0	0	25	75	0	100	3	3
6.	LC - EEE-312G	VLSI Design Lab	0	0	2	25	0	25	50	3	3
7.	PEC-II	Program Elective-II refer in List-III	3	0	0	25	75	0	100	3	3
8.	OEC-II	Open Elective –II refer in List-IV	3	0	0	25	75	0	100	3	3
9.	HSMC-02G	Organisational Behaviour	3	0	0	25	75	0	100	3	3
	Total								750	23	

Note:

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

List-III

PROGRAMM ELECTIVE (Semester-VI)			
Sr. No	**Code**	**Subject**	**Credit**
1.	PEC-EE-04G	Electrical and hybrid vehicle	3
2.	PEC-EE-06G	Power system protection	3
3.	PEC-EE-08G	Advance Electric Drives	3
4.	PEC-EE-10G	Electrical Machine Design	3
5.	PEC-EEE-12G	Computer organization and architecture	3

List-IV

OPEN ELECTIVE-I [Semester-VI]			
Sr.No	Code	Subject	Credit
1.	OEC-EE-04G	Python programming	3
2.	OEC-EE-06G	Introduction to MEMS	3
3.	OEC-EE-08G	Conventional and Renewable Energy Resources	3
4.	OEC-EE-10G	Soft Computing	3

POWER SYSTEM-I

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PCC- EE-301G		
Category	Program Core Course		
Course title	Power System-I (Theory)		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the concepts of power systems.
- Understand the various power system components.
- Evaluate fault currents for different types of faults.
- Understand basic protection schemes and circuit breakers.
- Understand concepts of HVDC power transmission and renewable energy generation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Section-A

Basic concepts : Introduction, Review of Three-phase systems. Analysis of simple three-phase circuits. Single-phase representation of balance three-phase network, The one-line diagram and the impedance or reactance diagram, Per unit (PU) system, Complex power, The steady state model of synchronous machine, Transmission of electric power, Representation of loads.

Section-B

Fault Analysis : Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults. Representation of generators, lines and transformers in sequence networks. Computation of Fault Currents. Neutral Grounding.

Section-C

Switchgear and protection: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application

Section-D

Introduction to DC Transmission & Solar PV System : DC Transmission Systems: Line-Commutated Converters (LCC) and Voltage Source Converters (VSC). LCC and VSC based dc link, Real Power Flow control in a dc link. Comparison of ac and dc transmission.

Solar PV systems: I-V and P-V characteristics of PV panels, power electronic interface of PV to the grid. Wind Energy Systems: Power curve of wind turbine. Fixed and variable speed turbines. Permanent Magnetic Synchronous Generators and Induction Generators.

Text/References:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.
2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
4. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.
5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012
6. EHV-AC/DC Transmission System ;S.Rao : Khanna Pub.
7. C.L Wadhwa, " Electrical Power system" new age publication.
8. Transmission & Distribution of Electrical Engineering: Westing House & Oxford Univ. Press, New Delhi8. Power System Protection & Switchgear By B. Ram, McGraw Hill

Power System-I Laboratory

Class Work: 25
Exam : 25
Total : 50

Course Code	**PCC-EE-303G**		
Category	Program Core Course		
Course title	Power system-I (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

At least 10 experiments are to be performed by students in the semester.

At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

LIST OF EXPERIMENTS:

(A) Hardware Based:

1. To determine negative and zero sequence reactances of an alternator.
2. To determine fault current for L-G, L-L, L-L-G and L-L-L faults at the terminals of an alternator at very low excitation
3. To study the IDMT over current relay and determine the time current characteristics
4. To study percentage differential relay
5. To study Impedance, MHO and Reactance type distance relays
6. To study ferranti effect and voltage distribution in H.V. long transmission line using transmission line model.
7. To study operation of oil testing set.
8. To understand PV modules and their characteristics like open circuit voltage, short circuit current, Fill factor, Efficiency,
9. To understand I-V and P-V characteristics of PV module with varying radiation and temperature level
10. To understand the I-V and P-V characteristics of series and parallel combination of PV modules.
11. To understand wind energy generation concepts like tip speed, torque and power relationship, wind speed versus power generation

(B) Simulation Based Experiments (using MATLAB or any other software)

12. To obtain steady state, transient and sub-transient short circuit currents in an alternator
13. To perform symmetrical fault analysis in a power system
14. To perform unsymmetrical fault analysis in a power system

Note:

1. Each laboratory group shall not be more than about 20 students.

2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

Control system

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-305G**		
Category	**Program Core Course**		
Course title	**Control Systems**		
Scheme	**L**	**T**	**P**
	03	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the modellingof linear-time-invariant systems using transfer function and state-space representations.
- Understandthe concept of stability and its assessment for linear-time invariant systems.
- Design simple feedback controllers.

Section-A

Introduction to control problem (4 hours)

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra, Signal flow graph.

Time Response Analysis (10 hours)

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Section-B

Frequency-response analysis (6 hours)

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Section-C

Introduction to Controller Design (10 hours)

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

Section-D

State variable Analysis (6 hours)

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigen values and Stability Analysis. Concept of controllability and observability.

Text/References:

1. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

2. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.

3. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

4. B.S.Manke, "Linear Control Systems: with MATLAB application", Khanna Publication.

5. https://nptel.ac.in/courses/107/106/107106081/ by Prof.C.S Shankar Ram, IIT Madras.

Control Systems Laboratory

Theory :	25
Class Work :	25
Total :	50

Course Code	**PCC-EE-307G**		
Category	**Program Core Course**		
Course title	**Control SystemsLaboratory**		
Scheme	**L**	**T**	**P**
	-	**-**	**02**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS: ANY SIX EXPERIEMENTS

1. To study speed Torque characteristics of

a) A.C. servo motor b) DC servo motor.

2. (a) To demonstrate simple motor driven closed loop DC position control system.

(b) To study and demonstrate simple closed loop speed control system.

3. To study the lead, lag, lead-lag compensators and to draw their magnitude and phase plots.

4. To study a stepper motor & to execute microprocessor or computer-based control of the same by changing number of steps, direction of rotation & speed.

5. To implement a PID controller for temperature control of a pilot plant.

6. To study behavior of 1^{st} order, 2^{nd} order type 0, type 1 system.

7. To study control action of light control device.

8. To study water level control using a industrial PLC.

9. To study motion control of a conveyor belt using a industrial PLC

SOFTWARE BASED (ANY FOUR EXPT.)

10. Introduction to SOFTWARE (Control System Toolbox), Implement at least any

- Different Toolboxes in SOFTWARE, Introduction to Control Systems Toolbox.
- Determine transpose, inverse values of given matrix.
- Plot the pole-zero configuration in s-plane for the given transfer function. Plot unit step response of given transfer function and find peak overshoot, peak time.
- Plot unit step response and to find rise time and delay time.
- Plot locus of given transfer function, locate closed loop poles for different values of k.
- Plot root locus of given transfer function and to find out S, Wd, Wn at given root & to discuss stability.
- Plot bode plot of given transfer function and find gain and phase margins Plot the Nyquist plot for given transfer function and to discuss closed loop stability, gain and phase margin.

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

Microprocessor and Microcontroller

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-309G**		
Category	**Program Core Course**		
Course title	**Microprocessor and Microcontroller**		
Scheme	**L**	**T**	**P**
	03	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Objective:

1. To develop an in-depth understanding of the operation of microprocessors.

2. To master the assembly language programming using concepts like assembler directives, procedures, macros, software interrupts etc.

3. To create an exposure to basic peripherals, its programming and interfacing techniques

4. To understand the concept of Interrupts and interfacing details of 8086.

5. To impart the basic concepts of serial communication in 8086.

Section-A

8086 MICROPROCESSORS

Introduction to 8086 Architecture, Features, Signals, I/O & Memory Interfacing, Addressing Modes, Interrupts, Minimum Mode & Maximum Mode Operation, Instruction Set, Assembly Language Programming.

Section-B

PERIPHERAL DEVICES

Parallel Peripheral Interface (8255), A/D & D/A Interface, Timer / Counter (8253), Keyboard and Display Controller (8279), USART (8251), Interrupt Controller (8259), DMA Controller (8237)

Section-C

INTRODUCTION OF MICROCONTROLLER

Different types of microcontrollers: Embedded microcontrollers, External memory microcontrollers; Processor Architectures: Harvard V/S Princeton , CISC V/S RISC; microcontrollers memory types; microcontrollers features : clocking, i/o pins, interrupts,timers, peripherals.

Section-D

8051 ARCHITECTURE

Microcontroller 8051- Architecture, Pin Diagram, I/O Ports, Internal RAM and Registers, Interrupts, Addressing Modes, Memory Organization and External Addressing, Instruction Set, Assembly Language Programming, Real Time Applications of Microcontroller- Interfacing with LCD, ADC, DAC, Stepper Motor, Key Board and Sensors.

Reference Books:

1. Mazidi and Mazidi: The 8051 Microcontroller and Embedded Systems, Pearson Education.
2. A. V. Deshmukh: Microcontroller (Theory and Application), TMH.
3. D. V. Hall: Microprocessors and Interfacing, TMH
4. Programming and Customizing the 8051 Microcontroller :Predko ; TMH.

Microprocessor and Microcontroller Lab

Theory :	25
Class Work :	25
Total :	50

Course Code	**PCC-EE-311G**		
Category	**Program Core Course**		
Course title	**Microprocessor and Microcontroller Lab**		
Scheme	**L**	**T**	**P**
	-	**-**	**02**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(iii) Group of students for practical should be 15 to 20 in number.

List of Experiments:

1. Write a program using 8085 and verify for :
   a. Addition of two 8-bit numbers.
   b. Addition of two 8-bit numbers (with carry).
2. Write a program using 8085 and verify for :
   a. 8-bit subtraction (display borrow)
   b. 16-bit subtraction (display borrow)
3. Write a program using 8085 for multiplication of two 8- bit numbers by repeated addition method. Check for minimum number of additions and test for typical data.
4. Write a program using 8085 for multiplication of two 8- bit numbers by bit rotation method and verify.
5. Write a program using 8086 for finding the square root of a given number and Verify.
6. Write a program using 8086 for copying 12 bytes of data from source to destination and verify.
7. Write a program using 8086 and verify for:
   a. Finding the largest number from an array.
   b. Finding the smallest number from an array.
8. Write a program using 8086 for arranging an array of numbers in descending

order and verify.

9. Write a program using 8086 for arranging an array of numbers in ascending order and verify.

10. Write a program to interface a two digit number using seven-segment LEDs. Use 8085/8086 microprocessor and 8255 PPI.

11. Write a program to control the operation of stepper motor using 8085/8086 microprocessor and 8255 PPI.

12. To study implementation & interfacing of Display devices Like LCD, LED Bar graph & seven segment display with Microcontroller 8051/AT89C51

13. To study implementation & interfacing of Different motors like stepper motor, DC motor & servo Motors.

14. Write an ALP for temperature & pressure measurement

15. Write a program to interface a graphical LCD with 89C51

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

ELECTRONIC MEASUREMENT AND INSTRUMENTATION

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EEE-313G**		
Category	**Program Core Course**		
Course title	**ELECTRONIC MEASUREMENT AND INSTRUMENTATION**		
Scheme	**L**	**T**	**P**
	03	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcome:

1.Analyze the performance characteristics of each instrument
2. Illustrate basic meters such as voltmeters and ammeters.
3. Explain about different types of signal analyzers.
4. Explain the basic features of oscilloscope and different types of oscilloscopes
5. Identify the various parameters that are measurable in electronic instrumentation.
6. Employ appropriate instruments to measure given sets of parameters.

Section-A

OSCILLOSCOPE:

Block diagram, study of various stages in brief, high frequency CRO considerations. Sampling and storage oscilloscope.

GENERATION & ANALYSIS OF WAVEFORMS:
Block diagram of pulse generators, signal generators, function generators wave analysers, distortion analysers, spectrum analyser, Harmonic analyser, introduction to power analyser.

Section-B

ELECTRONIC INSTRUMENTS:
Instruments for measurement of voltage, current & other circuit parameters, Q meters, R.F. power measurements, introduction to digital meters.
FREQUENCY & TIME MEASUREMENT:
Study of decade counting Assembly(DCA), frequency measurements, period measurements, universal counter, introduction to digital meters.

Section-C

DISPLAY DEVICES:

Nixie tubes, LED's LCD's, discharge devices.

TRANSDUCERS:
Classification, Transducers of types: RLC photocell, thermocouples etc. basic schemes of

measurement of displacement, velocity, acceleration, strain, pressure, liquid level & temperature.

Section-D

INTRODUCTION TO SIGNAL CONDITIONING:

DC signal conditioning system, AC signal conditioning system, data acquisition and conversion system

TEXT BOOK:

1. A course in Electrical & Electronics Measurements & Instrumentation : A.K.Sawhney; Dhanpat Rai & Sons.

REFERENCE BOOKS.

1. Electronics Instrumentation & Measurement Techniques : Cooper; PHI.

ELECTRONIC MEASUREMENT AND INSTRUMENTATION-LAB

Theory :	25
Class Work :	25
Total :	50

Course Code	**PCC-EEE-315G**		
Category	**Program Core Course**		
Course title	**ELECTRONIC MEASUREMENT AND INSTRUMENTATION-LAB**		
Scheme	**L**	**T**	**P**
	-	**-**	**02**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS

1) Study blocks wise construction of a analog oscilloscope & Function generator.
2) Study blocks wise construction of a Multimeter & frequency counter.
3) Study Measurement of different components & parameters like Q of a coil etc using LCRQ meter.
4) Study of distortion factor meter and determination of the % distortion of the given oscillator
5) Determine output characteristics of a LVDT and Measure displacement using LVDT
6) Study characteristics of temperature transducer like Thermocouple, Thermistor & RTD with implementation of a small project using signal conditioning circuits like instrumentation amplifier.
7) Measurement of Strain using Strain Guage.
8) To study differential pressure transducer & signal conditioning of output signal.
9) Measurement of level using capacitive transducer..
10) Study of Distance measurement using ultrasonic transducer.

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

DIGITAL SYSTEM DESIGN

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC- EEE-01G		
Category	PROGRAMM ELECTIVE		
Course title	DIGITAL SYSTEM DESIGN		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcome: After the completion of the course the student will be able to:

1. Understand the need & application of hardware description language.
2. Modeling & simulations of various basic & advanced digital systems using VHDL.
3. Implementation of various basic & advanced digital systems using FPGAs.
4. Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.

Section-A

INTRODUCTION :Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays Entity and Architecture declaration. Introduction to behavioral dataflow and structural models.

Section-B

VHDL STATEMENTS : Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

Section-C

COMBINATIONAL & SEQUENTIAL CIRCUIT DESIGN:VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

Section-D

DESIGN OF MICROCOMPUTER & PROGRAMMABLE DEVICE: Basic components of a computer, specifications, architecture of a simple microcomputer system, implementation of a simple microcomputer system using VHDL Programmable logic devices : ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

REFERENCE BOOKS:

1. Ashenden - Digital design,Elsevier

2. IEEE Standard VHDL Language Reference Manual (1993).
3. Digital Design and Modelling with VHDL and Synthesis : KC Chang; IEEE Computer Society Press.
4. "A VHDL Primmer" : Bhasker; Prentice Hall 1995.
5. “Digital System Design using VHDL” : Charles. H.Roth ; PWS (1998).
6. "VHDL-Analysis & Modelling of Digital Systems” : Navabi Z; McGraw Hill.
7. VHDL-IV Edition :Perry; TMH (2002)
8. “Introduction to Digital Systems” : Ercegovac. Lang & Moreno; John Wiley (1999).
9. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH (2000)
10. Modern Digital Electronics- III Edition: R.P Jain; TMH (2003).
11. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier

Scientific computing

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EEE-03G		
Category	PROGRAMM ELECTIVE		
Course title	Scientific computing		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the significance of computing methods, their strengths and application areas.
2. Perform the computations on various data using appropriate computation tools.
3. Analyze, design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs.
4. Understanding of the connection between the description of a concrete problem and the mathem
atical model that describes it.
5. Good theoretical insight and the ability to apply theory to the development of methods and techniques for problem solving.

Section-A

Introduction: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy

Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmetic, Cancellation

Section-B

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination,Pivoting, Gauss-Jordan, Norms and Condition Numbers, Symmetric Positive Definite Systems and Indefinite System, Iterative Methods for Linear Systems

Linear least squares: Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization, Rank Deficiency, and Column Pivoting

Eigenvalues and singular values:Eigenvalues and Eigenvectors, Methods for Computing All Eigenvalues, Jacobi Method, Methods for Computing Selected Eigenvalues, Singular Values Decomposition, Application of SVD

Section-C

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method

Optimization: One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares

Interpolation:Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation Numerical Integration And Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule, Finite Difference Approximation,

Section-D

Initial Value Problems for ODES, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems For ODES, Finite Difference Methods, Finite Element Method, Eigen value Problems Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for Sparse Linear Systems, Iterative Methods Fast Fourier Transform, FFT Algorithm, Limitations, DFT, Fast polynomial Multiplication, Wavelets, Random Numbers And Simulation, Stochastic Simulation, Random Number Generators, Quasi-Random Sequences

Text/ Reference Books:

1. Heath Michael T., " Scientific Computing: An Introductory Survey" , McGraw-Hill, 2nd Ed., 2002
2. Press William H., Saul A. Teukolsky, Vetterling William T and Brian P. Flannery, "Numerical Recipes: The Art of Scientific Computing", Cambridge University Press, 3rd Ed., 2007
3. Xin-she Yang (Ed.)., " Introduction To Computational Mathematics" , World Scientific Publishing Co., 2nd Ed., 2008
4. Kiryanov D. and Kiryanova E., " Computational Science", Infinity Science Press, 1st Ed., 2006
5. Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola, " Scientific Computing With MATLAB And Octave", Springer, 3rd Ed., 2010

HVDC Transmission Systems

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EE-05G		
Category	PROGRAM ELECTIVE		
Course title	HVDC Transmission Systems		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

1. Develop the knowledge of HVDC transmission and HVDC converters and the applicability and advantage of HVDC transmission over conventional AC transmission.
2. Formulate and solve mathematical problems related to rectifier and inverter control methods and learn about different control schemes as well as starting and stopping of DC links
3. Analyze the different harmonics generated by the converters and their variation with the change in firing angles.
4. Develop harmonic models and use the knowledge of circuit theory to develop filters and assess the requirement and type of protection for the filters.
5. Study and understand the nature of faults happening on both the AC and DC sides of the converters and formulate protection schemes for the same.
6. Review the existing HVDC systems along with MTDC systems and their controls and recognize the need to follow the advancements in both the existing systems and HVDC systems and determine the most economic coexistence of both.

Section A

BASIC CONCEPTS

Economics & Terminal equipment of HVDC transmission systems: Types of HVDC Links – Apparatus required for HVDC Systems – Comparison of AC &DC Transmission, Application of DC Transmission System – Planning & Modern trends in D.C. Transmission.

ANALYSIS OF HVDC CONVERTERS

Choice of Converter configuration – analysis of Graetz – characteristics of 6 Pulse & 12 Pulse converters – Cases of two 3 phase converters in star –star mode – their performance.

Section B

CONVERTER & HVDC SYSTEM CONTROL

Principle of DC Link Control – Converters Control Characteristics – Firing angle control Current and extinction angle control – Effect of source inductance on the system; Starting and stopping of DC link; Power Control.

REACTIVE POWER CONTROL IN HVDC

Reactive Power Requirements in steady state-Conventional control strategies-Alternate control strategies sources of reactive power-AC Filters – shunt capacitors-synchronous condensers.

Section C

POWER FLOW ANALYSIS IN AC/DC SYSTEMS

Modelling of DC Links-DC Network-DC Converter-Controller Equations-Solution of DC load flow – P.U. System for d.c. quantities-solution of AC-DC Power flow-Simultaneous method-Sequential method.

CONVERTER FAULT & PROTECTION

Converter faults – protection against over current and over voltage in converter station – surge arresters – smoothing reactors – DC breakers –Audible noise-space charge field-corona effects on DC lines-Radio interference.

Section D

HARMONICS

Generation of Harmonics –Characteristics harmonics,calculation of AC Harmonics, Non-Characteristics harmonics, adverse effects of harmonics – Calculation of voltage & Current harmonics – Effect of Pulse number on harmonics

FILTERS

Types of AC filters,Design of Single tuned filters –Design of High pass filters.

TEXT BOOKS:

1. HVDC Power Transmission Systems: Technology and system Interactions – by K.R.Padiyar,
New Age International (P) Limited, and Publishers.
2. EHVAC and HVDC Transmission Engineering and Practice – S.Rao.

REFERENCE BOOKS:

1. HVDC Transmission – J.Arrillaga.
2. Direct Current Transmission – by E.W.Kimbark, John Wiley & Sons.
3. Power Transmission by Direct Current – by E.Uhlmann, B.S.Publications.

3. *Arrillaga, J., HVDC Transmission, IEE Press (2007).*

High Voltage Engineering

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EE-07G		
Category	PROGRAM ELECTIVE		
Course title	High Voltage Engineering		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course outcomes:

At the end of the course the student will be able to:

- Explain conduction and breakdown phenomenon in gases, liquid dielectrics.
- Analyze breakdown phenomenon in solid dielectrics.
- Explain generation of high voltages and currents
- Analyze measurement techniques for high voltages and currents.
- Discuss overvoltage phenomenon and insulation coordination in electric power systems.
- Perform non-destructive testing of materials and electric apparatus and high-voltage testing of electric apparatus.

Section A

Conduction and Breakdown in Gases:

Collision Process, Ionization Processes, Townsend's Current Growth Equation, Current Growth in the Presence of Secondary Processes, Townsend's Criterion for Breakdown, Experimental Determination of Coefficients α and γ, Breakdown in Electronegative Gases, Time Lags for Breakdown, Streamer Theory of Breakdown in Gases, Paschen's Law, Breakdown in Non-Uniform Fields and Corona Discharges.

Conduction and Breakdown in Liquid Dielectrics:

Liquids as Insulators, Pure Liquids and Commercial Liquids, Conduction and Breakdown in Pure Liquids, Conduction and Breakdown in Commercial Liquids.

Breakdown in Solid Dielectrics:

Introduction, Intrinsic Breakdown, Electromechanical Breakdown, Thermal Breakdown.

Section B

Generation of High Voltages and Currents:

Generation of High Direct Current Voltages, Generation of High Alternating Voltages, Generation of Impulse Voltages, Generation of Impulse Currents, Tripping and Control of Impulse Generators.

Measurement of High Voltages and Currents:

Measurement of High Direct Current Voltages, Measurement of High AC and Impulse Voltages, Measurement of High Currents – Direct, Alternating and Impulse, Cathode Ray Oscillographs for Impulse Voltage and Current Measurements.

Section C

Overvoltage Phenomenon and Insulation Coordination in Electric Power Systems:

National Causes for Overvoltages - Lightning Phenomenon, Overvoltage due to Switching Surges, System Faults and Other Abnormal, Principles of Insulation Coordination on High Voltage and Extra High Voltage Power Systems.

Non-Destructive Testing of Materials and Electrical Apparatus:

Introduction, Measurement of Dielectric Constant and Loss Factor, Partial Discharge Measurements.

Section D

HV Testing of Electrical Apparatus:

Testing of Insulators and Bushings, Testing of Isolators and Circuit Breakers, Testing of Cables, Testing of Transformers, Testing of Surge Arrestors, Radio Interference Measurements, Testing of HVDC Valves and Equipment.

Reference Books

- High Voltage Engineering M.S. Naidu, V.Kamaraju McGraw Hill 5 th Edition, 2013.
- High Voltage Engineering Fundamentals E. Kuffel, W.S. Zaengl, J. KuffelNewnes 2 nd Edition, 2000
- High Voltage Engineering Wadhwa C.L. New Age International 3 rd Edition, 2012
- High-Voltage Test and Measuring Techniques Wolfgang Hauschild • Eberhard Lemke Springer 1 st Edition2014
- High Voltage Engineering Farouk A.M. Rizk CRC Press 1 st Edition2014

Bio-Medical Electronics

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EEE-09G		
Category	PROGRAM ELECTIVE		
Course title	**Bio-Medical Electronics**		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the application of the electronic systems in biological and medical applications.
2. Understand the practical limitations on the electronic components while handling bio-substances.
3. Understand and analyze the biological processes like other electronic processes.
4. Understand the impact of engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development.
5. Identify, formulate, research through relevant literature review, and solve engineering problems reaching substantiated conclusions.

Section: A

PHYSIOLOGY AND TRANSDUCERS

Brief introduction to human physiology: Cell and its structure; Resting and Action Potential; Nervous system: Functional organization of the nervous system ; Structure of nervous system, neurons; synapse; transmitters and neural communication; Cardiovascular system; respiratory system; Basic components of a biomedical system. Biomedical transducers: Transducers selection criteria; Piezoelectric; ultrasonic; displacement, velocity, force, acceleration, flow, temperature, potential, dissolved ions and gases; Temperature measurements; Fibre optic temperature sensors;

Section: B

ELECTRO – PHYSIOLOGICAL MEASUREMENTS

Bio-electrodes and Biopotential amplifiers for ECG, EMG, EEG, etc.: Limb electrodes; floating electrodes; pregelled disposable electrodes ;Micro, needle and surface electrodes; Preamplifiers, differential amplifiers, chopper amplifiers ;Isolation amplifier. ECG; EEG; EMG; ERG; Lead systems and recording methods

Section: C

NON-ELECTRICAL PARAMETER MEASUREMENTS

Measurement of blood temperature, pressure and flow; ; Cardiac output ; Heart rate ; Heart sound ;Pulmonary function measurements ; spirometer ; Impedance plethysmography; Photo Plethysmography, Body Plethysmography

Section: D

MEDICAL IMAGING

Ultrasonic, X-ray and nuclear imaging: Radio graphic and fluoroscopic techniques; Computer tomography; MRI; Ultrasonography

ASSISTING AND THERAPEUTIC EQUIPMENTS

Prostheses and aids: pacemakers, defibrillators, heart-lung machine, artificial kidney, aids for the handicapped; Safety aspects: safety parameters of biomedical equipments

TextReferencebooks:

1. W.F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical Publishers, 1977.
2. J.G. Websster, ed., Medical Instrumentation, Houghton Mifflin, 1978.
3. A.M. Cook and J.G. Webster, eds., Therapeutic Medical Devices, Prentice-Hall, 1982.
4. R.S.Khander, Handbook of Biomedical Instrumentation‖, TATA Mc Graw-Hill, New Delhi, 2003.
5. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, 2007

Speech and Audio Processing

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EEE-11G		
Category	PROGRAM ELECTIVE		
Course title	Speech and Audio Processing		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Mathematically model the speech signal
2. Analyze the quality and properties of speech signal.
3. Modify and enhance the speech and audio signals.
4. Present and discuss research, both orally and in writing, to other students and scientists
5. Locate, interpret, and synthesize scientific literature.

Section: A

Introduction- Speech production and modeling - Human Auditory System;General structure of speech coders; Classification of speech coding techniques – parametric, waveform and hybrid ; Requirements of speech codecs –quality, coding delays, robustness.

Section: B

Speech Signal Processing- Pitch-period estimation, all-pole and all-zero filters,convolution; Power spectral density, periodogram, autoregressive model, autocorrelation estimation.

Linear Prediction of Speech- Basic concepts of linear prediction; LinearPrediction Analysis of non-stationary signals –prediction gain, examples; Levinson-Durbin algorithm; Long term and short-term linear prediction models; Moving average prediction.

Speech Quantization- Scalar quantization–uniform quantizer, optimum quantizer,logarithmic quantizer, adaptive quantizer, differential quantizers; Vector quantization – distortion measures, codebook design, codebook types.

Section: C

Scalar Quantization of LPC- Spectral distortion measures, Quantization based onreflection coefficient and log area ratio, bit allocation; Line spectral frequency – LPC to LSF conversions, quantization based on LSF.

Linear Prediction Coding- LPC model of speech production; Structures of LPCencoders and decoders; Voicing detection; Limitations of the LPC model.

Section: D

Code Excited Linear Prediction-CELP speech production model; Analysis-by-synthesis; Generic CELP encoders and decoders; Excitation codebook search – state-save method, zero-input zero- state method; CELP based on adaptive codebook, Adaptive Codebook search; Low Delay CELP and algebraic CELP.
Speech Coding Standards-An overview of ITU-T G.726, G.728 and G.729standards

Text/Reference Books:

1. “Digital Speech” by A.M.Kondoz, Second Edition (Wiley Students *Edition), 2004.*
2. “Speech Coding Algorithms: Foundation and Evolution of Standardized Coders”, W.C. Chu, WileyInter science, 2003.

ELECTRICAL ENGINEERING MATERIALS

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**OEC-EE-01G**		
Category	OPEN ELECTIVE		
Course title	**ELECTRICAL ENGINEERING MATERIALS**		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

COURSE OUTCOME:

After the completion of the course, the students will be able to:

- Learn the basics of materials used in electrical engineering.
- Realize the dielectric properties of insulators in static and alternating fields.
- Explain the importance of magnetic properties and superconductivity.
- Explain the behavior of conductivity of metals and classifications of semiconductor material.

SECTION A

Conductivity of Metal: Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, Equation of motion of an electron, current carried by electrons, mobility, thermionic emission, photo electric emission, field emission, effect of temperature on electrical conductivity of metals, electrical conducting materials, thermal properties, thermal conductivity of metals, thermoelectric effects.

SECTION B

Dielectric Properties: Introduction, effect of a dielectric on the behavior of a capacitor, polarization, the dielectric constant of monatomic gases, dielectric losses, significance of the loss tangent, frequency and temperature dependence of the dielectric constant, dielectric properties of polymeric system, ionic conductivity in insulators, insulating materials, ferroelectricity, piezoelectricity

SECTION C

Magnetic properties of Materials: Introduction, Classification of magnetic materials, diamagnetism, paramagnetism, ferromagnetism, magnetization curve, the hysteresis loop, factors affecting permeability and hysteresis loss, common magnetic materials, magnetic resonance.

SECTION D

Semiconductors: energy band in solids, conductors, semiconductors and insulators, types of semiconductors, Intrinsic semiconductors, impurity type semiconductor, diffusion, the Einstein relation, hall effect, thermal conductivity of semiconductors, electrical conductivity of doped materials.

REFERENCE BOOKS

[1] C.S.Indulkar and S. Thiruvengadam, S., "An Introduction to Electrical Engineering

[2] Kenneth G. Budinski,, "Engineering Materials: Prentice Hall of India, New Delhi

ADDITIVE MANUFACTURING

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC-ECE332G		
Category	OPEN ELECTIVE		
Course title	ADDITIVE MANUFACTURING		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

1. Demonstrate the knowledge of Additive Manufacturing and Rapid Prototyping technologies. 2. Describe different RP techniques.

3. Discuss fundamentals of Reverse Engineering.

4. Describe the effects of surface finish and micro structural properties on behaviour for components produced using additive manufacturing

5. Display an awareness of residual stresses that may occur during additive manufacturing and their effects.

Section: A

Introduction and basic principles: Definition , Generic Additive Manufacturing (AM) Process, Terms related to AM, Benefits of AM, Distinction between AM and CNC machining, Additive manufacturing process chain: Variation between different AM machines, Metal systems, Maintenance of Equipment, Material Handling Issues.

Section: B

Introduction to rapid prototyping (RP), Need of RP in context of batch production, Basic principles of RP, Steps in RP, Process chain in RP in integrated CAD- CAM environment, Advantages of RP, Medical applications.

Section: C

Classification of different RP techniques – based on raw materials, layering technique (2-D or 3-D) and energy sources: Process technology, Stereo-lithography (SL), photo polymerization, liquid thermal polymerization, Solid foil polymerization

Section: D

Selective laser sintering, Selective powder binding, ballistic particle manufacturing – both 2-D and 3-D, Fused deposition modeling, Shape melting, Laminated object manufacturing, Solid ground curing, 3 D printing

Introduction to reverse engineering Meaning, Use, RE-The generic process, Phase of RE–scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development. Learning Resources

Text Books:

1. Ian Gibson, David W. Rosen, Brent Stucker , “Additive Manufacturing Technologies” ,Springer,2009

2. Chua C. K., Leong K. F., and Lim C. S., “Rapid Prototyping: Principles and Applications”, Second Edition, World Scientific Publishers (2003),.

3. Patri K. Venuvinod, Weiyin Ma “Rapid Prototyping: Laser-Based and Other Technologies” Springer , 2004

Reference Books :

1. Peter D. Hilton, Hilton/Jacobs, Paul F. Jacobs, “Rapid Tooling: Technologies and Industrial Applications”, CRC Press,2000.

2. Burns. M, “Automated fabrication”, Prentice-Hall,1993.

Intelligent Instrumentation

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC- EEE05G		
Category	Open Elective Course		
Course title	Intelligent Instrumentation(Theory)		
Scheme	L	T	P
	3		-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the

1. Understand the basic characteristic of intelligent instrumentation system Knowledge of new sensor technology
2. Understand the data acquisition system in intelligent instrumentation system
3. Understand the Signal amplification & attenuation.
4. To develop the design methodologies for measurement and instrumentation of real world problems.
5. To be study the concepts of intelligent sensor devices, their performance characteristics and signal and system dynamics.

Section-A

Intelligence, features characterizing intelligence, intelligent instrumentation system: features of intelligent instrumentation, components of intelligent instrumentation, block diagram of intelligent instrumentation.

Section-B

Signal amplification & attenuation (OP-AMP based), instrumentation amplifier (circuit diagram, high CMRR & other features), signal linearization(different types such as diode resistor combination, OP-AMP based etc.), bias removal signal filtering (output from ideal filters, output from constant – k filters, matching of filter sections, active analog filters).

Section-C

OP-AMP based voltage to current converter, current to voltage conversion, signal integration, voltage follower (pre amplifier), voltage comparator, phase locked loop, signal addition, signal multiplication, signal transmission, description of spike filter.

Smart sensors : Primary sensors, excitation, compensation, information coding/processing, data compensation, standard for smart sensor interface.

Section-D

Interfacing instruments and computers : basic issues of interfacing, address decoding, data transfer control, A/D convertor, D/A convertors, sample & hold circuit, other interface considerations.

Text Books :

1. Principles of measurements and instrumentation by Alan S Morris, PHI

2. Intelligent instrumentation by Bamay, G.C.Prentice Hall

Reference Books :

1. Sensors and transducers by Parranabis, PHI

2. Introduction to digital signal processing: MGH

Power Plant Engineering

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC-EE07G		
Category	OPEN ELECTIVE		
Course title	Power Plant Engineering		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

Upon completion of the course:

1. Understand the basics of Power Plants.
2. Understand the idea about the power generation by renewable and non-renewable energy resources.
3. Understand about the different types of cycles and natural resources used in power plants and their applications.
4. Understand the principal components and types of nuclear reactors.
5. Estimate different efficiencies associated with power plant systems.

Section-A

Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam andheating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems

Section-B

Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.

Section-C

Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized

Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.

Section-D

Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.

Text Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2nd ed., McGraw Hill, 1998.

ECONOMICS FOR ENGINEERS

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	HSMC-01G		
Category	HS		
Course title	ECONOMICS FOR ENGINEERS		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Objectives:

1. Acquaint the students to basic concepts of economics and their operational significance.
2. To stimulate the students to think systematically and objectively about contemporary economic problems.

COURSE OUTCOMES:

1. The students will able to understand the basic concept of economics.
2. The student will able to understand the concept of production and cost.
3. The student will able to understand the concept of market.
4. The student will able to understand the concept of privatization, globalization and banks.

UNIT-1

Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, **Elasticity of Demand**- meaning, factors effecting it, its practical application and importance.

UNIT-2

Production- Meaning of Production and factors of production, Law of variable proportions, Returns to scale, Internal and external economies and diseconomies of scale.

Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Real cost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-3

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT-4

Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), **Privatization -** meaning, merits and demerits.

Globalization of Indian economy - merits and demerits.

Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions, Difference between Commercial & Central Bank.

REFERENCES:

1. Jain T.R., Economics for Engineers, VK Publication.
2. Chopra P. N., Principle of Economics, Kalyani Publishers.
3. Dewett K. K., Modern economic theory, S. Chand.
4. H. L. Ahuja., Modern economic theory, S. Chand.
5. Dutt Rudar & Sundhram K. P. M., Indian Economy.
6. Mishra S. K., Modern Micro Economics, Pragati Publications.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
8. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
9. Micro Economic Theory – M.L. Jhingan (S.Chand).
10. Micro Economic Theory - H.L. Ahuja (S.Chand).
11. Modern Micro Economics : S.K. Mishra (Pragati Publications).
12. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co).

POWER SYSTEM-II

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC- EE-302G**		
Category	**Program Core Course**		
Course title	**Power System – II (Theory)**		
Scheme	**L**	**T**	**P**
	3	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to;

- Use numerical methods to analyse a power system in steady state.
- Understand stability constraints in a synchronous grid.
- Understand methods to control the voltage, frequency and power flow.
- Understand the basics of power system economics

SECTION-A

Power Flow Analysis : Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Application of numerical methods for solution of nonlinear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations.

Section -B

Economic Operation of Power Systems: Distribution of loads between units within a plant. Distribution of loads between plants, Transmission loss equation, Classical Economic dispatch with losses. Optimal unit commitment problems and their solutions.

Section -C

Voltage and Load Frequency Control: Introduction to control of active and reactive power flow, control of voltage, Excitation systems. Introduction to Load Frequency Control and Automatic generation control, Single area and modelling of AGC, Concept of multi area AGC.

Section -D

Power System Stability: Concepts, steady state and transient stability, swing equations, equal area criterion. Solution of Swing Equation, Transient stability algorithm using modified Euler's method and fourth order RungeKutta method,– multi-machine stability analysis

Text/References:

1. J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.

2. O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.

3. A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.

4. D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.

5. B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

Power system-II (Lab)

Theory :	25
Class Work :	25
Total :	50

Course Code	**PCC-EE-304G**		
Category	**Program Core Course**		
Course title	**Power system-II**(Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes: At least 10 experiments are to be performed by students in the semester.

(i) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

(ii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS:

1. Draw the flow chart and develop the computer program for the formation of the Y Bus of a generalized network.

2. Draw the flow chart and develop the computer program for the formation of the Z Bus of a generalized network.

3. To plot the swing curve and observe the stability.

4. To perform load flow analysis using Gauss Seidel method.

5. To perform load flow analysis using Newton-Raphson method.

6. To study comparison of different load flow methods

7. To develop the program for stability analysis.

8. To observe transmission losses and efficiency with variations in power for the given example.

9. Simulation study on LFC of two area interconnected power system.

10. Simulation study on voltage control in multi area interconnected power system.

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

Digital Signal Processing

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PCC-EEE-306G		
Category	Engineering Science Course		
Course title	Digital Signal Processing		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:
At the end of the course, students will demonstrate the ability to:

1. Use concepts of trigonometry, complex algebra, Fourier transform, z-transform to analyze the operations on signals and acquire knowledge about Systems
2. Select proper tools for analog-to-digital and digital-to-analog conversion. Also select proper tools for time domain and frequency domain implementation.
3. Design, implementation, analysis and comparison of digital filters for processing of discrete time signals
4. Integrate computer-based tools for engineering applications
5. Employ signal processing strategies at multidisciplinary team activities.
6. Assess the techniques, skills, and modern engineering tools necessary for analysis of different electrical signals and filtering out noise signals in engineering practice. Also develop creative and innovative designs that achieve desired performance criteria within specified objectives and constraints, understand the need for lifelong learning and continuing professional education

UNIT I

Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z- transforms, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

UNIT II

Frequency Representation of Signal and Systems: Frequency Domain analysis concept, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Parsevals Identity.

UNIT III

Design of Digital Filter : Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.

UNIT IV

Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks.

Text/Reference Books:

1 John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, 1997.
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
7. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

Digital Signal Processing Laboratory

Course Code	PCC-EE-308G		
Category	Engineering Science Course		
Course title	Digital Signal Processing Laboratory		
Scheme	L	T	P
	-	-	2

Notes:

1. At least 10 experiments are to be performed by students in the semester.
2. At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.
3. Group of students for practical should be 15 to 20 in number.

List of Experiments

1. Introduction to MATLAB.
2. Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
3 .To develop program for Z-Transform in MATLAB
4 .To develop program for Convolution of sequences in MATLAB
5 .To develop program for Correlation of sequences in MATLAB
6. To develop program for DFT & IDFT of two sequences
7. To develop program for FFT of two Sequences
8. To develop program for Circular Convolution
9. To design analog filter (low-pass, high pass, band-pass, band-stop).
10. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
11. To develop program for Interpolation and Decimation of sequences
12. To design FIR filters using windows technique.
13. Detection of Signals buried in Noise
14. Effect of noise on signals in MATLAB

VLSI DESIGN

Class Work: 25

Exam : 75

Total : 100

Course Code	**PCC -EEE-310G**		
Category	**Engineering Science Course**		
Course title	**VLSI DESIGN**		
Scheme	**L**	**T**	**P**
	3	**-**	**0**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

COURSE OUTCOMES:

1. Identify the various IC fabrication methods.
2. Express the Layout of simple MOS circuit using Lambda based design rules.
3. Apply the Lambda based design rules for subsystem design
4. Differentiate various FPGA architectures.
5. Design an application using Verilog HDL.
6. Concepts of modeling a digital system using Hardware Description Language.

Section-A

BASIC MOS TRANSISTOR : Enhancement mode & Depletion mode – Fabrication (NMOS, PMOS, CMOS, BiCMOS) Technology – NMOS transistor current equation – Second order effects – MOS Transistor Model.

Section-B

NMOS & CMOS INVERTER AND GATES : NMOS & CMOS inverter – Determination of pull up / pull down ratios – Stick diagram – Lamda based rules – Super buffers – BiCMOS & steering logic.

Section-C

SUB SYSTEM DESIGN & LAYOUT: Structured design of combinational circuits – Dynamic CMOS & clocking – Tally circuits – (NAND-NAND, NOR-NOR and AOI logic) – EXOR structure – Multiplexer structures – Barrel shifter.

Section-D

DESIGN OF COMBINATIONAL ELEMENTS & REGULAR ARRAY LOGIC : NMOS PLA – Programmable Logic Devices - Finite State Machine PLA – Introduction to FPGA**.**

VHDL PROGRAMMING: RTL Design – Combinational logic – Types – Operators – Packages – Sequential circuit – Sub-programs – Test benches. (Examples: address, counters, flipflops, FSM, Multiplexers / De-multiplexers).

TEXT BOOKS

1. D.A.Pucknell, K.Eshraghian, 'Basic VLSI Design', 3rd Edition, Prentice Hall of India, New
Delhi, 2003.

2. Introduction to Digital Integrated Circuits : Rabaey,Chandrakasan & Nikolic.

3. Principles of CMOS VLSI Design : Neil H.E. Weste and Kamran Eshraghian; Pearson.

REFERENCE BOOKS

1. N.H.Weste, 'Principles of CMOS VLSI Design', Pearson Education, India, 2002

2. VLSI Technology: S.M. Sze; McGraw-Hill.

VLSI DESIGN Laboratory

Course Code	PCC-EEE-312G		
Category	Engineering Science Course		
Course title	VLSI DESIGN Laboratory		
Scheme	L	T	P
	-	-	2

Note: 1. At least 10 experiments are to be performed by students in the semest

2. At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

3. Group of students for practical should be 15 to 20 in number.

List of Experiments

Combinational & Sequential Design Exercises using FPGA (Spartan 3) & CPLD

1) Design of Half-Adder, Full Adder, Half Subtractor, Full Subtractor
2) Design a parity generator
3) Design a 4 Bit comparator
4) Design a RS & JK Flip flop
5) Design a 4: 1 Multiplexer
6) Design a 4 Bit Up / Down Counter with Loadable Count
7) Design a 3: 8 decoder
8) Design a 8 bit shift register
9) Design a arithmetic unit
10) Implement ADC & DAC interface with FPGA
11) Implement a serial communication interface with FPGA
12) Implement a Telephone keypad interface with FPGA
13) Implement a VGA interface with FPGA
14) Implement a PS2 keypad interface with FPGA
15) Implement a 4 digit seven segment display

Electrical and hybrid vehicle

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EE-04G		
Category	Program Elective		
Course title	Electrical and hybrid vehicle (Theory)		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Explain the basics of electric and hybrid electric vehicles, their architecture, technologies and fundamentals
2. Analyse the use of different power electronics devices and electrical machines in hybrid electric vehicles.
3. Explain the use of different energy storage devices used for hybrid electric vehicles, their technologies and control and select appropriate technology
4. Interpret working of different configurations of electric vehicles and its components, hybrid vehicle configuration, performance analysis and Energy Management strategies in HEVs.

SECTION - A

ELECTRICVEHICLES

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

SECTION - B

BATTERY

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

SECTION - C

DC & AC ELECTRICAL MACHINES
Motor and Engine rating, Requirements, DC machines, Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines.

SECTION – D

ELECTRIC VEHICLE DRIVETRAIN

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

HYBRID ELECTRIC VEHICLES
Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

Reference Books:

1. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.
2. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
3. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.
4. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000

Power system protection

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	PEC-EE-06G		
Category	Program Elective		
Course title	Power system protection (Theory)		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the different components of a protection system.
- Evaluate fault current due to different types of fault in a network.
- Understand the protection schemes for different power system components.
- Understand the basic principles of digital protection.
- Understand system protection schemes, and the use of wide-area measurements.

Section A

Introduction and Components of a Protection System

Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers , Generator Protection: External and internal faults – differential protection – biased circulating current protection – self balance system – over-current and earth fault protection – protection against failure of excitation

Section B

Faults and Over-Current Protection

Review of Fault Analysis, Sequence Networks. Introduction to Overcurrent Protection and overcurrent relay co-ordination.

Transformer protection: Differential protection – self-balance system of protection – over-current and earth fault protection – buchholz' s relay and its operation.

Section C

Equipment Protection Schemes

Directional, Distance, Differential protection. Bus bar Protection, Bus Bar arrangement schemes.

Modeling and Simulation of Protection Schemes

CT/PT modeling and standards, Simulation of transients using Electro-Magnetic Transients (EMT) programs. Relay Testing.

Section D

System Protection

Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Phasor Measurement Units and Wide-Area Measurement Systems (WAMS). Application of WAMS for improving protection systems.

Text/References :

1. J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, New York, 1987.

2. Y. G.Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010. 3. A. G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley & Sons, 1988.

4. A. G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 2008.

5. D. Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, 2006.

Advance Electric Drives

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PEC-EE-08G**		
Category	**Program Elective**		
Course title	**Advance Electric Drives** (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- Understand the operation of power electronic converters and their control strategies.
- Understand the vector control strategies for ac motor drives
- Understand the implementation of the control strategies using digital signal processors.

Section A

Power Converters for AC drives

PWM control of inverter, selected harmonic elimination, space vector modulation, current control of VSI, three level inverter, Different topologies, SVM for 3 level inverter, Diode rectifier with boost chopper, PWM converter as line side rectifier, current fed inverters with self-commutated devices. Control of CSI, H bridge as a 4-Q drive.

Section B

Induction motor drives

Different transformations and reference frame theory, modeling of induction machines, voltage fed inverter control-v/f control, vector control, direct torque and flux control(DTC)

Section C

Synchronous motor drives

Modeling of synchronous machines, open loop v/f control, vector control, direct torque control, CSI fed synchronous motor drives.

Permanent magnet motor drives

Introduction to various PM motors, BLDC and PMSM drive configuration, comparison, block diagrams, Speed and torque control in BLDC and PMSM.

Section D

Switched reluctance motor drives

Evolution of switched reluctance motors, various topologies for SRM drives, comparison, Closed loop speed and torque control of SRM.

DSP based motion control

Use of DSPs in motion control, various DSPs available, realization of some basic blocks in DSP for implementation of DSP based motion control.

Text / Reference Books:

1. B. K. Bose, “Modern Power Electronics and AC Drives”, Pearson Education, Asia, 2003.

2. P.C. Krause, O. Wasynczuk and S.D. Sudhoff, “Analysis of Electric Machinery and Drive Systems”, John Wiley & Sons, 2013.

3. H. A. Taliyat and S. G. Campbell, “DSP based Electromechanical Motion Control”, CRC press, 2003.

4. R. Krishnan, “Permanent Magnet Synchronous and Brushless DC motor Drives”, CRC Press, 2009.

ELECTRICAL MACHINE DESIGN

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PEC-EE-10G**		
Category	**Program Core Course**		
Course title	**ELECTRICAL MACHINE DESIGN**		
Scheme	**L**	**T**	**P**
	03	**-**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

COURSE OUTCOMES:

- To understand the specified limits for Specific electric and magnetic loading.
- To understand about magnetic current of transformer and rotating machine.
- To understand the basic design procedure for transformer, d.c. machine, induction motor and synchronous machine individually.
- To explain the complete detailed design of all static and rotating machine and their performance with problems.
- To understand about the computerization of the design procedure.
- Analyze the design procedure and performance of various algorithms.

SECTION A

FUNDAMENTAL ASPPECTS OF ELECTRICAL MACHINE DESIGN: Design of Machines, Design Factors, Limitations in design, Modern Trends in design, manufacturing Techniques.

BASIC DESIGN PRINCIPLES: Output equation and output coefficient, Specific electric and magnetic
loading. Relation between rating and main dimension of rotating machine, Effect of size and ventilation/Factors affecting size of a rotating machine.

SECTION B

DESIGN OF INDUCTION MOTORS: Three Phase Induction Motor: Standard specifications, output equations, choice of specific loadings, main dimensions, conductor size and turns, air gap length, no. of slots, slot design, stator core depth, rotor design, rotor bars& slots area, end rings .

SECTION C

DESIGN OF TRANSFORMER: Output Equations of Single Phase and Three Phase Transformers, Expression for Volts/Turn, Determination of Main Dimensions of the Core, Estimation of Number of Turns and Conductor Cross Sectional area of Primary and Secondary Windings, Main Dimensions - kVA output for single and three phase transformers, Window space factor, Design of core, yoke and winding, overall dimensions.

DESIGN OF SYNCHRONOUS MACHINE: Output Equation, Choice of Specific Loadings, Short Circuit Ratio, Main Dimensions of Stator. Design of stator slots and Winding. Design of Salient and non- salient Pole Rotors. Magnetic Circuit and Field Winding, design difference between turbo alternator & salient pole generators.

SECTION D

DESIGN OF DC MACHINES: Output equation, choice of specific loadings, choice of poles and speed, Design of core length, armature diameter, depth of armature core,air gap length, cross section of armature conductors, armature slots ,design of field system field poles, field coils, commutator.

COMPUTER AIDED DESIGN: Computerization of design Procedures. Development of Computer program and performance prediction. Optimization techniques and their applications to design Problems.

TEXT BOOKS:

1. A course in Electrical Machine Design by A.K. Sawhney, Khanna Pub.
2. Princilplesof Electrical Machine Design by R. K. Aggarwal.

REFERENCE BOOKS:

1. Theory, performance and Design of alternating current machines by MG Say, ELBS, 15th Ed. 1986.
2. Theory, Performance and Design of Direct Current machines by A.E. Clayton, 3rd Ed. 1967.
3. Optimization Techniques, S.S. Rao

Python Programming

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**OEC-EE-04G**		
Category	**Open Elective**		
Course title	**Python Programming**		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course outcomes

• For a given conceptual problem student will able to analyze the problem and write a program in python with basic concepts.

• For a given problem of Strings and texts, student will able to analyze the problem and write a program in python with basic concepts involving strings and texts.

• The knowledge of list and dictionary will enable student to implement in python language and analyze the same.

• Student will able to write a program using functions to implement the basic concepts of object oriented programming language

Section:A

Introduction: Fundamental ideas in computer science; modern computer systems, installing Python; basic syntax, interactive shell, editing, saving, and running a script; The concept of data types; variables, assignments; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Control statements: if-else, loops (for, while)

Section: B

Strings, text files: String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Text files:

reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

Section: C

Lists, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries, arguments and return values. Recursive functions.

Section:D

Object Oriented concepts: Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, Inheritance, polymorphism, operator overloading; abstract classes.

Text books:

"Fundamentals of Python: First Programs" Kenneth Lambert, Course Technology, Cengage Learning, 2012

Reference books:

"Introduction to Computer Science Using Python: A Computational Problem-Solving Focus", By Charles Dierbach, John Wiley & Sons, December 2012,

Introduction to MEMS

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC-EE-06G		
Category	Open Elective		
Course title	Introduction to MEMS (Theory)		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:
At the end of the course the students will be able to:
1.Be introduced to the field of micro/nanosystems
2. Grain a knowledge of basic approaches for micro/nanosystem design
3. Gain a knowledge of state-of-the-art lithography techniques for micro/nanosystems
4. Learn new materials, science and technology for micro/nanosystem applications
5. Understand materials science for micro/nanosystem applications
6. Understand state-of-the-art micromachining and packaging technologies

Section:A

Overview of MEMS and Microsystems: Introduction Microsystems vs. MEMS, Microsystems and Microelectronics, the Multidisciplinary Nature of Microsystems design and manufacture, Application of MEMS in various industries. MEMS and Miniaturization: Scaling laws in miniaturization: Introduction to Scaling, Scaling in Geometry, Rigid Body dynamics, Electrostatic forces, Electromagnetic forces, Electricity, Fluid Mechanics, Heat Transfer, Over view of Micro/Nano Sensors, Actuators and Systems.

Section: B

Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA),and Etching. Micromachining:Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding.

Section: C

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods.

Section: D

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems: electrostatics, coupled electro mechanics.

Text/Reference Book:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

Conventional and Renewable Energy Resources

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	OEC-EE-08G		
Category	Open Elective		
Course title	Conventional and Renewable Energy Resources(Theory)		
Scheme	L	T	P
	3	-	-

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

1. Understand the need of energy conversion and the various methods of energy storage
2. Explain the field applications of solar energy
3. Identify Winds energy as alternate form of energy and to know how it can be tapped
4. Explain bio gas generation and its impact on environment
5. Understand the Geothermal &Tidal energy, its mechanism of production and its applications
6. Illustrate the concepts of Direct Energy Conversion systems & their applications.

Section A

INTRODUCTION: Energy sources, their availability, recent trends in Power Generation, Amount of generation of electric power from Conventional and non conventional sources of energy in Haryana, India and some developed countries of the world. Interconnected Generation of Power Plants.

Section-B

POWER GENERATION PLANNING: Load forecasting, load curves, load duration curve, Base load and Peak load Power Plants, connected Load, maximum demand, demand factor, Group diversity factor, load factor, significance of load factor, plant factor, capacity factor, selection of unit size, No. of Units, reserves, cost of powergeneration, Depreciation, tariff.

Section-C

CONVENTIONAL ENERGY SOURCES: Selection of site, capacity calculations, classification, Schematic diagram and working of Thermal Power Stations(TPS), HydroElectric Plant and Nuclear Power Plant .

NON-CONVENTIONAL ENERGY SOURCES: Wind, Solar, fuel cell, Magneto Hydro Dynamic (MHD) system.

Section-D

ELECTRIC ENERGY CONSERVATION & MANAGEMENT: Energy management, Energy Audit, Energy Efficient Motors, Co-generation.

TEXT BOOKS:

1. Renewable Energy Sources and Emerging Technologies : D.P Kothari, K.C.Singla, Rakesh

Ranjan- PHI Publications.

2.Electric Power Generation, B.R.Gupta

3. Power Generation, Operation and Control, Wood and Wollenberg, John Wiley &

Sons,1984.

REF. BOOKS:

1. A Course in Electric Power System, Soni, Gupta, Bhatnagar, Dhanpat Rai & Sons

2. Power System Engineering, Nagrath& Kothari, Tata Mc-Graw Hill, New Delhi

3. Power Plant Engg: G.D. Rai

4. Electric Power: S.L. Uppal (Khanna Publishing)

Soft Computing

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**OEC-EE-10G**		
Category	**Open Elective**		
Course title	**Soft Computing**(Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one willhave 10 parts of 1.5 marks from all units and remaining eight questions have to be set by taking two Questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

- To understand the concepts of soft computing vis-à-vis hard computing
- To introduce the ideas of fuzzy logic, neural networks, genetic algorithm.
- To introduce the concepts of hybrid intelligent systems
- To introduce application areas of soft computing and the criteria to select appropriate soft computing

Section A

Soft Computing: Introduction, requirement, different soft computing techniques and their characteristics, comparison with hard computing, applications.

Section B

Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, properties of fuzzy sets, operations on fuzzy sets, Extension principle, Fuzzy relations, Linguistic variables, linguistic terms, Linguistic hedges, Fuzzy reasoning, Mamdani and TSK fuzzy inference systems, Applications, fuzzy controllers, Theoretical and implementation issues.

Section C

Artificial Neural Network: Introduction, comparison with biological neural network, basic models of artificial neuron, different architectures of ANN, Learning techniques, ANN based system modeling, ANN based controller design, theoretical and implementation issues, Applications.

Section D

Evolutionary algorithms and hybrid systems: Genetic Algorithm (GA), different operators of GA, convergence of Genetic Algorithm, Particle swarm optimization algorithm, Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design, Fuzzy Logic design, other Applications of GA.

References :

1. Neuro Fuzzy & Soft Computing - J.-S.R.Jang, C.-T.Sun, E.mizutani, Pearson Education

2. Neural Networks and Fuzzy Systems: Dynamical Systems Application to Machine Intelligence - Bart Kosko, Prentice Hall

3. T.J. Ross, "Fuzzy Logic Control", TMH Publications.

4. S. Hekins, "Comprehensive Neural Networks", Pearson Publications.

5. S. Rajsekharan, Vijayalaxmi Pai, "Neural Networks, Fuzzy logic and Genetic Algorithms, Synthesis and applications", Prentice Hall

6. V. Kecman, "Learning and Soft Computing", MIT Press. B.Tech. (Electrical Engineering) BOS 24-05-2017

7. D. Ruan, "Intelligent Hybrid Systems", Kluwer Academic Publisher.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Textile Technology)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Textile Technology) – 5th Semester
w.e.f. 2020-21

Sr. No.	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Internal Assessment	External Examination	Practical	Total	
1	PCC-TT-301G	Yarn Manufacture-III	3	0	0	3	3	25	75	-	100	3
2	PCC-TT-302G	Advanced Weaving Technology-I	3	0	0	3	3	25	75	-	100	3
3	PCC-TT/TC/FAE-303G	Textile Testing	3	0	0	3	3	25	75	-	100	3
4	PEC-I	Elective-I	3	0	0	3	3	25	75	-	100	3
5	OEC-I	Open Elective-I	3	0	0	3	3	25	75	-	100	3
6	OEC-II	Open Elective-II	3	0	0	3	3	25	75	-	100	3
7	LC-TT-301G	Spinning Practical-III	0	0	2	2	1	25	-	25	50	3
8	LC-TT-302G	Weaving Practical-III	0	0	2	2	1	25	-	25	50	3
9	LC-TT/TC/FAE-303G	Textile Testing Practical	0	0	2	2	1	25	-	25	50	3
10	LC-TT-304G	Wet Processing Lab.	0	0	2	2	1	25	-	25	50	3
		Total					**22**				**800**	

ELECTIVE-I

Sr. No.	Course Category	Course Code	Course Title
1	Professional Elective Course (PEC-I)	PEC-TT/TC-301G	Post Extrusion Operations
2	Professional Elective Course (PEC-I)	PEC-TT-302G	Total Productive Maintenance in Textile Industry
3	Professional Elective Course (PEC-I)	PEC-TT-303G	Waste Management & Pollution Control

OPEN ELECTIVE-I

Sr. No.	Course Category	Course Code	Course Title
1	Open Elective Course (OEC-I)	OEC-TT-301G	Textile Chemical Processing
2	Open Elective Course (OEC-I)	OEC-TT-302G	Chemical Processing of Natural Fibres
3	Open Elective Course (OEC-I)	PEC-TC-302G	Chemical Processing of Unconventional Textile Materials

OPEN ELECTIVE-II

Sr. No.	Course Category	Course Code	Course Title
1	Open Elective Course (OEC-II)	OEC-TT/TC-303G	Garment Manufacturing Technology
2	Open Elective Course (OEC-II)	OEC-TT/TC-304G	Apparel Quality Evaluation and Standards
3	Open Elective Course (OEC-II)	OEC-TT/TC-305G	Introduction to Fashion and Apparel Industries

Scheme of Studies and Examination
B.TECH (Textile Technology) – 6th Semester
w.e.f. 2020-21

Sr No.	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Internal Assessment	External Examination	Practical	Total	
1	PCC-TT-303G	Unconventional Systems of Yarn Formation	3	0	0	3	3	25	75	-	100	3
2	PCC-TT-304G	Advanced Weaving Technology-II	3	0	0	3	3	25	75	-	100	3
3	PEC-II	Elective-II	3	0	0	3	3	25	75	-	100	3
4	PEC-III	Elective-III	3	0	0	3	3	25	75	-	100	3
5	OEC-III	Open Elective-III	3	0	0	3	3	25	75	-	100	3
6	HSMC-TT/TC/FAE-301G	Merchandising and Export Management	3	0	0	3	3	25	75	-	100	3
7	LC-TT-305G	Spinning Practical-IV	0	0	2	2	1	25	-	25	50	3
8	LC-TT-306G	Weaving Practical-IV	0	0	2	2	1	25	-	25	50	3
9	LC-TT-307G	Pattern Making and Garment Construction Lab.	0	0	2	2	1	25	-	25	50	3
Total							**21**				**750**	

NOTE: At the end of 6th semester each student has to undergo Practical Training of 6 weeks in an Industry/Mill/ Professional Organization and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester under the course ‘Mill Practice’ (Course Code PROJ-TT-401G).

ELECTIVE-II

Sr. No.	Course Category	Course Code	Course Title
1	Professional Elective Course (PEC-II)	PEC-TT-304G	Mechanics of Textile Machinery
2	Professional Elective Course (PEC-II)	PEC-TT-305G	Structure and Properties of Fibres
3	Professional Elective Course (PEC-II)	PEC-TT-306G	Wool Technology

ELECTIVE-III

Sr. No.	Course Category	Course Code	Course Title
1	Professional Elective Course (PEC-III)	PEC-TT-307G	Engineering of Textile Structures
2	Professional Elective Course (PEC-III)	PEC-TT-308G	Modeling and Simulation of Fibrous Assemblies
3	Professional Elective Course (PEC-III)	PEC-TT-309G	Sustainable Textile Production

OPEN ELECTIVE-III

Sr. No.	Course Category	Course Code	Course Title
1	Open Elective Course (OEC-III)	OEC-TT-306G	Advanced Textile Testing
2	Open Elective Course (OEC-III)	OEC-TT-307G	Statistics for Textile Engineers
3	Open Elective Course (OEC-III)	OEC-TT-308G	Total Quality Management and Six Sigma

PCC-TT-301G Yarn Manufacture-III

<table>
<tr><td>Course code</td><td colspan="5">PCC-TT-301G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course Title</td><td colspan="5">Yarn Manufacture-III</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Yarn Manufacture-I; Yarn Manufacture-II

Course Objectives:

- To familiarize the students with objectives of conventional system of single and double yarn formation viz. ring spinning and doubling
- To make the students understand basic mechanisms involved in conventional system of yarn formation and doubling viz ring frame and doubling machine
- To make students learn calculations related to ring spinning and doubling.
- Introduce about different yarn according to application viz. fancy yarn, core spun yarn, sewing thread etc.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-1

Objective, principle and mechanism involved in drafting, twisting and winding. Function of different drafting elements, Design and construction of spindle, Types of spindle drive, Ring and its type, Design and construction of traveler. Different combination of ring and traveler,

UNIT-II

Concept of twist multiplier and yarn contraction, Factors affecting twist in a yarn, Building mechanism, Importance of spinning geometry and its elements, Control of yarn tension in ring frame, Mechanism of package formation. Types of spinning waste and system of waste collection, Compact spinning- its types and advantages,

UNIT-III

Limitation of ring spinning and factors responsible for loss in efficiency, Processing of manmade fibre on ring-frame, Concept of average count and 20s conversion, Yarn faults and their remedies, Causes of end breakage and its control, Limitations of large package spinning, Calculation related to ring spinning, Recent developments in ringframe.

UNIT-IV

Objective of doubling, Different systems of doubling, Study of ring doubler and TFO (Two for one) machine, Calculations related to yarn doubling, Fancy yarns, Sewing threads, Core spun yarn and other specialty yarns, Objective of reeling, Types of reeling, Construction and working of reel, Yarn bundling.

Suggested Reading List:

Title	**Author**
Engineering Techniques of Ring Spinning	Shaikh & Bhattacharya
Short Staple Spinning Volume-I, II, III & IV	W. Klein
Cotton Spinning	W. S. Taggart
Manual of Cotton Spinning	De
Barr & Catling Essential Elements of Practical Cotton Spinning	T.
K. Pattabhiram Spinning of Manmade and their blends on cotton system K. R. Salhotra	

Course Outcomes:

At the end of the course, the students will:

- have the detailed knowledge including the function of each part of ring frame and doubling machine for processing different materials;
- have learnt the principle and working of ring frame and doubling.
- be able to calculate various parameters like draft, waste, production and efficiency related to ring frame and doubling.
- have the basic knowledge end use of different yarns like fancy yarns, sewing threads, core-spun yarns etc.

PCC-TT-302G Advanced Weaving Technology-I

<table>
<tr><td>Course code</td><td colspan="5">PCC-TT-302G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course Title</td><td colspan="5">Advanced Weaving Technology-I</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Fabric Manufacture-I; Weaving Preparation

Course Objectives:

- To familiarize the students about the shortcomings of shuttle looms
- To familiarize the students about different shuttleless weaving machines and their application area
- Understanding the principle, design and mechanism of modern shedding, beat up, take-up and let- off mechanisms
- Understanding the principle, design and mechanism of projectile weaving machines
- Understanding the principle, design and mechanism of rapier weaving machines

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Principle and working of modern shedding mechanisms - crank, matched cam, electronic dobby, electronic jacquard, e-shedding.

Principle and working of Beat up mechanisms - Matched cam beat up, Multi link crank beat up.

UNIT-II

Principle and working of take up (mechanical & electronic take up) and let off (mechanical & electronic let off) mechanisms used in shuttleless looms.

Introduction to Shuttleless weaving: Restrictions as well as merits of Shuttle weaving; types of shuttleless looms, their development, typical speeds, production rates and application domain.

UNIT-III

Projectile weaving machine: Principle of weft insertion, typical specification & features of modern projectile looms. Merits, demerits and standard application domain; Torsion bar picking - construction, working, settings, mechanics; Path of weft, function of each component, projectile types, projectile circulation, weft transfer to projectile, projectile brake; Sequence of weft insertion, typical timings, projectile velocity calculation. Types and features of shedding, beat up, take up and let off motions used in projectile looms; standard manufacturers.

UNIT-IV

Rapier Weaving Machine: Principle of weft insertion, typical specification & features of modern rapier looms; Merits, demerits and standard application domain; Classification of rapier looms, brief description of each type under classification. Gabler and Dewas system of weft insertion and their comparison; Path of weft in modern rigid and flexible rapier looms, function of each component in the path, sequence of weft insertion; Rapier heads, negative and positive weft transfer at shed center, their comparison; Typical timings, synchronous and asynchronous rapier movement, calculation of rapier/weft velocities, figure of merit; Rapier drives: Eccentric and cam drive systems, working of some standard drive mechanisms. Types and features of shedding, beat up, take up and let off motions used in rapier looms; standard manufacturers.

Suggested Reading List:

Title	**Author**
Handbook of Weaving	S. Adanur
Weaving: Technology & Operations	A. Ormerod
Weaving: Machines, Mechanisms, Management	Talukdar,
Sriramulu, Ajgaonkar Principles of Weaving	R. Marks & A. T.
C. Robinson	
Woven Fabric Production – I & II	NCUTE Publications

Course Outcomes:

After completion of the course, students will be able to:

- understand the concept of shuttleless weaving and the principle of different shuttleless weaving machines
- comprehend the design and mechanism of projectile and rapier weaving machines
- comprehend the design and mechanism of modern shedding, beat up, take-up and let-off mechanisms

PCC-TT/TC/FAE-303G Textile Testing

Course code	PCC-TT/TC/FAE-303G				
Category	Professional Core Course				
Course Title	Textile Testing				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry, Fashion and Apparel Engg.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic knowledge of textile fibres, yarns and fabrics.

Course Objectives:

- To familiarize the students about the importance, concept and techniques of sampling
- To familiarize the students about important fibre, yarn and fabric dimensions and characteristics and their measurement techniques
- Comprehending the mechanical behavior of textile materials and its evaluation methods
- To familiarize the students about the evaluation methods of colour fastness
- To familiarize the students about common types of garment testing

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to textile testing - aim and scope. Sampling and Sampling techniques: General requirements; fibre, yarn and fabric sampling techniques.

Measurement of fibre dimensions and characteristics, viz. length, fineness, cotton maturity, neps and trash including principle and operation of equipment in common use.

Relation between R.H. and moisture regain of textile materials; equilibrium regain, hysteresis. Measurement of moisture regain. Official regain and concept of correct invoice weight.

UNIT-II

Measurement of yarn dimensions and characteristics: yarn count/diameter, twist and hairiness including principle and operation of equipment in common use.

Yarn evenness: Terms and definitions, nature of irregularities. Principles and methods of evenness testing, variance-length curves and their interpretation.

Test methods for fabric dimensional and other physical properties like, thickness, weight, crimp, bending and drape including principle and operation of equipment in common use.

UNIT-III

Mechanical behaviour of textiles: Terms and definitions, expression of results, quantities and units. Experimental methods: Principle of CRL, CRT and CRE type tensile testing machines. Fibre strength testing – single fibre strength and bundle strength. Yarn strength testing – single yarn strength and lea strength. Fabric strength testing - tensile, tearing and bursting strength tests. Principle and operation of equipment in common use.

Measurement of fabric abrasion resistance and evaluation of results; measurement of fabric pilling and crease recovery.

UNIT-IV

Measurement of fabric air permeability and water vapour permeability. Introduction to fabric handle.

Introduction to fastness properties of dyed and printed textiles - evaluation methods of colour fastness to Laundering, Crocking, Sunlight, Perspiration, Dry-cleaning and Hot Pressing.

Garment Testing: Testing of Seam Strength, Seam Slippage, Seam Puckering, Button Strength and Zipper or Closer Strength.

Suggested Reading List:

Title	**Author**
Principles of Textile Testing	J. E. Booth
Physical Testing of Textiles	B. P. Saville
Fabric Testing	Jinlian Hu
Physical Properties of Textile Fibres	W. E. Morton & J. W. S. Hearle
Textile Fibres, Yarns and Fabrics	E. R. Kaswell

Course Outcomes:

After completion of the course, students will be:

- able to understand the concept of sampling and sampling techniques for testing of textile materials.
- familiar with the important fibre, yarn and fabric dimensions and characteristics and their measurement techniques.
- familiar with the mechanical behavior of textile materials, different related terms and principles, and its evaluation methods.
- familiar with the evaluation methods of colour fastness
- familiar with the common types of garment testing

PEC-TT/TC- 301G Post Extrusion Operations

<table>
<tr><td>Course code</td><td colspan="5">PEC-TT/TC-301G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course (PEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Post Extrusion Operations</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology, Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Man-made fibre production

Course Objectives:

The course is designed to impart the following:

- Basic concept of drawing of filaments
- Basic concept of setting
- Basic concept of texturizing

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Drawing: Objectives, neck drawing of filaments, NDR, MDR and LDR; Drawing of polyester and nylon; Spin-draw process; Various parameters of drawing and their effects on structure and properties of filaments.
Heat setting process: Nature of set, mechanism of setting; Various parameters of heat-setting and their influence on structure and properties of filaments; Thermal healing; Settability and measurement of degree of set.

UNIT-II

Texturing process: Principle of texturing; Types of texturing processes; Principle and brief description of stuffer box crimping, Edge crimping, Knit-de-knit texturing; Manufacturing of BCF and Hi-bulk yarns.

UNIT-III

Twist texturing principle; Material, machine and process variables affecting structure and properties of twist textured yarns; Faults in twist textured yarns and their remedies; Evaluation of twist textured yarns.

UNIT-IV

Air-jet texturing: Principles and mechanism of air-jet texturing; Material, machine and process variables affecting structure and properties of the air-jet textured yarn; Different types of jets, baffle elements and their description; Properties of air-jet textured yarns and their importance; Evaluation of air-jet textured yarns.

Suggested Reading List:

Title	**Author**
Manufactured Fibre Technology	Gupta & Kothari
Modern Yarn Production	G R Wray
Yarn Texturing Technology	Hearle, Hollick & Wilson

Course Outcomes:

After completion of the course, students will be able to:

- understand the essential requirements for drawing of filaments.
- comprehend the basics of temporary and permanent setting.
- get familiarised with manufacturing techniques of texturizing.

PEC-TT-302G Total Productive Maintenance in Textile Industry

<table>
<tr><td>Course code</td><td colspan="5">PEC-TT-302G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course (PEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Total Productive Maintenance in Textile Industry</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Basic concepts of textile production equipment and their functions.

Course Objectives:
The objectives of this course is to

- familiarize the students about various activities pertaining to maintenance of textile machineries.
- give an idea on utility services requirements in textile industry
- familiarize the students about total productive maintenance
- give an overview on importance of maintenance activities on the productivity, quality of output and life span of machines.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Maintenance: definition and objectives. Importance of maintenance in an industry. Type of maintenance: Planned and unplanned maintenance. Activities involved in planned and unplanned maintenance. Functions of maintenance management: maintenance planning and execution, scheduling, inventory management of spare parts and accessories, record keeping and analysis. Maintenance audit.

UNIT-II

Bearing; Type of bearing and their uses in textile machineries; Identification of bearing through numbering. Reason for failure of bearing; lubrication of bearing; type of lubricants used in textile machineries. Characteristics of lubricant; selection and application of lubricants. Brief idea on different types of utility service in textile industries and their importance.

UNIT-III

Evolution of concept of Total Productive Maintenance (TPM); Definition of maintenance and its benefits. Components of TPM: predictive maintenance, condition based monitoring, corrective maintenance, Role of machine designer, production and maintenance department in T.P.M. Implementation of T.P.M. Autonomous maintenance. Determination of R.P.N and idea on F.M.E.A. Brief idea on occupational safety and health hazard in textile industry.

UNIT-IV

Idea on preventive maintenance activities in textile industries. Brief description, frequency and effect of quality, productivity and life of important maintenance activities in spinning machineries – card wire mounting and grinding, card setting, cot mounting, buffing and treatment, ring-spindle centering, roller truing, spindle oil replacement etc. Brief idea on replacement frequency of important spare parts like card wire, cots, ring, spindle, cradle etc. Brief description, frequency and effect of quality, productivity and life of important maintenance activities in preparatory and weaving machineries like, periodic lubrication schedule, size box cleaning and setting, roller alignment in weaving machines, different settings in weaving machines, etc. Brief idea on replacement frequency of important spare parts in weaving machines like, air jet/water jet nozzles, projectiles in projectile weaving machines, rapier heads and rapier rod/tapes, reed, heald wires, etc.

Suggested Reading List:

Title	Author
Maintenance of spinning machineries	S. Nihajan

Course Outcomes:

After completion of the course, students will be able to:

- understand the activities involved in maintenance.
- understand the various maintenance activities of textile machines and their impact on quality, productivity and life of the machines.
- understand the concept of total productive maintenance and its implementation methodology.

PEC-TT-303G Waste Management and Pollution Control

Course code	PEC-TT-303G				
Category	Professional Elective Course (PEC-I)				
Course Title	Waste Management and Pollution Control				
Scheme and Credits	L	T	P	Credits	Semester-V
	3	0	0	3	
Branch	Textile Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic concepts of textile production.

Course Objectives:

- To familiarize the students about various wastes and pollutants from textile production.
- To familiarize the students about the importance of waste management and pollution control.
- To familiarize the students different textile effluents and their recovery/recycling.
- To give an overview on toxicity of bleaching, dyeing, printing and finishing auxiliaries and their analysis and minimization.
- To give an overview on water, air and noise pollution due to textile production, their control, standards and acts.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Definition of Waste and Pollutant: Classification of wastes and pollutants; Importance of waste management and pollution control. Environmental impact assessment, definition & need, introduction to environmental impact assessment methodology, unit processes.

UNIT-II

Textile effluents and their characterization, methods of effluent treatment, disposal of effluents, reuse of water in a process house, fiber and polymer waste, recovery and recycling of monomer. Modifications of polymer waste. Recovery and recycling of monomers, Modifications of polymer waste and its utilization, Waste Management approaches, Statistical interpretation of data on waste of different sections of textile industry.

UNIT-III

Toxicity of intermediates dyes, processing aids-bleaching, dyeing, printing and finishing auxiliaries etc. Analytical methods for various pollutants. Formaldehyde, Pentachlorophenol, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Minimization, Optimization and Standardization of waste in textile industry.

UNIT-IV

Source of water pollution: Factors contributing water pollution and their effect, water pollution parameters, physical, biological, chemical standards for quality of treated water. Effluent treatment methods and control, basic principles - Unit operations (sedimentation, precipitation, filtration, and incineration), specific pollutants. Pollution of air, causes, effect, monitoring and control. Source of noise pollution, its effect and control. Legislation- salient provisions of water act, Air act, Environment protection act, Environment Impact Assessment: Basic principles, purpose, components, methodology and constraints.

Suggested Reading List:

Title	**Author**
Basic course in environmental studies	S. Deswal & Anupama Deswal.
Environment impact Assessment	L.W. Caeter
Environment Pollution & Control	H. S. Bhatia
Textile management	V. D. Dudeja.
Water and effluent in textile mills	P. B. Jhala

Course Outcomes:

After completion of the course, students will be:

- familiarized with various wastes and pollutants from textile production.
- able to comprehend the importance of waste management and pollution control.
- familiarized with different textile effluents and their scope of recovery/recycling.
- have an idea on toxicity of bleaching, dyeing, printing and finishing auxiliaries and their analysis and scope of its minimization/optimisation.
- have an idea on water, air and noise pollution due to textile production, their control, standards and acts.

OEC-TT-301G Textile Chemical Processing

<table>
<tr><td>Course code</td><td colspan="5">OEC-TT-301G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Textile Chemical Processing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
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Pre-requisites: Basic knowledge of fiber chemistry and their properties; fundamental knowledge of fabric manufacturing.

Course Objectives:

- To provide basic knowledge of basic concept of chemical processing of textiles.
- To familiarize students with the various pre-treatments involved in natural and man-made fiber processing.
- To introduce students about dyeing and printing of various textile materials.
- To introduce students to the various types of finishing treatments associated with textile materials.
- To familiarize students with the machinery involved in textile chemical processing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction: Sequence of chemical processing of textiles. Natural and added impurities in textiles. Preparatory Processes: Singeing, Desizing, Scouring and Bleaching in context to natural, man-made and blended textiles; objectives, types, methods, mechanism, recipe and machine associated with each process. Brief introduction to Mercerization, Heat setting and Degumming of Silk.

UNIT-II

Introduction to the dyeing of natural & synthetic fibres/fabrics with different dye classes: Direct, Reactive, Vat, Sulphur, Acid, Basic, Metal-complex, Disperse etc. Introduction to dyeing machineries: Yarn package dyeing machines, Jigger, Winch, Jet dyeing machines and Padding mangles.

UNIT-III

Printing: Introduction to printing methods Block, screen and roller printing. Advantages and disadvantages of each method. Introduction to various styles of printing like Direct, Discharge and Resist styles on natural, man-made and blended textiles. Ingredients of print paste with details on classification of thickeners. Introduction to Transfer Printing and Pigment Printing: Mechanism and recipe details of pigment printing.

UNIT-IV

Introduction to finishing of textiles with their classification and elementary idea of various mechanical and chemical finishes: Calendaring, Sanforizing, Sueding/Napping, Decatising etc. Chemical Finishes: Anti-crease finish on cotton. Introduction to water repellent and Flame proofing finishes on cotton. Basic idea of Softeners and their application.

Suggested Reading List:

Title **Author**

Technology of Textile Processing Vol-2, 3, 4

V. A. Sehnai Textile Technology and Dyeing of Textile Fibres

E. R. Trotman Principle and practice of Dyeing

V. A. Sehnai

Chemical processing of Synthetic Fibres and Blends K. V. Datye

& A. A. Vaidya Fundamentals and Practices in Coloration of Textiles J. N. Chakraborty

Title	Author
Silk Dyeing, Printing and Finishing	M. L. Gulrajani
Technology of Printing	V. A. Shenai
Textile Printing	L. W. C. Miles
Chemical Finishing of Textiles	W. D. Schindler & P. J. Hauser
An Introduction to Textile Finishing	J. T. Marsh

Course Outcomes:

After completion of the course, students will:

- have knowledge of chemical processing of textile fibers.
- be able to elaborate the various pre-treatments involved in the chemical processing of different fibres.
- be familiar with application of different types of colorants to natural and manmade fibers.
- be familiar with the various finishing treatments involved in the textile processing.
- be able to explore the machinery involved in the chemical processing of textiles.

OEC-TT-302G Chemical Processing of Natural Fibres

<table>
<tr><td>Course code</td><td colspan="5">OEC-TT-302G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Chemical Processing of Natural Fibres</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Basic knowledge of fiber chemistry and their properties; fundamental knowledge of fabric manufacturing.

Course Objectives:

- To provide basic knowledge of basic concept of chemical processing of textiles.
- To familiarize students with the various pre-treatments involved in natural fibres.
- To introduce students about coloration of natural fibre textile materials.
- To introduce students with the various types of finishing treatments associated with natural textile materials.
- To familiarize students with the machinery involved in textile chemical processing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to chemical processing of textiles. Natural and added impurities in textiles. Sequence of chemical processing of textiles. Preparatory Processes for cotton textiles: Singeing, Desizing, Scouring, Bleaching and Mercerization.

UNIT-II

Chemical Processing of Wool and Silk: Desizing, Scouring/Degumming, Bleaching, Milling, Decatising, Silk Weighting etc.

Chemical Processing of Bast Fibres (Jute, Flax Ramie etc.):
Retting/Degumming/Scouring, Bleaching etc.

UNIT-III

Dyeing of natural fibres/fabrics with different dye classes: Direct, Reactive, Vat, Sulphur, Acid, Basic, Metal-complex etc. Introduction to dyeing machineries: Yarn package dyeing machines, Jigger, Winch, Jet dyeing machines and Padding mangles.

UNIT-IV

Introduction to printing methods Block, screen and roller printing. Introduction to various styles of printing like Direct, Discharge and Resist styles on natural fibre/fabrics.

Introduction to finishing of textiles with their classification and elementary idea of various mechanical and chemical finishes: Calendaring, Sanforizing, Sueding/Napping etc. Chemical Finishes: Anti-crease finish on cotton, Biopolishing. Basic idea of Softeners and their application.

Suggested Reading List:

Title	**Author**
Technology of Textile Processing Vol-2, 3, 4	V.
A. Sehnai Textile Technology and Dyeing of Textile Fibres	E.
R. Trotman Principle and practice of Dyeing	V.
A. Sehnai Fundamentals and Practices in Coloration of Textiles	J.
N. Chakraborty Silk Dyeing, Printing and Finishing	M.
L. Gulrajani	
Technology of Printing	V. A. Shenai
Chemical Finishing of Textiles	W. D. Schindler & P. J. Hauser
An Introduction to Textile Finishing	J. T. Marsh

Course Outcomes:

After completion of the course, students will:

- have knowledge of chemical processing of textile fibers.
- be able to elaborate the various pre-treatments involved in the chemical processing of natural fibres.
- be familiar with application of different types of colorants to natural fibers.
- be familiar with the various finishing treatments involved in the natural fibre processing.
- be able to explore the machinery involved in the chemical processing of textiles.

PEC-TC-302G Chemical Processing of Unconventional Textile Materials

<table>
<tr><td>Course code</td><td colspan="5">PEC-TC-302G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course (OEC-I)</td></tr>
<tr><td>Course Title</td><td colspan="5">Chemical Processing of Unconventional Textile Materials</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology, Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
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Pre-requisites: Basic knowledge of textile raw materials and elementary idea of textile chemical processing.

Course Objectives:
- To discuss the chemical processing of Knit goods with technical details of machinery.
- To explain the chemical processing Denim fabric including dyeing and finishing.
- To explain process and machines used for terry towel and carpet products.
- To discuss processing of Jute and Linen fabrics.
- To discuss the processing route of spandex containing materials.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Basic concept of knitting: warp knits, weft knits, courses, wales, stitch and loop density. Factors to be considered in knit processing. Process sequences in tubular and open width form processing. Pre- treatment like singeing, scouring, bleaching and mercerization. Dyeing with direct, reactive, vat and sulphur using winch and soft flow dyeing machines. Finishing of knit goods: Hydro-extraction and slitting, drying and compacting. Faults in knit goods.

UNIT-II

Processing of Denim: Introduction to denim, types of Denim fabrics, chemistry and process of warp dyeing with indigo. Indigo dyeing equipments. Dyeing with mixture of indigo and other dyes. Finishing of Denim Fabrics and Garments. Quality and process control in wet processing.

UNIT-III

Terry Towel Processing: Process sequence and machines used for terry towel manufacturing, essential properties of terry towel fabrics like pile properties, water absorbency. Type and application of terry fabrics. Different stages of towel processing and finishing. Common defects in terry fabrics.

Carpet Processing: Different fibres suitable for carpets, types of carpets, essential properties of carpet fabric. Dyeing and printing of carpets. Mechanical and chemical finishing of carpets.

UNIT-IV

Jute and Linen Processing: General properties and uses of jute and linen fibres. Their pre-treatment and dyeing processes. Woollenisation of jute.

Processing of Fabric containing spandex: Brief introduction of properties and uses of spandex fibres and blends. Wet processing of Cotton/ Spandex, Viscose/Spandex, Nylon/Spandex, Polyester/Spandex fabrics. Finishing of warp knits containing spandex fibres.

Suggested Reading List:

Title	Author
Processing of cotton knitted fabrics	M. Chakraborty, Amit Dayal
and M L Gulrajni Denim: A Fabric for all	M. S. Parmar
Manufacturing of Terry Towel	Subhash J. Patil
Textile Floor covering	G. H. Crowshaw, Textile Progress, Vol. 9,
No. 2	
Interior Furnishing	Mortimer O'shea, Textile Progress, Vol. 11,
No. 1	
Carpet Surface	H. Pointon, Textile Trade Press
Textile Printing	L. W. C. Miles

Course Outcomes:

After completion of the course, students will be able to:

- explain processing, precaution and details of Knit goods
- explain processing and finishing of Denim fabric and garments
- explain the processing of terry towel and carpet product
- explain the complete chemical processing of jute and linen fabrics
- understand the chemical processing of Spandex containing textile materials.

Course code	OEC-TT/TC-303G				
Category	Open Elective Course (OEC-II)				
Course Title	Garment Manufacturing Technology				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Textile raw materials, yarn formation, woven & knitted fabrics.

Course Objectives:

- To familiarize the students with the role of Fashion in Apparels.
- To understand the marker planning, spreading and cutting processes in Garment Industries.
- To familiarize with the contribution of various entities of sewing in Apparel production.
- To understand the pressing procedure followed in Garment industries.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Concepts of Fashion: various terms used- fashion cycle, fad, style etc. Fashion Theories, Consumer identification with different phases of Fashion Cycle. Introduction to Garment Manufacturing process. Introduction of merchandising and retail concepts. Future prospects for engineers in garment sector.

UNIT-II

Planning, drawing and reproduction of the marker, requirements of marker-planning, marker efficiency, methods of marker planning and marker use – normal marker, planning and computerized marker planning, requirement of spreading process, nature of fabric packages, Objectives and methods of cutting straight knife, band knife, notches, drills, computer controlled knives, Die cutting, Laser cutting, Plasma cutting, Microprocessor based machinery in pattern construction and planning, marking and cutting processes.

UNIT-III

Sewing: Properties of seams, seam types, stitch types, sewing machine feed mechanism, sewing machine needles, sewing threads, sewing problems. Introduction to Sewing Machinery: Basic sewing machines and associated work aids. Automation in Garment Industry, Information Technology in Garment Industry.

UNIT-IV

Pressing: Purpose of pressing, pressing equipment and methods General description to alternative methods of joining materials and the use of components, trimmings to care labeling in garment manufacturing.

Suggested Reading List:

Title	Author
Fashion from Concept to Consumer	Emilio Puc
The Technology of Clothing Manufacture	Harold Carr & B. Latham
The Apparel Industry in India	I. L. A. Kanti
Garment Manufacturing Technology	Nayak & Padhey
Apparel Manufacturing Analysis	Jacob Solinger
Apparel Manufacturing Handbook	Jacob Solinger
Apparel Manufacturing Technology	Karthik, Ganeshan, Goplakrishnan

Course Outcomes:

After completion of the course, students will be able to:

- relate fashion concepts in garment industries.
- analyse marker planning and efficiency, spreading and cutting processes in Garment Industries.
- work and relate sewing parameters in Apparel products.
- develop pressing procedure in Garment industries.

Course code	OEC-TT/TC-304G				
Category	Open Elective Course (OEC-II)				
Course Title	Apparel Quality Evaluation and Standards				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Textile raw materials, yarn formation, woven & knitted fabrics

Course Objectives:
- To familiarize the students with the role of Quality in Apparels and its categorization.
- To create clarity regarding the Inspection systems and tools of Quality Control.
- To familiarize with the contribution of various entities in Apparel organizations towards Quality.
- To understand the sampling procedure followed in Garment industries.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Meaning of quality, testing and standards and their importance in apparel industry; Quality terminologies; Sources of international standards. Quality Parameters of fabric and garment.

Quality – definition, classification of defects, Quality loop, inspection loop, stages of inspection, how much to inspect-arbitrary, statistical sampling, AQL, zones in garment evaluation, Quality function. Evaluation of quality cost, categorisation of quality costs, objectives of quality cost evaluation.

UNIT-II

Role of quality management for Fashion Buyer - Role of fashion Buyer, Buying team, buying cycle - comparative shopping, directional shopping. Principles of TQM – Deming’s PGDCA Cycle - KAIZAN concepts – 5 „S‟ applications in apparel industry. Application of seven QC tools in apparel industry.

UNIT-III

Inspection- purpose, inspection manuals, how much to inspect, random sampling etc. Quality standards- ISO-9000 series of standards, Quality assurance, Six Sigma. various care labelling symbols, different stages at which inspection is carried out and its effect on overall garment quality like raw material inspection- Fabric Inspection system : 4 point,10 point system and in process inspection.

UNIT-IV

Understanding procedures in sampling and sample development, different stages of samples and their requirements from Proto to Shipment sample Proto, fit, size set, pre-production, TOP, sealer etc. Inspection: Incoming and raw material inspection: Fabric inspection – 4-point system. In process/ online inspection: Advantages – On line inspection during spreading, pattern making, cutting, sewing and ironing. Final inspection: Sampling plans and AQL charts – Level of final inspection. Packing & packaging quality tests. Care labeling and international care symbols.

Suggested Reading List:

Title	**Author**
Hand book of Quality Control	Joseph Juran
Total Quality Management: A pictorial guide for manager	John Oakland
Statistical Quality Control	G. Eugene &
Lavenworth Richard	
Managing Productivity in Apparel Industry	Rajesh Bheda
Productivity through Quality	Rajesh Bheda,
Fashion Buying	Halen Goworek
Evaluating Apparel Quality	Stamper
ISO 9000 Quality Management System.	D. L. Shah
Managing the Quality in Apparel Industries	Pradeep V. Mehta
Principles of Textile Testing	J. E. Booth
Testing and Quality Management	V. K. Kothari

Course Outcomes:

After completion of the course, students will be able to:

- implement the Quality parameter in Apparel industry.
- utilize the various tools of Quality control and Inspection systems.
- evaluate the sampling procedure being followed in Garment Industries.
- analyze the contribution of different entities towards Quality control.

Course code	OEC-TT/TC-305G				
Category	Open Elective Course (OEC-II)				
Course Title	Introduction to Fashion and Apparel Industries				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Textile Raw Materials, Yarn and Fabric Formation, Apparel Production, Colour & Design Concepts

Course Objectives:

- To understand the elementary knowledge of Indian and global apparel industries.
- To learn the concept of fashion, components of fashion, fashion cycle, fashion theories.
- To gain knowledge of fashion centres, fashion brands.
- To develop skills for application of fashion promotion, information services and communications

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to Apparel Industry, Indian Apparel industry scenario and its SWOT Analysis, Status of Structure and working flowchart of various departments of a garment production house. Apparel manufacturing countries: their features, level of technology, product mix. Indian apparel industry- challenges & global scenario.

UNIT-II

Fashion terminology, components of fashion, fashion cycle – its phases, Style classification based on fashion cycle - fad/classic, recurring & interrupted cycles, Consumer identification with fashion cycles
- leaders, innovators, followers, victims & laggards. Motives of consumer buying & factors affecting fashion growth & declination. Fashion adaptation theories.

UNIT-III

Major fashion centers of the world: Brief introduction to world fashion centers – Millan, Italy, Paris, Rome, American, European, and Japanese. Who's who of fashion world - national & international designers, their private labels, Luxury brands of apparels & accessories.

General introduction to careers & future opportunities in fashion & apparel sector - export & buying houses, design houses etc.

UNIT-IV

Fashion information services, trend forecasting and auxiliary services. Importance of fashion seasons & fashion calendar in apparel industry.

Introduction to fashion forecasting – significance, purpose of forecasting trends, forecasting tools & techniques and role of fashion forecasters. Fashion promotion and communications - Trade fairs, Fashion shows, exhibitions & promotional events.

Suggested Reading List:

Title	**Author**
The Theory of Fashion Design	H. L. Brockman
Fundamentals of Men's Fashion Design	Masaaki Kawashima
The Clothing Factory, The Clothing Institute	H. C. Carr
Inside the Fashion Business	J. A. Jarnow and B. Judelle
Advertising Handbook	Roger A. Barton
Merchandising of Fashion	Swinney, B. John
Garment Manufacturing Technology	Nayak & Padhey
The Technology of Clothing Manufacture	Carr & Latham
Apparel manufacturing analysis	Jacob Solinger
Apparel manufacturing Handbook	Jacob Solinger
Apparel Manufacturing Technology	Karthik, Ganeshan, Goplakrishnan

Course Outcomes:

After completion of the course, students will be able to:

- understand the fundamentals of fashion and apparel industries.
- analyse the fashion cycles, fad and different styles and fashion theories.
- apply the work of fashion leaders and brands into practice.
- develop fashion promotion and communication skills.

Course code	LC-TT-301G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Spinning Practical-III				
Scheme and Credits	L	T	P	Credits	Semester–V
	0	0	2	1	
Branch	Textile Technology				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic knowledge of drafting, twisting and winding.

Course Objectives:

The objective of this course is to make the student acquainted with,

- passage of material through ring frame, different parts of ring frame and their function.
- transmission of drive to the various parts.
- effect of various process and machine parameters on the performance of ring frame in terms of productivity and quality.
- factors need to be considered for setting of process parameters.
- important parts like ring traveller, spindle, top roller, bottom roller, top arm cradle etc.
- setting and fine tuning of ring frame.
- passage of material through ring twister , different parts of ring twister and their functions

List of Experiments:

1. To study the different zones in a ring frame and passage of material through various zones.

2. Detailed study on different parts of ring frame and their function

3. To study effect of various process and machine parameters on the performance of ring frame in terms of productivity and quality.

4. To study the transmission of drive in ring frame and determination of total draft and distribution of draft, tpi, winding length and delivery speed.

5. To study the drafting system and Top arm of ring frame (K2) PK-235 and roller setting for various fibres.

LC-TT-301G Spinning Practical-III

6. Draw and study the drafting system and Top arm of ring frame G5/1 (R2P X) and roller setting for different type of fibres.

7. Study of various change places in a ring frame K2 and G5/1.

8. Study on adjustment of various setting of ring frame.

9. Study on trouble shooting pertaining to quality and productivity in ring frame.

10. Study on selection of ring and traveller.

11. Draw the passage of material through various zones of ring doubling frame and study functions of various parts of ring doubling frame.

12. Study on trouble shooting pertaining to quality and productivity in doubled yarn.

Course Outcomes:

After completion of the course, students will be able to,

- identify the various parts of ring frame and their functions.
- get an idea regarding the various process and machine parameters of ring frame and their effect on quality and productivity.
- get an idea regarding the setting and fine tuning of ring frame.
- identify the various parts of ring twister and their functions
- understand the working of stop motions in ring twister.
- understand the sources of troubles and their remedial measures in ring frame and ring twister.

Course code	LC-TT-302G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Weaving Practical-III				
Scheme and Credits	L	T	P	Credits	Semester–V
	0	0	2	1	
Branch	Textile Technology				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Fabric Manufacture-I

Course Objectives:
This practical is designed to impart first-hand experience of the features, layout and different motions of shuttleless weaving machines and their settings. It also gives a first-hand experience of in-depth working of projectile weaving machines. It serves as a bridge between theory and practice.

Contents: Study of construction, working and related calculation/settings of shedding (matched cam, electronic dobby and jacquard), beat-up (matched cam, multi-link crank), let-off (positive) and take-up mechanisms used in shuttle-less looms. Projectile loom: study of salient features, construction & working of torsion bar picking mechanism, path of weft, different components in the path and their working, weft transfer, projectile circulation, sequence of weft insertion, timings, related calculations, shedding, beat-up, secondary and auxiliary motions, selvedge mechanism, settings/operation.

List of Experiments:

1. Salient features and layout of different shuttleless weaving machines, production calculations

2. Study of construction, working and related calculation/settings of shedding mechanisms (matched cam, electronic dobby and jacquard) used in shuttleless weaving machines

3. Study of construction, working and related calculation/settings beat-up (matched cam, multi-link crank) used in shuttleless weaving machines

4. Study of construction, working and related calculation/settings take-up mechanisms used in shuttleless weaving machines

5. Study of construction, working and related calculation/settings let-off (positive) mechanisms used in shuttleless weaving machines

6. Projectile Weaving Machine: study of salient features, construction & working of torsion bar picking mechanism, path of weft, different components in the path and their working, weft transfer, projectile circulation, sequence of weft insertion, timings, related calculations, settings/operation.

Course Outcomes:

After completion of the course, students will be able to:

- correlate between theory and practice of the concept of shuttleless weaving
- visualise the layout and structure of shuttleless weaving machines along with their primary components
- visualise the mechanisms of different motions of shuttleless weaving machines and comprehend their settings
- visualise the working of projectile weaving machine and comprehend its settings and operation
- develop practical skills relevant to industrial practice

Course code	LC-TT/TC/FAE-303G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Textile Testing Practical				
Scheme and Credits	L	T	P	Credits	Semester–V
	0	0	2	1	
Branch	Textile Technology, Textile Chemistry, Fashion and Apparel Engg.				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic knowledge of textile fibres, yarns and fabrics, Textile Testing.

Course Objectives:

- To impart first-hand experience of the procedures of basic testing of fiber, yarn, fabric and garment.
- To learn presentation of test results in a suitable manner.
- To impart first-hand experience of test result analysis.
- It serves as a bridge between theory and practice.

List of Experiments:

1. Measurement of trash content in raw cotton

2. Measurement of fiber fineness by whole fiber method

3. Measurement of fiber fineness by airflow method

4. Measurement of fiber length parameters by Baer Sorter

5. Determination of fiber bundle strength using Pressley fiber bundle strength tester

6. Determination of fiber bundle strength using Stelometer

7. Measurement of yarn twist

8. Measurement of linear density of sliver, roving and yarn

9. Measurement of C.S.P value of yarn

10. Measurement of fabric tensile properties

11. Measurement of fabric tearing strength

12. Evaluation of washing and rubbing fastness properties of dyed fabrics

13. Evaluation of seam properties (Seam strength and Seam Slippage)

Course Outcomes:

After completion of the course, students will be able to:

- correlate between theory and practice of the concept of textile testing.
- conduct basic testing of fiber, yarn, fabric and garment.
- present the results in graphical and tabular manner.
- analyze the results from the tests.
- develop practical skills relevant to industrial practice.

<table>
<tr><td>Course code</td><td colspan="5">LC-TT-304G</td></tr>
<tr><td>Category</td><td colspan="5">Laboratory Course (Professional Core Course)</td></tr>
<tr><td>Course Title</td><td colspan="5">Wet Processing Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
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Pre-requisites: Basic knowledge of fibres and their properties

Course Objectives:
This practical is designed to understand the chemical processing (pre-treatment, dyeing/printing and finishing) of various textile materials.

List of Experiments:

1. Desizing of cotton fabric using various types of desizing agents.

2. Scouring of natural fibres in the form of yarn and fabric and find the scouring loss.

3. Scouring of Polyester/ Cotton blend and Wool.

4. Degumming of Silk and calculation of weight loss percentage.

5. Bleaching of natural fibres namely Cotton, Wool with: (a) Hyperchloride Bleaching (b) Peroxide Bleaching

6. Bleaching of Polyester /Cotton blended Fabric.

7. Determination the pH value of a given material.

8. Dyeing of cotton fabric with direct dyes followed by after-treatment.

9. Dyeing of cotton fabric with reactive dyes using different techniques.

10. Dyeing of cotton fabric with sulphur and vat dyes.

11. Dyeing of wool/silk with acid and metal-complex dyes.

12. Dyeing of polyester fabric with Disperse dye.

13. Printing of cotton fabric with direct style of printing using dye.

14. Printing of cotton fabric with resist style of printing.

15. Printing of cotton fabric with discharge style of printing.

16. To do softener finishing of all type of materials using different chemicals.

17. To apply water repellent finish to textile materials.

18. To apply flame retardant finish to textile materials.

Course Outcomes:

After completion of the course, students will be able to:

- perform chemical pre-treatment of various textile materials.
- perform dyeing/printing of various textile materials.
- perform finishing of various textile materials.

PCC-TT-303G Unconventional Systems of Yarn Formation

<table>
<tr><td>Course code</td><td colspan="5">PCC-TT-303G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course Title</td><td colspan="5">Unconventional Systems of Yarn Formation</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Textile Raw Materials; Yarn Manufacture-I; Yarn Manufacture-II; Yarn Manufacture- III

Course Objectives:

- To familiarize students about the causes for invention of unconventional systems of yarn production
- To familiarize students about classifications of unconventional systems of yarn production
- To make students understand the working principle and engineering design of various parts of rotor spinning
- To make students understand the mechanism of yarn formation on friction and air-jet spinning
- To make students understand the mechanism of yarn formation on other non-conventional systems
- To make students understand comparison of yarn structure and properties spun on different systems
- To make students understand the applications of yarns spun on different systems

NOTE: Examiner will set 9 questions in total, with two questions from each unit and one question covering all sections which will be Q.1. This Q.1 is compulsory and will have 06 parts of 2.5 marks each. The remaining eight questions each of 15 marks are to be set by taking two questions from each unit. Students have to attempt 5 questions in all selecting at least one question from each unit.

UNIT-I

Causes leading to the advent of unconventional systems of spinning; Basic Principle of Open end Spinning systems; Variables for classification of unconventional methods of yarn production; Different Classifications of unconventional methods of yarn production; Principle involved in each group of classification. Introduction to Rotor Spinning

UNIT-II

Principle and Engineering design of various parts of rotor spinning, effect of rotor machine variables and fibre properties on the properties of rotor spun yarns. Limitations of rotor spinning, advances in rotor spinning,

UNIT-III

Study of other spinning systems, viz. Friction and Air-jet etc; Mechanism of yarn formation, Structure, properties and end-uses of yarns spun on these systems, Various developments in these systems

UNIT-IV

Electrostatic, air-vortex, Wrap, Twist less, Self-twist and other non-conventional methods of yarn production: Structure, properties and end-uses of these yarns, Potential and limitations of various spinning technologies

Suggested Reading List:

Title	Author
Spinning in 70's	P. R. Lord
Spun Yarn Technology	E. Oxtoby
Short Staple Spinning	W. Klein
Textile	
Research	
Journal	
Journal of	
Textile	
Institute	
Textile	
Progress	
NCUTE Publications	

Course Outcomes:

After completion of the course, students will:

- have comprehensive knowledge of various unconventional systems of yarn production
- be able to differentiate the yarns spun on various unconventional systems
- be able to understand the effects of process parameters on structure and properties of yarns spun on unconventional systems
- be able to understand the applications of yarns spun on unconventional systems

<table>
<tr><td>Course code</td><td colspan="5">PCC-TT-304G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course Title</td><td colspan="5">Advanced Weaving Technology-II</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Advanced Weaving Technology-I

Course Objectives:

- To familiarize the students about the types, mechanism and features of selvedges employed in shuttleless weaving machines
- Understanding the principle, design and mechanism of air jet weaving machines
- Understanding the principle, design and mechanism of water jet weaving machines
- Understanding the concept of multiphase weaving, its advantages and shortcomings
- Understanding the principle, design and mechanism of weft-directional and warp-directional multiphase weaving machines

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Selvedges - Types, mechanism, features

Airjet weaving machine (Part-I): Principle of weft insertion, typical specification & features of modern air jet looms; Merits, demerits and standard application domain; Path of weft, function of each component, sequence of weft insertion, typical timings Types, design, working of accumulators and main nozzles.

UNIT-II

Airjet weaving machine (Part-II): Types of air-guide systems, their design and comparison; Types, spacing, arrangement, blowing action of relay nozzles; stretch nozzle; Air supply to nozzles, blowing sequence and timing control (Automatic Pick Control systems); Calculation of weft velocity, number of relay nozzles and timings of different nozzles; Quality of air required; Air drag theory, factors affecting air drag force Weft breaks in air jet looms - reason and control devices. Types and features of shedding, beat up, take up and let off motions used in modern air jet looms; standard manufacturers

UNIT-III

Water jet weaving machine: Principle of weft insertion, typical specification & features of modern water jet looms; Merits, demerits and standard application domain; Path of weft, function of each component, sequence of weft insertion, typical timings, calculation of weft velocity; Nozzle and jet pump design, working and settings; Quality of water required, water extraction from fabric in loom. Types and features of shedding, beat up, take up and let off motions used in modern water jet looms; standard manufacturers.

Developments in shuttle less weaving as applicable from time to time

UNIT-IV

Multiphase weaving: Classification: Warp- and weft-directional multiphase looms and their principle

Weft-directional multiphase looms: different methods of shedding, picking and beat-up, advantages and disadvantages; Circular looms – classification, working, uses and limitations.

Warp-directional multiphase looms: Principle of drum type weaving machines; Sulzer M8300 – specification, features, working, advantages and limitations.

Suggested Reading List:

Title	**Author**
Handbook of Weaving	S. Adanur
Weaving: Technology & Operations	A. Ormerod
Weaving: Machines, Mechanisms, Management	Talukdar,
Sriramulu, Ajgaonkar Principles of Weaving	R. Marks & A. T.
C. Robinson	

Course Outcomes:

After completion of the course, students will be able to:

- understand the types and mechanism of selvedges formed in shuttleless weaving machines
- comprehend the design and mechanism of air jet and water jet weaving machines
- comprehend the concept, design and mechanism of multiphase weaving machines

<table>
<tr><td>Course code</td><td colspan="5">PEC-TT-304G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course (PEC-II)</td></tr>
<tr><td>Course Title</td><td colspan="5">Mechanics of Textile Machinery</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Basic mathematics, basic physics, yarn manufacture-I and fabric manufacture-I.

Course Objectives:

- To familiarize the students about the basic elements used in textile machinery.
- To familiarize the students about the basic functioning of textile machinery.
- Understanding the principle of design of textile machinery

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Simple harmonic motion: Properties of S.H.M. Simple Pendulum, Laws of simple pendulum, Compound Pendulum, Centre of Percussion. Application of S.H.M in textile machinery.

Flexible drives: Types of belts, Material used for belts, Velocity ratio of belt drive, Length of belt drive, Power transmitted by a belt, Chain drives.

Toothed Gearing and gear trains: Classification of gears, Terms used in gears. Types of gear trains, Velocity Ratio of gear trains, Applications of epicyclic gear trains in textile machinery.

UNIT-II

Machine Balancing: Concept of static and dynamic balancing, balancing of rotating masses, balancing of reciprocating masses.

Machine vibration: Introduction. Terms used in vibratory motion, Types of vibratory motion, Types of free vibrations, Natural frequency of free longitudinal, transverse and torsional vibrations, Effect of inertia of the constraint in longitudinal and transverse vibrations.

The physics and theory of spinning balloon, Yarn tension in ring spinning

UNIT-III

Introduction to Brakes and clutches: Types of brakes and clutches for the use in textile machinery.

Bearings: Sliding contact bearings, friction in journal bearings, Classification and use of ball and roller bearings, Equivalent bearing load and load-life relationship, Type of Bearings used in various stages of textile machinery

Types of cams and followers, cam terminology, types of motion of the follower, analysis of motion of the follower for cams with specified contours, Design of cam and tappet profiles for textile machinery.

UNIT-IV

Mechanics of Winding tension and tension variation and other weaving preparatory mechanisms, Velocity profile of shuttle during acceleration and retardation, picking force, Kinematics of sley for shuttle and shuttle less looms, Warp and Fabric Tension under Normal and Bumping conditions and their measurement, Excess tension theory, Power requirements for operating various motion and for machines as a whole, at various stages of weaving.

Suggested Reading List:

Title	**Author**
Theory of machines	R. S. Khurmi
and J. K. Gupta Textile Mathematics Vol. 1, 2 and 3	J.
E. Booth	
Principles of Mechanism	F. Dyson
Mechanics for Textile Students	W. A. Hanton
Principles of Weaving	Marks & Robinson
Mechanisms of Weaving	W. T. Fox

Course Outcomes:

After completion of the course, students will be able to:

- understand the concept of basic machine functioning
- able to design the basic machine elements
- comprehend the maintenance of textile machinery

Course code	PEC-TT-305G				
Category	Professional Elective Course (PEC-II)				
Course Title	Structure and Properties of Fibres				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic knowledge of fibres

Course Objectives:

After completion of the course, students will be able to:

- understand the morphological structure of fibre
- get familiarized with the properties of the fibre to suit their applications
- appreciate mechanism of absorption of moisture in fibres and their effects
- understand thermal and optical properties of fibre

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Theories of fine structure of fibres; Methods of determination of molecular structures, crystallinity and orientation, crystal size etc. by X-Ray methods; Stress-strain, creep and stress-relaxation of fibres, Simple spring and dashpot models simulating fibres.

UNIT-II

Absorption of moisture in fibres, hysteresis. Quantitative theories of absorption, Pierce’s theory, Fick's laws of moisture diffusion; Retention of liquid water; Swelling; Heat of sorption.

UNIT-III

Optical properties: Polarization and refractive index, Birefringence and its measurement.

Thermal properties: Molecular motions and transition phenomenon, First order and second order transition phenomenon, Concept of heat setting and pleating, Measurement of specific heat of fibres

UNIT-IV

Electrical properties: Di-electric properties and its measurement, Effect of frequency and temperature on dielectric constant, Electrical resistance of fibres and its measurement, Static electricity and measurement of static charge in fibres.

Frictional properties of fibres – nature and measurement.

Suggested Reading List:

Title	**Author**
Physical properties of fibres	Morton and Hearle

Course Outcomes:

After completion of the course, students will be able to:

- understand the fine structure of the fibres which is an essential tool to predict properties of fibres.
- assess various aspects of structure of fibre.
- blend different fibres to suit for various uses.
- understand the scope and limitations to improve structure and properties of synthetic fibres.

<table>
<tr><td>Course code</td><td colspan="5">PEC-TT-306G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course (PEC-II)</td></tr>
<tr><td>Course Title</td><td colspan="5">Wool Technology</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Textile Raw Material, Yarn Manufacture-I; Yarn Manufacture-II: Yarn Manufacture- III

Course Objectives:

- To familiarize the students with an understanding of the basic structure, physics and chemistry of the wool fibre.
- To make the students understand basic mechanisms involved in woolen and worsted system of yarn formation.
- To make students learn about new and innovative product with wool and their application.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-1

Wool Fibre Science - Wool and other animal fibre, Process of harvesting wool (shearing, classing, baling and transport), Testing procedures carried out on raw wool to determine its value, Structure of wool fibre, Physics and chemistry of wool fibre, Setting of wool fibre, Shrinkage of wool products, Benefits of wool.

Wool scouring - Aims and objectives of scouring, Characteristics of wool contaminants, The machinery used for scouring, the issues affecting product quality, Recovery of wool grease, impact of scouring quality on downstream processing.

UNIT-II

Various systems of wool fibre spinning - woollen, semi worsted and worsted system - Flow chart. Woolen spinning system - woolen cards, woolen ring frame. Semi worsted spinning system - sequence of machines and their operations.

UNIT-III

Worsted top making - Worsted carding, Drafting and Gilling, Combing, Quality assurance of wool top, Treatment of wool top.

Worsted spinning system - Preparation of top for worsted spinning, Worsted ring spinning, Variation and alternatives for worsted ring spinning, Post spinning operations. Quality assurance in worsted and woolen spinning operations.

UNIT-IV

New wool products and applications, Improving the whiteness and photostability of wool, Enhancing wool products using nanotechnology, Wool performance apparel for sport, High-performance wool blends; Intelligent wool apparel, Application of wool keratins ranging from industrial materials to medical devices.

Suggested Reading List:

Title	**Author**
Wool Hand Book Vol. II	Werner Von Bergei
British Wool Manual	H. Spibey
Advances in Wool Technology	N. A. G. Johnson and I. M. Russell
Woollen Spinning	C. Vickerman
Wool: Science and Technology	W. S. Simpson and G. H. Crawshaw
Woollen and Worsted Spinning	Abhishek Publications, Chandigarh-17
Wool Spinning Vol. I, II.	Ya. Lipenkov

Course Outcomes:

At the end of the course, the students will:

- understand the structure, physics and chemistry of wool fibre and the relationship between the structure and properties of the fibre.
- have detail knowledge about how wool is manufactured from a greasy raw fibre into worsted and woollen yarns.
- be aware about innovations in wool and how these can be used to design different products made from wool.

Course code	PEC-TT-307G				
Category	Professional Elective Course (PEC-III)				
Course Title	Engineering of Textile Structures				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Yarn Manufacture-I and II, Fabric Manufacture-I, Weaving Preparation

Course Objectives:

- To familiarize the students about the utility of yarn geometry.
- To familiarize the students about yarn performance for designing.
- Understanding the basic aspects of fabric designing.
- Understanding the principle, design and mechanism of fabric response to mechanical forces.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Yarn Geometry- Idealized yarn geometry, relationship of yarn number and twist factor. Twist contraction, Limit of twist.
Ideal packing of fibers in a yarn: Open Packing, Hexagonal packing and deviations from ideal forms.

Fiber Migration- Mechanism of migration, Condition for migration to occur, Characterization of fiber migration and experimental set up for study of migration.

UNIT-II

Theory of the extension of continuous filament yarns: Simplest analysis of tensile behavior, Analysis of large extension, analysis with transverse forces and lateral contraction, Prediction of yarn breakages.

Strength of yarn spun of fiber blends: Strictly similar yarns, Hamburger model.

UNIT-III

Elements of fabric geometry: Ashenhurst's theory and its application, The geometry of Plain woven fabrics (Peirce's model), Peirce's approximation theory, Jammed structures, Fabric cover, cover factor and their significance, Relationships between cover and mass per unit area of fabric, Crimp interchange equation.

UNIT-IV

Geometrical changes during tensile loading: Determination of Poisson's ratio and modulus.
Fabric geometry of non-circular cross-sections: Kemp's Race track theory, Peirce's elliptical model.

The yarn path in woven fabrics and inter-yarn forces (Peirce's rigid thread model) and Application of Peirce's geometry for other weaves.

Suggested Reading List:

Title	**Author**
Structural mechanics of fibers, yarns, and fabrics	J. W. S. Hearle, P.
Grosberg, S. Backer The structure of yarn	W. Zurek
Structure and Mechanics of textile fibrous assemblies	P. Schwartz
Cloth Geometry	F. T. Peirce, J.
R. Womersley (Journal of the Textile Institute Transactions, 1937, pp. T45- T112)	
Woven textile structure, Theory and applications	B. K. Behera, P. K. Hari

Course Outcomes:
After completion of the course, students will be able to:

- understand the concept of yarn geometry and the arrangement of fibers inside the yarn
- predict the mechanical response of yarn
- comprehend the design of fabric using fabric geometry

Course code	PEC-TT-308G				
Category	Professional Elective Course (PEC-III)				
Course Title	Modeling and Simulation of Fibrous Assemblies				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Mathematics-I**,** Applied statistics and operation research, Fabric Manufacture-I, Yarn Manufacture-I.

Course Objectives:

- To familiarize the students about the utility of models
- To familiarize the students about the simulation techniques for fibrous assemblies.
- Understanding the basic aspects of probability theory and its application in random fibrous assemblies
- Understanding the principle and mechanism of heat and fluid flow in fibrous assemblies

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

The Modeling and Simulation Process: Opening Perspectives, Role of modeling and simulation, Nature of a model, Types of models, Concept of simulators. The observation interval, Entities and their interactions, Time and other variables. Poisson’s process, Markov process and Markov chain.

UNIT-II

Stochastic Model: Basics of probability tools; Stochastic independence; Expectations of random variables; Probability distribution functions; Application for random fibrous assemblies, anisotropy characteristics in fibrous assemblies, two and three dimensional fibrous assemblies.

Curve fitting techniques: Linear and nonlinear curve fitting techniques; Prediction of mechanical properties of fibrous assemblies, process-structure-property relationship of fibrous structures.

UNIT-III

Fluid Dynamics: Fluid and its characteristics; One, two and three dimensional flows; Concept of Newtonian and Non-Newtonian Fluids and their applications in extrusion processes; Concept of fluid flows through porous materials, heat and mass transfer in fibrous assemblies; Concept of basic flow analysis techniques.

Finite Element Analysis: Basic concept of the finite element and finite difference method; A general procedure for finite element analysis; Application of one dimensional conduction problem.

UNIT-IV

Simulation: Simulation models; Monte Carlo simulation and its application for random fibrous assemblies; Application of simulation using Matlab.

Multiscale Modeling: Geometrical modeling of textile structures; Prediction of properties of fibrous assemblies. Predictions of fabric drape using polar co-ordinate model.

Suggested Reading List:

Title	**Author**
Structure and Mechanics of textile fibrous assemblies	P. Schwartz 3-D fibrous
assemblies	Jinlian Hu
Engineering textiles	Y. E. Ei Mogahzy
Probaility, Random variables and stochastic processes	A.
Papoulis, S. U. Pilai The structure of yarn	W.
Zurek	
Cloth Geometry	F. T. Peirce & J.
R. Womersley (Journal of the Textile Institute Transactions, 1937, pp. T45- T112)	
Woven textile structure, Theory and applications	B. K. Behera & P. K. Hari

Course Outcomes:

After completion of the course, students will be able to:

- understand the concept of models and the application in fibrous assemblies
- predict the mechanical response of fibrous assemblies
- comprehend the fabric design using simulation

Course code	PEC-TT-309G				
Category	Professional Elective Course (PEC-III)				
Course Title	Sustainable Textile Production				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Textile Raw Material, Yarn Manufacture, Fabric Manufacture, Garment Manufacturing

Course Objectives:

- This subject will aware on the varied environmental challenges of our time and develop practical and sustainable solutions.
- This subject will also help to understand the consumption of energy at different levels of textile production.
- This subject will helps to learn the environmental aspect of energy sources developed, leveraged, regulated, and financed while assessing trends in energy and cultivating sound environmental policies.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Sustainability: Definition, Overview of energy consumption pattern and its assessment, Assessment of environmental impacts, Concept of greenhouse gas emission and its impact on environment.

Renewable energy: Fossil fuel based energy and its impact on environment, Renewable energy sources and its future prospect.

UNIT-II

Sustainability in yarn manufacturing: Environmental impact of yarn manufacturing, Sustainable practices at different stage of yarn manufacturing, Sustainability for ring, rotor and air-jet spinning system, Waste management in spinning, recent trends in energy usages.

Sustainability in fabric manufacturing: Energy consumption in fabric manufacturing, Energy conservation techniques in fabric manufacturing, Noise pollution and its control in fabric manufacturing, Solid waste problem, Wastewater generation and its control in fabric manufacturing.

UNIT-III

Sustainability in textile chemical processing: Textile dyes used in the textile chemical processing and its impact on environment, Energy consumption in textile chemical processing, Sustainable approaches in effluent treatment.

Sustainability in garment manufacturing: Energy consumption in different phase of garment manufacturing, circular economy in fashion, Garment life cycle.

UNIT-IV

Recycling of textile products: Quantity of waste generated from the textile industry, Textile waste management, Current situation of textile recycling (global scenario), Textile recycling technologies, Factors influencing fabric waste recycling process, Fabric wastes valorization, Challenge of textile recycling.

Sustainable raw materials: Ecological footprint of the fibers, Sustainable raw materials, Recycling of plastics into textile raw materials and products.

Suggested Reading List:

Title	**Author**
Sustainable Technologies for Fashion and Textiles, Woodhead	R. K. Nayak
Principles of Sustainable Energy, CRC Press, 2011.	F. Kreith
and J. Kreider Sustainable Fibres and Textiles, Woodhead, UK	S. Muthu

Course Outcomes:

After completion of the course, students will be able to:

- understand the concept of environmental problems due to the manufacturing of textile products.
- learn the power consumption pattern in different stages in apparel production.
- comprehend the waste management skills and recyclability of the textile products.

Course code	OEC-TT-306G				
Category	Open Elective Course (OEC-III)				
Course Title	Advanced Textile Testing				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Textile Testing.

Course Objectives:

- To familiarize the students about statistical techniques relevant to testing and quality control.
- To familiarize the students about commonly used advanced testing equipment related to fibre and yarn testing.
- Comprehending the concept of fabric handle and clothing comfort and their assessment methods.
- To familiarize the students about specific tests like fabric dimensional stability, water absorbency and repellency, and flammability.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Significance testing of means and dispersion, determination of number of tests, test of goodness of fit. Analysis of Variance: Introduction, One-way and Two-way analysis of variance.

Statistical quality control: concept of control chart, definition of limits, interpretation of control charts; $\overline{X}$-chart, R-chart, np-chart, p-chart and c-chart.

UNIT-II

Principle and working of advanced testing instruments related to fibre and yarn testing.

Flammability testing of fabrics: importance, terms and definitions related to flammability properties of textile materials, standard test methods.

UNIT-III

Fabric dimensional stability: Types of fabric dimensional changes and measurement methods.

Fabric Handle: Concept of fabric handle; Subjective evaluation of fabric handle – Primary Hands and Total Hand Value; Objective evaluation of fabric handle: Kawabata Evaluation System for Fabrics – different instruments, parameters measured and analysis of data, primary hand values and total hand value; FAST system – different instruments/method and measured/calculated parameters.

UNIT-IV

Thermo-physiological clothing comfort: Concept and different aspects of thermo-physiological comfort. Thermal properties of fabrics – terms and definitions, principle of operation of standard instruments like togmeter, guarded hot plate, sweating guarded hot plate, thermal and sweating thermal manikins. Liquid moisture transport through fabrics – concept and importance of wicking, longitudinal and transverse wicking and their measurement methods.

Water absorption and water repellency: importance and common measurement methods.

Suggested Reading List:

Title	**Author**
Physical Testing of Textiles	B. P. Saville
Fabric Testing	Jinlian Hu
Advanced Characterization and Testing of Textiles	Dolez,
Vermeersch & Izquierdo Principles of Textile Testing	J. E. Booth

Statistics for Textile Engineers J. R. Nagla Practical Statistics for the Textile Industry, Vol-I & II G. A. V. Leaf

Course Outcomes:

After completion of the course, students will:

- be able to apply common statistical methods to analyse test data.
- be familiar with the working of common advanced testing instruments related to fibre and yarn testing.
- be familiar with the concept of fabric handle and clothing comfort and their assessment.
- be familiar about specific tests like fabric dimensional stability, water absorbency and repellency, and flammability.

Course code	OEC-TT-307G				
Category	Open Elective Course (OEC-III)				
Course Title	Statistics for Textile Engineers				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Applied Statistics & Operation Research, Textile Testing.

Course Objectives:

- To familiarize the students about the application of statistics in textile industry.
- To familiarize the students about statistical quality control.
- Understanding the basic aspects of sample collection for fabric development.
- Understanding the principle of statistics for the experimental designs.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Basic Statistics: Nature of textile industry, Need for SQC techniques, Methods of data collection, Classification and graphical representations, Measures of central tendency, Measures of dispersion.

Population and Sample: Sampling, Random Samples, Random Numbers, Population Parameters, Sample Statistics, Sampling Distributions, The Sample Mean, Sampling Distribution of Means, Sampling Distribution of Proportions, Sampling Distribution of Differences and Sums, The Sample Variance, Frequency Distributions, Relative Frequency Distributions.

UNIT-II

Curve Fitting, Regression, And Correlation: The Method of Least Squares, The Least-Squares Line, The Least-Squares Regression Line in Terms of Sample Variances and Covariance, Standard Error of Estimate, The Linear Correlation Coefficient, Generalized Correlation Coefficient, Correlation and Dependence.

UNIT-III

Probability Distributions: Multinomial Distribution, Hypergeometric Distribution, Uniform Distribution, Cauchy Distribution, Gamma Distribution, Beta Distribution, Chi-Square Distribution, Student's t Distribution, F Distribution, Relationships among Chi-Square, t, and F Distributions

Analysis of Variance: Introduction, One-way analysis of variance, Two-way analysis of variance.

UNIT-IV

Design of Experiments: Concept of Design of Experiments, Completely randomized design, Randomized block design, Latin square design, Factorial experiments.

Statistical Quality Control: Significance of Control Charts, Process control, Control chart, Interpretation of control chart, Specification limits, X chart, R Chart, np Chart, p Chart, c chart; applications of control chart in textile industry.

Suggested Reading List:

Title **Author**
Statistics for Textile Engineers J. R. Nagla Practical Statistics for the Textile Industry, Vol-I & II G. A. V. Leaf
Applied Statistics and Probability for Engineers D. C. Montgomery
& G. C. Runger Modern Engineering Statistics Thomas P. Ryan

Course Outcomes:

After completion of the course, students will be able to:

- understand the concept of statistical methods used in quality control.
- design experiments for collection of data.
- comprehend the statistical approach for product development and design.

Course code	OEC-TT-308G				
Category	Open Elective Course (OEC-III)				
Course Title	Total Quality Management and Six Sigma				
Scheme and Credits	L	T	P	Credits	Semester-VI
	3	0	0	3	
Branch	Textile Technology				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic concept of management and statistics

Course Objectives:

The objective of this course is to

- impart knowledge about quality management system standard and its requirements.
- familiarize the student on quality audit and preparation of audit report.
- familiarize the student on concept of TQM and TQM tools.
- impart knowledge on Six Sigma and its statistical implication.
- make the student understand the methodology in Six Sigma implementation through D.M.A.I.C approach.
- impart knowledge about Failure Modes and Effects Analysis (F.M.E.A) and determination of R.P.N.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Concept of Quality and Quality Management System (Q.M.S); Overview of Quality Management System Standards. Formulation of Quality Plan in textile industry. Implementation procedure of Q.M.S in an industry. Documentation of quality management system and preparation of Quality manual. Definition of Quality Audit. Procedure of conducting quality audit; Preparation of Audit Report. Benefits of implementing Quality Management System in an organization.

UNIT-II

Concept of Total Quality Management (T.Q.M.). Evolution of T.Q.M. Different views on TQM. Importance of cost of quality. T.Q.M tools example, Quality circle, 5S, J.I.T, Kaizen Concept of Environment Management System (EMS) and its importance in an organization. Method of implementing E.M.S.

UNIT-III

Evolution of Six Sigma concept in industry. Statistical concept of Six Sigma. Key Concepts of process management. Measurement of Process Performance. Causes of variation of output of a process. Determination of Potential process capability index (Cp) and Process capability index (Cpk). Relationship between Cp, Cpk and Sigma level. Idea on C.T.Q. Unified quality level for multi- characteristics rolled throughput yield (RTY). Determination of CTQ. Determination of defects per unit *(*DPU) and defects-per- million opportunities (DPMO).

UNIT-IV

Elements of the Six Sigma framework. Importance of top management commitment and stakeholder's involvement in six sigma. Important methodology in Six Sigma management D.M.A.I.C approach. Activities designing for six sigma. Flow chart and process mapping. Quality function deployment (Q.F.D). Failure modes and effects analysis (F.M.E.A) and determination of R.P.N. Keys for Six Sigma Success.

Suggested Reading List:

Title	**Author**
Total Quality Management	P. N. Mukherjee
Total Quality Management	B. Vijaya Ramnath & R. Kesavan,
Six Sigma for Quality and Productivity	Sung H. Park
ISO series of Standard on Quality management system	International Organization for Standardization

Course Outcomes:

After completion of the course, students will be able to:

- understand the concept of Quality and Quality management system requirements
- understand the concept of Total Quality Management
- get an idea on Six Sigma and its methodology to implement
- understand the methodology in Six Sigma implementation through .D.M.A.I.C approach
- carry out Failure Modes and Effects Analysis (F.M.E.A) and determination of R.P.N

Course code	HSMC-TT/TC/FAE-301G				
Category	Humanities and Social Sciences including Management Courses				
Course Title	Merchandising and Export Management				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Technology, Textile Chemistry, Fashion and Apparel Engg.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic concept of management

Course Objectives:

- To make the students acquainted with various concepts of marketing and different aspects pertaining to marketing which include market segmentation, product life cycle, various stages involved in new product development.
- To make them understand the various pricing strategy and functions of distribution channel.
- To make them understand the importance of export.
- To familiarize them on export procedure, export terms of payment and final assistance provided by government.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Fundamental idea and basic terms and definition in marketing. Definition of marketing. Explanation of various concept of marketing with examples. Types of Marketing: Target marketing and Mass Marketing. Market segmentation. Classification of market based on size. Various stages of new product development and product life cycle.

UNIT-II

Concept and definition of Marketing mix. Variables of market mix: 4Ps Product, Price, Promotion and Place. Distribution channels and various functions performed by the distribution channel. Logistics and its relevance. Promotion mix: various kinds of promotion mix; their scope of applications and their relative merits and demerits. Various factors need to be considered while deciding the price. Pricing decision and strategy.

UNIT-III

Export Management–importance of export. Risk involved in export and remedial measures. Various kind of terms of payment and their relative merits and demerits. Various kinds of document to be prepared and maintained for export. Various steps involved in Export Assistance given for export. Pre shipment and post shipment finance. Common incoterms.

UNIT-IV

Concept and definition of Merchandising. Utility and obsolescence factors in merchandising. Essential qualification criteria of a merchandiser. Types of merchandising. Roles of a merchandiser in an apparel industry. Various activities involved in merchandising: Line Planning, Line Development and Line presentation. Different types of sampling and their importance. Visual Merchandising. Elements of interior, exterior window display, store planning and layout-fixtures, location. Different types of sampling and their importance in merchandising. Brand building: Introduction, strategies, brand expansion, global trends. Introduction to customer relationship.

Suggested Reading List:

Title	**Author**
Marketing Management	Phillip Kotlar
Nabhi's Publication on Export	Govt. Handbook
International Marketing	Hess and Cateora
Export Management	B. S. Rathore

Course Outcomes:

After completion of the course, students will understand:

- the concept of marketing and marketing mix
- the importance and functions of distribution channel
- the use of different promotional tools and their scope of applications
- the various documents required for commercial and legal purpose
- financial assistance provided by government to the exporters and different modes of terms of payment in export business.

Also, the students will be exposed to different components of fashion merchandising and activities involved in product line planning, development and presentation and use of different types of samples during merchandising.

Course code	LC-TT-305G				
Category	Laboratory Course (Professional Core Course)				
Course Title	Spinning Practical-IV				
Scheme and Credits	L	T	P	Credits	Semester–VI
	0	0	2	1	
Branch	Textile Technology				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Yarn Manufacture-III, Spinning Practical-III

Course Objectives:
This practical is designed to impart first-hand experience of change places/features of the latest machineries. This course will also enable to comprehend issues as regards increasing realisation % of output material by controlling waste, determining workload of workers, improving efficiency of machines. The course is also designed to make the students help to understand the causes of faults and their remedies.

Contents: Study of drafting, twisting and winding operations of rotor and air-jet spinning machines; Familiarity with established processing parameters for producing carded, combed, blended, folded and fancy yarns.

Case studies pertaining to waste analysis, estimation of the total productivity, actual efficiency levels and causes of loss of efficiency in different spinning preparatory departments, viz. blowroom, card, comber, draw-frame and simplex; Study of blow-room and card performance; Nep count in card web; Checking of comber waste.

Assessment and control of variability before yarn formation, Practice in handling and setting of the various spinning preparatory machines; Workload measurements in spinning preparatory; Oiling and maintenance schedules; Idea of time and motion study.

List of Experiments:

1. To calculate the number of spinning preparatory machine, workers & accessories required to produce a given quantity of yarn per day.

2. To find out the waste % & its distribution being extracted in a blow-room line in any mill.

3. What is meant by nep count? To find out nep count for two different materials running on four different cards.

4. To estimate the performance of a card in terms of fibre breakage rate.

5. To set the comber for a given noil %.

6. Study of drafting, twisting & winding of Rotor and Airjet spinning machines.

Course Outcomes:

After completion of the course, students will be able to:

- develop ideas to solve burning issues in mills.
- set up machine and process parameters to handle the real problems on shop floor.
- enhance quality of the output material along with productivity.

<table>
<tr><td>Course code</td><td colspan="5">LC-TT-306G</td></tr>
<tr><td>Category</td><td colspan="5">Laboratory Course (Professional Core Course)</td></tr>
<tr><td>Course Title</td><td colspan="5">Weaving Practical-IV</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Fabric Manufacture-III; Weaving Practical-III

Course Objectives:
This practical is designed to impart first-hand experience of the features and in-depth working of rapier, air jet and water jet weaving machines. It also imparts first-hand experience of different selvedge mechanisms. It serves as a bridge between theory and practice.

Contents: Rapier loom: study of salient features, path of weft, different components in the path and their working, weft transfer at shed center, timings, rapier displacement curves, related calculations, colour mixing, rapier drive, settings/operation.

Air jet loom: study of salient features, path of weft, different components in the path and their working, air supply, timings, related calculations, settings/operation.

Water jet loom: study of salient features, path of weft, different components in the path and their working, jet pump and nozzle, timings, related calculations, settings/operation.

Different selvedge mechanisms used in shuttleless weaving machines and their construction, working and structure.

List of Experiments:

1. Rigid Rapier weaving machine: study of salient features, path of weft, different components in the path and their working, weft transfer at shed center, timings, rapier displacement curves, related calculations, colour mixing, rapier drive, settings/operation.

2. Flexible Rapier weaving machine: study of salient features, path of weft, different components in the path and their working, weft transfer at shed center, timings, rapier displacement curves, related calculations, colour mixing, rapier drive, settings/operation.

3. Air jet weaving machine: study of salient features, path of weft, different components in the path and their working, air supply, timings, related calculations, settings/operation.

4. Water jet Weaving Machine: study of salient features, path of weft, different components in the path and their working, jet pump and nozzle, timings, related calculations, settings/operation.

5. Study of construction, working and structure of selvedge mechanisms used in shuttleless weaving machines.

Course Outcomes:

After completion of the course, students will be able to:

- correlate between theory and practice of the concept of rapier, air jet and water jet weft insertion mechanisms.
- visualise the working of rapier, air jet and water jet weaving machines and comprehend their settings and operation.
- visualise the mechanisms of different selvedge formation techniques.
- develop practical skills relevant to industrial practice.

<table>
<tr><td>Course code</td><td colspan="5">LC-TT-307G</td></tr>
<tr><td>Category</td><td colspan="5">Laboratory Course (Professional Core Course)</td></tr>
<tr><td>Course Title</td><td colspan="5">Pattern Making and Garment Construction Lab.</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre-requisites: Textile raw materials, yarn formation, woven & knitted fabrics.

Course Objectives:
This Laboratory course is designed to impart first-hand experience of features, layout, mechanisms of pattern making, and sewing machines their settings. It also helps students practically understand in- depth working of basics of sewing operations and stitching of garments.

Contents: Introduction to garment manufacturing steps, different work aids, tools and equipments commercially used in pattern making &garment construction– functions and applications.

Overview of different pattern types – sloper, design pattern, production pattern & drafting of patterns - child’s basic block, adult bodice blocks, sleeves as set-in, puff, raglan, flared,leg’o’mutton, & collars as peter-pan, sailor, mendarin and shirt collars.

Preparation of pattern layout for different fabric types- directional, symmetrical, asymmetrical and plaids.

Functions and components of sewing machineries, thread passage, sewing elements – needle, sewing thread and packages, practice working of SNLS machine on paper & fabric.

Identification of different seam & stitch classes & sample preparation. End article development using machine stitches & seams.

Application of different trims and components - identification & designing using different trims & notions.

An overview of fusing and pressing equipment in apparel industry.

List of Experiments:

1. Study of sewing machines.

2. Study of different sewing machine parts.
3. Study of sewing machine setting, SPI.
4. Study of Basic blocks.
5. Developing basic blocks.
6. Adapting basic blocks.
7. Identification of fitting problems.
8. Drafting of flat patterns.
9. Construction of flat patterns of different sizes.
10. Designing of different garments.
11. Construction of garments – men's wear, women's wear, kid's wear.
12. Handling of different fabrics.
13. Analysis of different garments.
14. Study of different parts of garments.
15. Study of different operational stitches of garments.
16. Study of Sleeves.

Course Outcomes:

After completion of the course, students will be able to:

- understand practically the concepts of basic blocks and developing blocks.
- prepare patterns for garment construction.
- analyse garments and different parts of garments.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Textile Chemistry)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Textile Chemistry) – 5th Semester
w.e.f. 2020-21

S N.	Category	Course Code	Course Title	Hours per week			Total Contact hrs /week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assesment	External Examination	Practical	Total	
1	Professional Core Course	PCC-TC-301G	Technology of Dyeing	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-TC-302G	Textile Printing	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-TT/TC/FAE-303G	Textile Testing	3	0	0	3	3	25	75		100	3
4	Professional Elective Courses	PEC-I	Elective-I	3	0	0	3	3	25	75		100	3
5	Open Elective Courses	OEC-I	Open Elective-I	3	0	0	3	3	25	75		100	3
6	Open Elective Courses	OEC-II	Open Elective-II	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-TC-301G	Dyeing Lab-I	0	0	2	2	1	25		25	50	3
8	Professional Core Course	LC-TC-302G	Textile Printing Lab	0	0	2	2	1	25		25	50	3
9	Professional Core Course	LC-TT/TC/FAE-303G	Textile Testing Practical	0	0	2	2	1	25		25	50	3
TOTAL CREDITS								**21**				**750**	

S.No.	Category	Course Code	Name of the Course	Preferred Semester
Elective-I				
1.	PEC-I	PEC-TC-302G	Chemical Processing of Unconventional Textile Materials	V
2.		PEC-TC-303G	Chemical Processing of Woollen Textiles	V
3.		PEC-TT/TC-301G	Post Extrusion Operations	V
Open Elective-I				
1.	OEC-I	OEC-TC-301G	Textile Design	V
2.		OEC-TC-302G	Textile Colour and Design Concept	V
3.		PEC-TT-303G	Waste Management & Pollution Control	V
Open Elective-II				
1.	OEC-II	OEC-TT/TC-303G	Garment Manufacturing Technology	V
2.		OEC-TT/TC-304G	Apparel Quality Evaluation and Standards	V
3.		OEC-TT/TC/FAE-305G	Introduction to Fashion and Apparel Industries	V

Scheme of Studies and Examination
B.TECH (Textile Chemistry) – 6th Semester
w.e.f. 2020-21

S N.	Category	Course Code	Course Title	Hours per week L	T	P	Total Contact hrs/week	Credit	Examination Schedule (Marks) Internal Assesment	External Examination	Practical	Total	Duration of Exam (Hours)
1	Humanities and Social science including Management courses	HSMC-TT/TC/FAE-301G	Merchandising & Export Management	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-TC-304G	Processing of Synthetics & Blends	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-TC-305G	Textile Finishing	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-TC-306G	Textile Processing Machinery	3	0	0	3	3	25	75		100	3
5	Professional Elective Course	PEC-II	Elective-II	3	0	0	3	3	25	75		100	3
6	Open Elective Courses	OEC-III	Open Elective-III	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-TC -304G	Dyeing Lab-II	0	0	2	2	1	25		25	50	3
8	Professional Core Course	LC-TC-305G	Characterisation and Evaluation of Dyed & Finished Textiles	0	0	2	2	1	25		25	50	3
9	Professional Core Course	LC-TC-306G	Technical Analysis Lab	0	0	2	2	1	25		25	50	3
TOTAL CREDITS								**21**				**750**	

Note: At the end of 6th semester each student has to undergo Practical Training of 6 weeks in a Mill/Industry and submit typed report along with a certificate from the organization & its evaluation shall be carried out through viva in the 7th Semester.

S.No.	Category	Course Code	Name of the Course	Preferred Semester
Elective-II				
1.	PEC-II	PEC-TC-304G	Textile Chemical Testing	VI
2.		PEC-TC-305G	Textile Auxiliaries	VI
3.		PEC-TC-306G	Chemistry of Dyes	VI
Open Elective-III				
1.	OEC-III	OEC-TC-306G	Garment Processing & Quality Control	VI
2.		PEC-TT-305G	Structure and Properties of Fibres	VI
3.		OEC-TC-307G	Coating & Laminating of Textiles	VI

PCC–TC–301G Technology of Dyeing

Course code	**PCC–TC–301G**				
Category	Professional Core Course				
Course title	Technology of Dyeing				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge the chemistry of fibres and their properties Also some fundamental knowledge of organic chemistry

Course Objectives:

1. To provide basic knowledge of different types of colourants used for textile colouration.
2. To familiarize students with the basic concept of dyeing with various terms used in dyeing.
3. To familiarize students with the different types of machineries involved in natural fibre dyeing.
4. To make students learn about dyeing of cellulosic and protein fibres with different classes of colouring materials.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to coloring materials and their classifications. Nomenclature of dyes: Colour Index and Commercial names. Basic concept of dyeing with various terms used in dyeing: Concept of percentage shade, MLR, exhaustion, etc. Introduction to various methods of dyeing: Batch, Semi-continuous and Continuous dyeing. Different types of dye-fiber interactions.
Dyeing machineries: Loose fibre, yarn and package dyeing machines. Jigger, Winch dyeing machines and Padding mangles.

UNIT-II

Direct dyes- Mechanism of direct dyeing, factors affecting the dyeing process: electrolytes, temperature and liquor ratio. Application process for direct dye on cellulosic textiles and after treatments to improve wash fastness.
Reactive dyes – Introduction and types of reactive dyes. Dyeing mechanism and Application methods for Chlorotriazine and Vinylsulphone based reactive dyes. Reactivity & Affinity of reactive dyes and the concept of hydrolysis. Study the influence of process parameters. Batch and continuous application techniques for reactive dyeing. Concept of bi and multi functional dyes. Reactive dyes for non-cellulosic substrates.

UNIT-III

Vat dyes - Introduction, commercial vat dyes and forms, concept of vatting and particle size. Classification of vat dyes, principles and application of vat dyes. Leuco-vat, Pigment padding, Semi pigmentation and Vat-acid processes. Concept of Indigo dyeing of Denim & its continuous range.
Indigosols (Solubilized vat) dyes: Principle and technology of dyeing with solubilized vat dyes. Sulphur dyes - General considerations of sulphur colours, classification based on dissolution and application techniques. Reduction and oxidation process of sulphur dyes. Bronziness of shades and sulphur black tendering- causes and remedies.

UNIT-IV

Principles and technology of dyeing with Pigments, Oxidation colours (Aniline Black) and Mineral colours (Mineral Khaki).
Azoic colours – Introduction to Azoic colours, methods of dissolution for naphthols, concept and process of diazotization, coupling reaction.
Dyeing of protein fibres: Wool and Silk with Acid, Metal-complex (1:1 and 1:2) and Mordant dyes. Classification of these dyes, their mechanisms of action and effect of process parameters.

Reading List

Title	**Author**
Fundamentals and Practices in Coloration of Textiles	J N
Chakraborty Technology of Dyeing	V A
Shenai	
Dyeing and Chemical Technology of Textile Fibres	E
R Trotman Silk Dyeing, Printing and Finishing	
M L Gulrajni	
Denim-A Fabric for All	Parmar

Course Outcomes:

At the end of the course, the students will be:

1. familiar with types of colouring materials for textiles and suitability of dyes for different fibres
2. having the basic idea of dyeing and also different techniques of dyeing
3. familiar with the different types of machineries involved in natural fibre dyeing
4. Able to explore the applications of different class of dyes on natural (cellulosic and protein) fibres.

PCC-TC-302G Textile Printing

<table>
<tr><td>Course code</td><td colspan="5">PCC-TC-302G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Textile Printing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Knowledge of Introduction to Textile Processes

Course Objectives:
1. Concept of printing and various styles of printing.
2. Various ingredients of printing paste and recipes involved in printing.
3. Overview of various machines involved in printing of textiles.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Definition of Printing. Composition of printing paste. Printing ingredients and their function. Methods of printing viz block, roller, screen and transfer printing. Design making and screen exposing. Table, flatbed and rotary screen printing.

UNIT-II

Styles of printing, i.e. direct, discharge and resist. Various discharging and resisting agents. Special effects like Batik, Tie and dye etc. Printing of cellulosics with Direct and Azoic colours.

UNIT-III

Printing with vat, solubilised vat, aniline black, reactive, acid and metal complex dyes in different styles.

UNIT-IV

Pigment printing. Transfer printing: advantages, disadvantages, machinery, paper printing, dyes in context to cotton and polyester. Methods of print fixation. Machines used in print drying, print-fixation and washing.

Reading List

Title	**Author**
Technology of Printing	V A Shenai
Textile Printing	LWC Miles

Course Outcomes:

At the end of course students are able to:

1. Understand textile printing process and its various styles.
2. Use of various printing paste ingredients and recipes for printing.
3. Understand machine involved in textile printing.

PCC-TT/TC/FAE-303G Textile Testing

<table>
<tr><td>Course code</td><td colspan="5">PCC-TT/TC/FAE-303G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Textile Testing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology/Textile Chemistry/Fashion & Apparel Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic knowledge of textile fibres, yarns and fabrics.

Course Objectives:
1. To familiarize the students about the importance, concept and techniques of sampling
2. To familiarize the students about important fibre, yarn and fabric dimensions and characteristics and their measurement techniques
3. Comprehending the mechanical behavior of textile materials and its evaluation methods
4. To familiarize the students about the evaluation methods of colour fastness
5. To familiarize the students about common types of garment testing

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to textile testing - aim and scope. Sampling and Sampling techniques: General requirements; fibre, yarn and fabric sampling techniques.
Measurement of fibre dimensions and characteristics, viz. length, fineness, cotton maturity, neps and trash including principle and operation of equipment in common use.
Relation between R.H. and moisture regain of textile materials; equilibrium regain, hysteresis. Measurement of moisture regains. Official regain and concept of correct invoice weight.

UNIT-II

Measurement of yarn dimensions and characteristics: yarn count/diameter, twist and hairiness including principle and operation of equipment in common use.

Yarn evenness: Terms and definitions, nature of irregularities. Principles and methods of evenness testing, variance-length curves and their interpretation.
Test methods for fabric dimensional and other physical properties like, thickness, weight, crimp, bending and drape including principle and operation of equipment in common use.

UNIT-III

Mechanical behaviour of textiles: Terms and definitions, expression of results, quantities and units. Experimental methods: Principle of CRL, CRT and CRE type tensile testing machines. Fibre strength testing – single fibre strength and bundle strength. Yarn strength testing – single yarn strength and lea strength. Fabric strength testing - tensile, tearing and bursting strength tests. Principle and operation of equipment in common use.
Measurement of fabric abrasion resistance and evaluation of results; measurement of fabric pilling and crease recovery.

UNIT-IV

Measurement of fabric air permeability and water vapour permeability. Introduction to fabric handle.
Introduction to fastness properties of dyed and printed textiles - evaluation methods of colour fastness to Laundering, Crocking, Sunlight, Perspiration, Dry-cleaning and Hot Pressing.
Garment Testing: Testing of Seam Strength, Seam Slippage, Seam Puckering, Button Strength and Zipper or Closer Strength.

Suggested Reading List:

Title	**Author**
Principles of Textile Testing	J E Booth
Physical Testing of Textiles	B P Saville
Fabric Testing	Jinlian Hu
Physical Properties of Textile Fibres	W E Morton & J W S Hearle
Textile Fibres, Yarns and Fabrics	E R Kaswell

Course Outcomes:

After completion of the course, students will be:

1. Able to understand the concept of sampling and sampling techniques for testing of textile materials.
2. Familiar with the important fibre, yarn and fabric dimensions and characteristics and their measurement techniques.
3. Familiar with the mechanical behavior of textile materials, different related terms and principles, and its evaluation methods.
4. familiar with the evaluation methods of colour fastness
5. familiar with the common types of garment testing

LC–TC–301G Dyeing Lab-I

<table>
<tr><td>Course code</td><td colspan="5">LC–TC–301G</td></tr>
<tr><td>Category</td><td colspan="5">Laboratory Course (Professional Core Course)</td></tr>
<tr><td>Course title</td><td colspan="5">Dyeing Lab-I</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic knowledge of fibres chemistry and their properties

Course Objectives:

This Lab course is designed to impart first-hand experience of cellulosic fabric dyeing with different types of colorants thus serving as a bridge between theory and practice.

Contents

Introduction to experimental dyeing, commercial dye nomenclature and colour Index. Effect of salt concentration and M/L ratio on exhaustion of direct dyes. Effect of after treatments on wash fastness of direct dyes. Dyeing of cotton and rayon with various dyes - direct, azoic, reactive, sulphur, vat and indigosol. Effect of various fixation methods for reactive dyeing. Pigment dyeing. Dyeing of wool and silk with acid, metal complex and mordant dyes.

List of Experiments

1. Dyeing of the cotton fabric with direct dyes in open bath beaker dyeing machine.
2. Different after treatments on Direct dyed fabric.
3. Dyeing of cotton yarn with hot brand reactive dyes.
4. Dyeing of the cotton fabric with cold brand reactive dyes.
5. Dyeing of cotton fabric with different padding methods like cold pad batch, pad bake and pad steam.
6. Dyeing of cotton with Vat Dyes.
7. Dyeing of cotton with Solublized vat Dyes.
8. Dyeing of cotton with Azoic colours
9. Dyeing of cotton fabric with Sulphur Dye.

10. Dyeing of wool and silk with Basic Dye.
11. Dyeing of wool and silk with Acid Dye.
12. Dyeing of wool and silk with Metal-complex Dye.
13. Dyeing of cotton with Mineral Khaki.
14. Application of pigment colour to textile materials.

Course Outcomes:

1. To understand basic concept of dyeing of cotton fabric direct dye and it’s after treatment.
2. Different methods of dyeing cotton fabric with reactive dyes.
3. Dyeing of cotton fabric with vat and sulphur dyes.
4. Dyeing of wool and silk fabrics with different class of dyes.
5. To understand the application of pigments over textiles.

LC–TC–302G Textile Printing Lab

<table>
<tr><td>Course code</td><td colspan="5">LC–TC–302G</td></tr>
<tr><td>Category</td><td colspan="5">Lab Course (Professional Core Course)</td></tr>
<tr><td>Course title</td><td colspan="5">Textile Printing Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic knowledge of textile printing process.

Course Objectives:

This Lab course is designed to impart knowledge of printing processes as a bridge between theory and practice.

List of Experiments

1. Direct style of printing of Direct Dyes on cotton
2. Direct style of printing of Reactive Dyes on cotton
3. Direct style of printing of Reactive Dyes on cotton with various types of thickeners
4. Direct style of printing of Vat Dyes cotton
5. Direct style of printing of Azoic colours on cotton
6. Direct style printing on Polyester with Disperse dyes
7. Direct style printing on Wool with Acid and Direct dyes
8. Direct style of printing of Pigments on cotton and polyester
9. Discharge style of printing – white discharge under direct dyed ground
10. Discharge style of printing – white discharge under Reactive dyed ground
11. Discharge style of printing – Vat discharge under direct dyed ground
12. Discharge style of printing – pigment under reactive dyed ground
13. Resist style of printing – White resist under reactive dyed ground
14. Special print effect – Tie and Dye style of printing
15. Special print effect – Batik style of printing
16. Special print effect – burnt out/brasso style of printing

Course Outcomes:

1. To familiarize the students with various machinery and process involve in printing process.
2. To understand the function of different chemicals in printing process.
3. To learn preparation of various recipes for printing.

LC–TT/TC/FAE–303G Textile Testing Practical

Course code	**LC–TT/TC/FAE–303G**				
Category	Laboratory Course (Professional Core Course)				
Course title	Textile Testing Practical				
Scheme and Credits	L	T	P	Credits	Semester–V
	0	0	2	1	
Branch	Textile Technology/Textile Chemistry/Fashion & Apparel Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of textile fibres, yarns and fabrics, Textile Testing.

Course Objectives:

1. To impart first-hand experience of the procedures of basic testing of fiber, yarn, fabric and garment.
2. To learn presentation of test results in a suitable manner.
3. To impart first-hand experience of test result analysis.
4. It serves as a bridge between theory and practice.

List of Experiments:

1. Measurement of trash content in raw cotton
2. Measurement of fiber fineness by whole fiber method
3. Measurement of fiber fineness by airflow method
4. Measurement of fiber length parameters by Baer Sorter
5. Determination of fiber bundle strength using Pressley fiber bundle strength tester
6. Determination of fiber bundle strength using Stelometer
7. Measurement of yarn twist
8. Measurement of linear density of sliver, roving and yarn
9. Measurement of C.S.P value of yarn
10. Measurement of fabric tensile properties
11. Measurement of fabric tearing strength
12. Evaluation of washing and rubbing fastness properties of dyed fabrics
13. Evaluation of seam properties (Seam strength and Seam Slippage)

Course Outcomes:

After completion of the course, students will be able to:

1. Correlate between theory and practice of the concept of textile testing.
2. Conduct basic testing of fiber, yarn, fabric and garment.
3. Present the results in graphical and tabular manner.
4. Analyze the results from the tests.
5. Develop practical skills relevant to industrial practice.

PEC–TC–302G Chemical Processing of Unconventional Textile Materials

Course code	PEC-TC–302G				
Category	Professional Elective Course				
Course title	Chemical Processing of Unconventional Textile Materials				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of textile raw materials and elementary idea of textile chemical processing

Course Objectives:

1. To discuss the chemical processing of Knit goods with technical details of machinery.
2. To explain the chemical processing Denim fabric including dyeing and finishing.
3. To explain process and machines used for terry towel and carpet products.
4. To discuss processing of Jute and Linen fabrics.
5. To discuss the processing route of spandex containing materials.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Knit Goods Processing

Basic concept of knitting: warp knits, weft knits, courses, wales, stitch and loop density. Factors to be considered in knit processing. Process sequences in tubular and open width form processing. Pre-treatment like singeing, scouring, bleaching and mercerization. Dyeing with direct, reactive, vat and sulphur using winch and soft flow dyeing machines. Finishing of knit goods: Hydro-extraction and slitting, drying and compacting. Faults in knit goods.

UNIT-II

Processing of Denim

Introduction to denim, types of Denim fabrics, chemistry and process of warp dyeing with indigo. Indigo dyeing equipments. Dyeing with mixture of indigo and other dyes. Finishing of Denim Fabrics and Garments. Quality and process control in wet processing.

UNIT-III

Terry Towel Processing

Process sequence and machines used for terry towel manufacturing, essential properties of terry towel fabrics like pile properties, water absorbency. Type and application of terry fabrics. Different stages of towel processing and finishing. Common defects in terry fabrics.

UNIT-IV

Jute and Linen Processing

General properties and uses of jute and linen fibres. Their pre-treatment and dyeing processes. Woollenisaion of jute.

Processing of Fabric containing spandex

Brief introduction of properties and uses of spandex fibres and blends. Wet processing of Cotton/ Spandex, Viscose/Spandex, Nylon/Spandex, Polyester/Spandex fabrics. Finishing of warp knits containing spandex fibres.

Reading List

Title	**Author**
Processing of cotton knitted fabrics	M. Chakraborty, Amit Dayal and
M L Gulrajni Denim a Fabric for All	Parmar
Manufacturing of Terry Towel	Subhash J. Patil
Interior Furnishing	Mortimer O'shea, Textile Progress, Vol. 11,
No. 1	
Textile Printing	L W C Miles

Course Outcomes:

At the end of the course, the students will be:

1. Explain processing, precaution and details of Knit goods
2. Explain processing and finishing of Denim fabric and garments
3. Explain the processing of terry towel and carpet product
4. Explain the complete chemical processing of jute and linen fabrics
5. Able to understand the chemical processing of Spandex containing textile materials.

PEC–TC–303G Chemical Processing of Woollen Textiles

Course code	PEC-TC–303G				
Category	Professional Elective Course				
Course title	Chemical Processing of Woollen Textiles				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Knowledge of physical and chemical properties of wool fibre and elementary idea of textile chemical processing

Course Objectives:

1. To discuss the different varieties of wool and the impurities present in them.
2. To explain pre-treatments associated with woollen textiles.
3. To discuss dyeing of woollen materials with different class of dyes.
4. To discuss the finishing processes involved in woollen textiles.
5. To explain the chemical processing of woollen and their blended textiles.
6. To make students learn about new and innovative product with wool and their application.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Different varieties and quality of wool fiber, impurities in wool. Scouring and bleaching of wool fibers, machines for wool scouring, bleaching. Processing of woollens and worsted. Milling, crabbing and super contraction.

UNIT-II

Dyeing of woollen materials in loose fiber form, tops, hanks and fabric. Dyeing with various classes of dyes viz. acid, metal complex, chrome dyes, reactive dyes, natural dyes.

UNIT-III

Finishing of woollen materials, application of various finishes viz. blowing, KD process, rotary press, paper press, London shrinkage. Shrink proofing of wool. Flame retardant finish on woollen materials. Processing of wool blends e.g. wool cotton, polyester wool.

UNIT-IV

New wool products and applications, Improving the whiteness and photostability of wool, Enhancing wool products using nanotechnology, Wool performance apparel for sport, High- performance wool blends; Intelligent wool apparel, Application of wool keratins ranging from industrial materials to medical devices.

Reading List

Title	**Author**
Dyeing and Chemical Technology of Textile Fibers	E.
R. Trotman Textile Processing and Properties	
	Vi
go	
Finishing of woollen material	A. R. Brady
Textile fibers and their uses	K. P. Hess
Chemical Processing of Polyester and its Blends	R.M. Mittal & Trivedi
Advances in Wool Technology	N.A.G. Johnson and I.M.
Russell	

Course Outcomes:

At the end of the course, the students will be:

1. Able to understand the different varieties of wool with their chemical composition.
2. Able to explain the pre-treatments associated with woollen textiles.
3. Able to understand the dyeing of woollen textiles materials with different class of dyes.
4. Able to explain the finishing processes involved in the woollen textiles.
5. Able to understand the chemical processing of woollen and their blended textiles.
6. Aware about innovations in wool and how these can be used to design different products made from wool.

PEC–TT/TC–301G Post Extrusion Operations

<table>
<tr><td>Course code</td><td colspan="5">PEC-TT/TC–301G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Post Extrusion Operations</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology, Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Man-made fibre production

Course Objectives:

The course is designed to impart the following:
1. Basic concepts of drawing of filaments.
2. Basic concept of setting.
3. Basic concept of texturizing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Drawing: Objectives, neck drawing of filaments, NDR, MDR and LDR; Drawing of polyester and nylon; Spin-draw process; Various parameters of drawing and their effects on structure and properties of filaments.
Heat setting process: Nature of set, mechanism of setting; Various parameters of heat-setting and their influence on structure and properties of filaments; Thermal healing; Settability and measurement of degree of set.

UNIT-II

Texturing process: Principle of texturing; Types of texturing processes; Principle and brief description of stuffer box crimping, Edge crimping, Knit-de-knit texturing; Manufacturing of BCF and Hi-bulk yarns.

UNIT-III

Twist texturing principle; Material, machine and process variables affecting structure and properties of twist textured yarns; Faults in twist textured yarns and their remedies; Evaluation of twist textured yarns.

UNIT-IV

Air-jet texturing: Principles and mechanism of air-jet texturing; Material, machine and process variables affecting structure and properties of the air-jet textured yarn; Different types of jets, baffle elements and their description; Properties of air-jet textured yarns and their importance; Evaluation of air-jet textured yarns.

Suggested Reading List:

Title	**Author**
Manufactured Fibre Technology	Gupta & Kothari
Modern Yarn Production	G R Wray
Yarn Texturing Technology	Hearle, Hollick & Wilson

Course Outcomes:

After completion of the course, students will be able to:

1. understand the essential requirements for drawing of filaments.
2. comprehend the basics of temporary and permanent setting.
3. get familiarised with manufacturing techniques of texturizing.

OEC–TC–301G Textile Design

<table>
<tr><td>Course code</td><td colspan="5">OEC-TC–301G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Textile Design</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basics of woven fabric formation.

Course Objectives:
1. To understand the basic concepts of textile design.
2. To impart knowledge of different types of basic weave designs and their derivatives.
3. To impart knowledge of different types of decorative weave designs.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Importance of textile design: Identification of warp and weft in the fabric, classification of woven fabrics. Methods of fabric representation. Basic elements of woven design: Weaving Plan, Drafting Plan & Lifting Plan. Different types of drafting plans. Construction of plain weave and its derivatives, ornamentation of plain weave.

UNIT-II

Twill weave and its derivatives. Sateen /satin weaves. Stripe and check effects by combination of two weaves.

UNIT-III

Diamond weaves, Crepe weaves, Cork screw weaves, Bedford cord, Warp pile and weft pile fabrics.

UNIT-IV

Welts and Pique structures, Mock leno, Huckaback, Honeycomb structures and Double cloth.

Suggested Reading List:

Title	**Author**
Watson's Textile Design & Colour	Z J Grosicki
Fabric Structure and design	N Gokarneshan.
Watson's Advanced Textile Design	Z J Grosicki
Structural Fabric Design	J W Klibbe

Course Outcomes:

After completion of the course, students will:

1. Have the knowledge of fabric structure and weave designs.
2. Be able to identify and design different types of weave designs along with drafting, denting and lifting plans.

OEC–TC–302G Textile Colour & Design Concept

Course code	OEC-TC–302G				
Category	Open Elective Course				
Course title	Textile Colour & Design Concept				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Textile raw materials, yarn formation, woven & knitted fabrics

Course Objectives:

1. To familiarize the students with the role of colour theories in Textile and Apparels.
2. To understand the Colour combination techniques in fabric and garments.
3. To familiarize with the contribution of composition of designs and Geometric ornamentation in Textile and Apparel production.
4. To understand the patterns, symmetry procedure followed in Textile and Garment products.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT – I

Concept and specifications of colour, Light and colour phenomenon, Additive and Subtractive combinations, Colour theories as light theory, pigment/ Brewster colour theory. Colour wheel – primary, secondary, sub-secondary and tertiary colours, Rainbow colours. Colour combination techniques in fabric and garments. Psychological effects of colour, Warm and Cool colours. Colour harmony. Definition of Colour as per C.I.E., Tristimulus value, Hue and Chroma; Color gamut

UNIT – II

Colour combination techniques in fabric and garments. Colour contrast in fabric and garments. Application of colour combination and harmony in designing of clothing/fabric. Modification of colours as formation of tint, shades and coloured grays etc. Colour intensity charts. Outline for the movement of colours in fashion with the factors affecting the choice of colour. Elements of design of a motif: line, dot, curve, colour and texture. Different Types and their applications.

UNIT – III

Composition of designs Geometric ornamentation, conventional treatment of natural and artificial forms, adoption and reproduction of earlier designs. Construction of symmetrical figures, reversing inclined figures. Arrangement of figures - unit-repeating design, the drop device, drops reverse designs, sateen system of distribution (with reference to half drop, diamond base, ogee base, rectangular base lines). Construction of designs from incomplete repeat.

UNIT – IV

Study of Pattern: – historical precedents. Symmetry – principle concepts, perspectives and its application, classification of motifs, border patterns, all over patterns, Counterchange motifs, border patterns and allover patterns.

Suggested Reading List:

Title	**Author**
Watson’s Textile Design and colour	Watson
Colour mixing Bible	Watson
Colour: right from the start	Watson
Textile Science	Gohl E P G and Vilensky LD
Fashion from Concept to Consumer	Emilio Puc

Course Objectives:
After completion of the course, students will be able to

1. Relate colour and colour theory in designing Textile and Apparel products.
2. Develop colour combination techniques in fabric and garments.
3. Analyze composition of designs and Geometric ornamentation in Textile and Apparel production.
4. Design patterns and symmetry in Textile and Garment products.

PEC–TT–303G Waste Management and Pollution Control

Course code	PEC-TT–303G				
Category	Open Elective Course				
Course title	Waste Management and Pollution Control				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre-requisites: Basic concepts of textile production.

Course Objectives:

1. To familiarize the students about various wastes and pollutants from textile production.
2. To familiarize the students about the importance of waste management and pollution control.
3. To familiarize the students different textile effluents and their recovery/recycling.
4. To give an overview on toxicity of bleaching, dyeing, printing and finishing auxiliaries and their analysis and minimization.
5. To give an overview on water, air and noise pollution due to textile production, their control, standards and acts.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Definition of Waste and Pollutant: Classification of wastes and pollutants; Importance of waste management and pollution control. Environmental impact assessment, definition & need, introduction to environmental impact assessment methodology, unit processes.

UNIT-II

Textile effluents and their characterization, methods of effluent treatment, disposal of effluents, reuse of water in a process house, fiber and polymer waste, recovery and recycling of monomer. Modifications of polymer waste. Recovery and recycling of monomers, Modifications of polymer waste and its utilization, Waste Management approaches, Statistical interpretation of data on waste of different sections of textile industry.

UNIT-III

Toxicity of intermediates dyes, processing aids-bleaching, dyeing, printing and finishing auxiliaries etc. Analytical methods for various pollutants. Formaldehyde, Pentachlorophenol, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Minimization, Optimization and Standardization of waste in textile industry.

UNIT-IV

Source of water pollution: Factors contributing water pollution and their effect, water pollution parameters, physical, biological, chemical standards for quality of treated water. Effluent treatment methods and control, basic principles - Unit operations (sedimentation, precipitation, filtration, and incineration), specific pollutants. Pollution of air, causes, effect, monitoring and control. Source of noise pollution, its effect and control. Legislation- salient provisions of water act, Air act, Environment protection act, Environment Impact Assessment: Basic principles, purpose, components, methodology and constraints.

Suggested Reading List:

Title	**Author**
Basic course in environmental studies	S Deswal & Anupama Deswal.
Environment impact Assessment	L W Caeter
Environment Pollution & Control	H S Bhatia
Textile management	V D Dudeja
Water and effluent in textile mills	P B Jhala

Course Outcomes:

After completion of the course, students will be:

1. familiarized with various wastes and pollutants from textile production.
2. able to comprehend the importance of waste management and pollution control.
3. familiarized with different textile effluents and their scope of recovery/recycling.
4. have an idea on toxicity of bleaching, dyeing, printing and finishing auxiliaries and their analysis and scope of its minimization/optimisation.
5. have an idea on water, air and noise pollution due to textile production, their control, standards and acts.

OEC–TT/TC–303G Garment Manufacturing Technology

<table>
<tr><td>Course code</td><td colspan="5">OEC-TT/TC–303G</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Garment Manufacturing Technology</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–V</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Technology/Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Textile raw materials, yarn formation, woven & knitted fabric formation

Course Objectives:
1. To familiarize the students with the role of Fashion in Apparels.
2. To understand the marker planning, spreading and cutting processes in Garment Industries.
3. To familiarize with the contribution of various entities of sewing in Apparel production.
4. To understand the pressing procedure followed in Garment industries.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT – I

Concepts of Fashion: various terms used- fashion cycle, fad, style etc. Fashion Theories, Consumer identification with different phases of Fashion Cycle. Introduction to Garment Manufacturing process. Introduction of merchandising and retail concepts. Future prospects for engineers in garment sector.

UNIT – II

Planning, drawing and reproduction of the marker, requirements of marker-planning, marker efficiency, methods of marker planning and marker use – normal marker, planning and computerized marker planning, requirement of spreading process, nature of fabric packages, Objectives and methods of cutting straight knife, band knife, notches, drills, computer controlled knives, Die cutting, Laser cutting, Plasma cutting, Microprocessor based machinery in pattern construction and planning, marking and cutting processes.

UNIT – III

Sewing: Properties of seams, seam types, stitch types, sewing machine feed mechanism, sewing machine needles, sewing threads, sewing problems. Introduction to Sewing Machinery: Basic sewing machines and associated work aids. Automation in Garment Industry, Information Technology in Garment Industry

UNIT – IV

Pressing: Purpose of pressing, pressing equipment and methods general description to alternative methods of joining materials and the use of components, trimmings to care labelling in garment manufacturing.

Suggested Reading List:

Title	Author
Fashion from Concept to Consumer	Emilio Puc
The Technology of Clothing Manufacture	Harold Carr & B. Latham
The Apparel Industry in India	I. L. A. Kanti
Garment Manufacturing Technology	Nayak & Padhey
Apparel Manufacturing Analysis	Jacob Solinger
Apparel Manufacturing Handbook	Jacob Solinger
Apparel Manufacturing Technology	Karthik, Ganeshan, Goplakrishnan

Course Outcomes:

After the completion of the course the students will be able to:

1. Relate fashion concepts in garment industries.
2. Analyze marker planning and efficiency, spreading and cutting processes in Garment Industries.
3. Work and relate sewing parameters in Apparel products.
4. Develop pressing procedure in Garment industries.

OEC–TT/TC–304G Apparel Quality Evaluation and Standards

Course code	OEC-TT/TC–304G				
Category	Open Elective Course				
Course title	Apparel Quality Evaluation and Standards				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Technology/Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Textile raw materials, yarn formation, woven & Knitted Fabrics, GMT, Apparel Merchandising

Course Objectives:

1. To familiarize the students with the role of Quality in Apparels and its categorization.
2. To create clarity regarding the Inspection systems and tools of Quality Control.
3. To familiarize with the contribution of various entities in Apparel organizations towards Quality.
4. To understand the sampling procedure followed in Garment industries.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT – I

Meaning of quality, testing and standard and their importance in apparel industry – Quality terminologies- Sources of international standards. Quality Parameters of fabric and garment.

Quality –definition, classification of defects, Quality loop, inspection loop, stages of inspection, how much to inspect-arbitrary, statistical sampling, AQL, zones in garment evaluation,Quality function. Evaluation of quality cost, categorisation of quality costs, objectives of quality cost evaluation.

UNIT –II

Role of quality management for Fashion Buyer - Role of fashion Buyer, Buying team, buying cycle - comparative shopping, directional shopping. Principles of TQM – Deming’s PGDCA

Cycle - KAIZAN concepts – 5 S applications in apparel industry. Application of seven QC tools in apparel industry.

UNIT – III

Inspection- purpose, inspection manuals, how much to inspect, random sampling etc. Quality standards- ISO-9000 series of standards, Quality assurance, Six Sigma. various care labelling symbols, different stages at which inspection is carried out and its effect on overall garment quality like raw material inspection- Fabric Inspection system : 4 point,10 point system and in process inspection.

UNIT – IV

Understanding procedures in sampling and sample development, different stages of samples and their requirements from Proto to Shipment sample Proto, fit, size set, pre production, TOP, sealer etc. Inspection: Incoming and raw material inspection: Fabric inspection – 4-point system. In process/ online inspection: Advantages – On line inspection during spreading, pattern making, cutting, sewing and ironing. Final inspection: Sampling plans and AQL charts – Level of final inspection. Packing & packaging quality tests. Care labeling and international care symbols.

Suggested Reading List:

Title	**Author**
Hand book of Quality Control	
	Jo
seph Juran Total Quality Management: A pictorial guide for manager	
	Jo
hn Oakland	
Statistical Quality Control	Grant Eugene & L
Richard	
Managing Productivity in Apparel Industry	Rajesh Bheda
Productivity Through Quality	Rajesh Bheda
Fashion Buying	Halen Goworek
Evaluating Apparel Quality	Stamper
ISO 9000 Quality Management System	D.L.Shah
Managing the Quality in Apparel Industries	Pradeep V Mehta
Principles of Textile Testing	J E Booth
Testing and Quality Management	V K Kothari

Course Outcome:

After the completion of the course the students will be able to:

1. Implement the Quality parameter in Apparel industry.
2. Utilize the various tools of Quality control and Inspection systems.
3. Evaluate the sampling procedure being followed in Garment Industries.
4. Analyze the contribution of different entities towards Quality control.

OEC–TT/TC–305G Introduction to Fashion and Apparel Industries

Course code	OEC-TT/TC–305G				
Category	Open Elective Course				
Course title	Introduction to Fashion and Apparel Industries				
Scheme and Credits	L	T	P	Credits	Semester–V
	3	0	0	3	
Branch	Textile Technology/Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Textile Raw Materials, Yarn and Fabric Formation, Apparel Production, Colour & Design Concepts

Course Objectives:

1. To understand the elementary knowledge of Indian and global apparel industries.
2. To learn the concept of fashion, components o fashion, fashion cycle, fashion theories.
3. To gain knowledge of fashion centres fashion brands.
4. To develop skills for application of fashion promotion, information services and communications.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set up by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT – I

Introduction to Apparel Industry, Indian Apparel industry scenario and its SWOT Analysis, Status of Structure and working flowchart of various departments of a garment production house. Apparel manufacturing countries: their features, level of technology, product mix. Indian apparel industry- challenges & global scenario.

UNIT – II

Fashion terminology, components of fashion, fashion cycle – its phases, Style classification based on fashion cycle - fad/classic, recurring & interrupted cycles, Consumer identification with fashion cycles- leaders, innovators, followers, victims & laggards. Motives of consumer buying & factors affecting fashion growth & declination. Fashion adaptation theories.

UNIT – III

Major fashion centres of the world: Brief introduction to world fashion centers – Millan, Italy, Paris, Rome, American, European, and Japanese. Who's who of fashion world- national & international designers, their private labels, Luxury brands of apparels & accessories.
General introduction to careers & future opportunities in fashion & apparel sector- export & buying houses, design houses etc.

UNIT – IV

Fashion information services, trend forecasting and auxiliary services. Importance of fashion seasons & fashion calendar in apparel industry.
Introduction to fashion forecasting – significance, purpose of forecasting trends, forecasting tools & techniques and role of fashion forecasters. Fashion promotion and communications- Trade fairs, Fashion shows, exhibitions & promotional events

Suggested Reading List:

Title	**Author**
The theory of Fashion	John Wiley & Sons, 1965.
Fundamentals of Men's Fashion Design	Kawashima, Masazki
The clothing Factory	H C Carr
Inside the Fashion Business	J A Jarnow, B Judelle
Advertising Handbook	Barton Roger
Merchandising of Fashion	John B
Garment Manufacturing Technology	Nayak & Padhey
The Technology of Clothing Manufacture	Carr & Latham
Apparel manufacturing analysis	Jacob Solinger
Apparel manufacturing Handbook:	Jacob Solinger
Apparel Manufacturing Technology	Karthik, Ganeshan & Goplakrishnan

Course Outcomes:

After completion of the course, students will be able to:

1. Understand the fundamentals of fashion and apparel industries.
2. Analyze the fashion cycles, fad and different styles and fashion theories.
3. Apply the work of fashion leaders and brands into practice
4. Develop fashion promotion and communication skills.

HSMC-TT/TC/FAE-301G Merchandising and Export Management

Course code	**HSMC-TT/TC/FAE-301G**				
Category	Humanities and Social Sciences including Management Courses				
Course Title	Merchandising and Export Management				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Technology/Textile Chemistry/Fashion and Apparel Engg.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic concept of management

Course Objectives:

1. To make the students acquainted with various concepts of marketing and different aspects pertaining to marketing which include market segmentation, product life cycle, various stages involved in new product development.
2. To make them understand the various pricing strategy and functions of distribution channel.
3. To make them understand the importance of export.
4. To familiarize them on export procedure, export terms of payment and final assistance provided by government.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Fundamental idea and basic terms and definition in marketing. Definition of marketing. Explanation of various concept of marketing with examples. Types of Marketing: Target marketing and Mass Marketing. Market segmentation. Classification of market based on size. Various stages of new product development and product life cycle.

UNIT-II

Concept and definition of Marketing mix. Variables of market mix: 4Ps Product, Price, Promotion and Place. Distribution channels and various functions performed by the distribution channel. Logistics and its relevance. Promotion mix: various kinds of promotion mix; their scope of applications and their relative merits and demerits. Various factors need to be considered while deciding the price. Pricing decision and strategy.

UNIT-III

Export Management–importance of export. Risk involved in export and remedial measures. Various kind of terms of payment and their relative merits and demerits. Various kinds of document to be prepared and maintained for export. Various steps involved in Export Assistance given for export. Pre shipment and post shipment finance. Common incoterms.

UNIT-IV

Concept and definition of Merchandising. Utility and obsolescence factors in merchandising. Essential qualification criteria of a merchandiser. Types of merchandising. Roles of a merchandiser in an apparel industry. Various activities involved in merchandising: Line Planning, Line Development and Line presentation. Different types of sampling and their importance. Visual Merchandising. Elements of interior, exterior window display, store planning and layout-fixtures, location. Different types of sampling and their importance in merchandising. Brand building: Introduction, strategies, brand expansion, global trends. Introduction to customer relationship.

Suggested Reading List:

Title	**Author**
Marketing Management	Phillip Kotlar
Nabhi's Publication on Export	Govt. Handbook
International Marketing	Hess and Cateora
Export Management	B S Rathore

Course Outcomes:

After completion of the course, students will understand:

1. The concept of marketing and marketing mix
2. The importance and functions of distribution channel
3. The use of different promotional tools and their scope of applications
4. The various documents required for commercial and legal purpose
5. Financial assistance provided by government to the exporters and different modes of terms of payment in export business.

PCC-TC-304G Processing of Synthetics & Blends

Course code	**PCC–TC–304G**				
Category	Professional Core Course				
Course title	Processing of Synthetics & Blends				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Knowledge of Introduction to Textile Processes

Course Objectives:
The course is designed to impart the following:
1. Sufficient knowledge and skills in synthetic dyeing
2. Must be aware of principle of dyeing operations, Material, equipment, process
3. Overview of various machines involved in processing of Synthetics & Blends.
4. Concept of Synthetics printing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Chemistry and Technology of chemical processing of polyester, nylon and acrylics.

UNIT-II

Dyeing of important blends of natural and synthetic fibre fabrics. Analysis and remedy of barre effect. Developments of synthetic fibre dyeing and other chemical processing.

UNIT-III

Dyeing of microfibre fabrics. Dyeing machines for dyeing fibre, yarn and fabric. Mass colouration. Weight reduction treatment of polyester.

UNIT-IV

Styles and techniques of printing synthetics and blended textiles. Heat setting and other finishing (Antisoiling, antistatic, antipilling etc.) techniques.

Reference books	Author
Chemical Processing of Synthetics	K C Datye & A A Vaidya

Course Outcomes:

Student will learn

1. Effective use of dyeing and printing knowledge for synthetic fibre, yarn and fabric in industries.
2. Use of various recipes for synthetic dyeing and printing.
3. Effective use of various machines for synthetic dyeing and printing.

PCC–TC–305G Textile Finishing

Course code	**PCC-TC–305G**				
Category	Professional Core Course				
Course title	Textile Finishing				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of different fiber properties and elementary idea of textile chemical processing

Course Objectives:

1. To enunciate the objects, classes and types of finishing & select the finishing process sequence according to the type of fabric and end use.
2. To describe working of finishing machinery used for application of various types of finishes to fabric.
3. To elucidate the importance, chemistry, mechanism, different types of finishes applied to various substrates and choose the ingredients for the same.
4. To describe the various problems faced during finishing of fabric with their remedies and choose proper method for evaluation of the performance of finishes applied on various substrates.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Objects of Textile finishing, Classification of finishing processes viz. Mechanical and Chemical Finishes, Temporary and Permanent Finishes. Finishing Process Sequences for different types of fabric like cotton, silk, wool, man-made etc.

Brief outline of Mechanical Finishes e.g. Calendaring, Raising, Sueding, Sanforising, Heat- Setting, Decatising & Milling of Wool and Aero finishing. Drying of textiles, concept and various type of drying machines used in textile industry.

UNIT-II

Chemical finishing process: Anti-crease finish: Mechanism of creasing, chemistry and technology used for improving wrinkle resistance, wash & wear and durable press properties of fabrics; Non-formaldehyde finishes Technologies eg: application of BTCA, CA, etc. Evaluation of these finishes.

Concept and mechanism of Flame retardandcy. Flame retardant and proof finishes on natural fibres, synthetics and blends; temporary and durable finishes. Methods of evaluation of these finishes.

UNIT-III

Water repellent finishes, Chemistry and application of water repellents. Soil release finish – mechanism of soiling, steps of soil release and theory, different soil release finishes, soil repellency, fluorocarbons and Teflon finishes. Introduction to Antimicrobial finishing, chemistry of various antimicrobial finishes and their application. Methods of evaluation of these finishes.

UNIT-IV

Classification and chemistry of softeners, their application on textiles, merits and demerits. Detail on Silicone softeners and their chemistry. Application of Macro, micro and nano emulsion softeners. Brief introduction Optical brighteners. Introduction to Rot and Mildew proof finishing of Wool.

Reading List

Title	**Author**
Principles of Textile Finishing	A K R Chaudhary
Chemical Finishing of Textiles	W D Schindler & P J Hauser
An Introduction to Textile Finishing	J T Marsh
The Technology of Textile Finishing, Vol-X	V A Shenai
Encyclopedia of Textile Finishing	H K Rouette

Course Outcomes:

At the end of the course, the students will be:

1. Understand the objects of finishing & select the finishing process sequence according to the type of fabric and end use.
2. Understand working of finishing machinery used for application of various types of finishes to fabric.
3. Explain the importance, chemistry, mechanism, different types of finishes applied to various substrate and choose the ingredients for the same.
4. Analyze problems with their remedies in finishing of textiles and evaluate the performance of finishes applied on various substrates.

PCC–TC–306G Textile Processing Machinery

Course code	**PCC-TC–306G**				
Category	Professional Core Course				
Course title	Textile Processing Machinery				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of the various processes involved in the textile chemical processing like pre-treatments, dyeing, printing and finishing.

Course Objectives:

1. To describe the functions and working of various machinery used in pre-treatment of textiles.
2. To explain working of different dyeing and printing machines.
3. To explain working of various finishing machines

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Shearing and Cropping - Various types of shearing machines for woven fabric, surface shearing for terry towels, carpets, etc. Singeing machine- Various types of gas singeing machines for woven and knit goods. Construction and working of singeing machines. Open width and Rope form washing machines. Water extraction equipments of different mechanism like centrifuging, mangling, suction.

UNIT-II

Scouring and Bleaching Machine - Various types of kiers. J-box for continuous scouring, pad- roll system of scouring. Equipments for conventional bleaching. Continuous Pre-treatment range. Mercerizing, Washing, Relaxing Machines and Machinery for knit goods- Yarn mercerization machines, fabric mercerization machines like pad chain, pad chainless and padless – chainless. Caustic recovery plant.

UNIT-III

Dyeing Machineries - Batch and continuous fibre dyeing machine, Hank dyeing machine, Package dyeing machine, different types of packages. Jigger, different types of Jiggers, winch dyeing machine, Horizontal beam dyeing machine. Pad batch and continuous open width fabric dyeing range. Different types of padding mangles. Different types of Jet dyeing machines, Soft flow, over flow & air flow dyeing machine.

UNIT-IV

General aspects of Textile Printing machinery: Study of roller printing machine. Study of construction & working of rotary printing machine & flat bed printing machine. Continuous & cut panel thermo transfer printing. Developments in printing machines. Study of agers, steamers & polymeriser. Finishing machinery - Drying equipments like Vertical Drying Range, Stenter for drying & finishing.

Reading List

Title	**Author**
Textile Wet Processing Machinery	N B Peefel
Engineering in Textile Colouration	C Duckworth
Handbook of Textile processing machinery	R S Bhagwat
Encyclopaedia of Textile Finishing	H K Rouette

Course Outcomes:

At the end of the course, the students will be:

1. Describe the functions and working of various machinery used in pre-treatment of textiles.
2. Explain working of different dyeing and printing machines.
3. Explain working of various finishing machines.

LC–TC-304G Dyeing Lab-II

Course code	**LC–TC–304G**				
Category	Lab Course (Professional Core Course)				
Course title	Dyeing Lab-II				
Scheme and Credits	L	T	P	Credits	Semester–VI
	0	0	2	1	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of processing of synthetics and their blends.

Course Objectives:
This Lab course is designed to impart knowledge of dyeing processes of synthetic fibers and their blends as a bridge between theory and practice.

List of Experiments:

1. Dyeing of polyester with disperse dye by carrier
2. Dyeing of polyester with disperse dye by high temperature & high pressure
3. Dyeing of polyester with disperse dye by thermosol dyeing
4. To study the Effect of carrier concentration on dye uptake of polyester
5. Dyeing of Acrylic
6. To study the effect of retardants
7. Dyeing of nylon with acid dyes
8. Dyeing of Nylon with metal complex dyes
9. To study the effect of dye fixing agents
10. Dyeing of polyester/cotton blended fabric
11. Dyeing of polyester/viscose blended fabric
12. Dyeing of polyester/wool blended fabric
13. Dyeing of cotton/wool blended fabric
14. Dyeing of acrylic/wool blended fabric

Course Outcomes:

1. To familiarize the students with various machinery and process involve in dyeing of synthetic fibres and their blends.
2. To understand the function of different chemicals in dyeing process of synthetic fibres.
3. To learn preparation of various recipes for Dyeing of synthetic fibres.

LC–TC–305G Characterization and Evaluation of Dyed & Finished Textiles

<table>
<tr><td>Course code</td><td colspan="5">LC–TC–305 G</td></tr>
<tr><td>Category</td><td colspan="5">Laboratory Course (Professional Core Course)</td></tr>
<tr><td>Course title</td><td colspan="5">Characterization and Evaluation of Dyed & Finished Textiles</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic knowledge of dyeing, printing and finishing of textile materials

Course Objectives:
This Lab course is designed to understand the various methods of evaluating the performance of dyed/printed and finished textile materials.

List of Experiments

1. Evaluation of colour fastness to Washing using standard test methods.
2. Evaluation of colour fastness to Rubbing using standard test methods.
3. Evaluation of colour fastness to Sublimation.
4. Evaluation of colour fastness to Perspiration.
5. Evaluation of colour fastness to Light.
6. Evaluation of colour fastness to Bleach with hypochlorite and peroxide.
7. Evaluation of colour fastness to Hot pressing.
8. Evaluation of colour fastness to Dry cleaning.
9. Evaluation of dimensional stability to washing, dry heat relaxation shrinkage.
10. Application and the evaluation of Anti-crease finish on cotton fabric.
11. Application of water repellent finish and determination of water repellency using Spray test.
12. Application of flame retardant finish and evaluation of flame retardency using flammability tester.
13. Application of Anionic softener and evaluation of softener application.
14. Application of Cationic softener and evaluation of softener application.
15. Application of Silicone softener and evaluation of softener application.

Course Outcomes:

At the end of the course, the students will:

1. Demonstrate testing of colour fastness of dyed and printed textiles.
2. Demonstrate the evaluation of various finish application to textiles.
3. Demonstrate the evaluation of various softeners applied to textiles.

LC–TC–306G Technical Analysis Lab

<table>
<tr><td>Course code</td><td colspan="5">LC–TC–306G</td></tr>
<tr><td>Category</td><td colspan="5">Laboratory Course (Professional Core Course)</td></tr>
<tr><td>Course title</td><td colspan="5">Technical Analysis Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic knowledge of analytical chemistry and chemistry of textile auxiliaries

Course Objectives:

This Lab course is designed to impart experience of testing and analysis of various raw materials (dyes, chemicals & raw materials) used in textile chemical processing.

List of Experiments

1. Identification of class and the sub-class of dyes from given dye power eg: Basic, Direct, Reactive, Vat, Sulphur, Acid etc.
2. Identification of the class of dyes from the given dyed substrate eg: Direct, Reactive, Vat, Sulphur etc.
3. Estimation of the strength of NaOH volumetrically.
4. Volumetrically analyze the strength of given Hypochlorite solution.
5. Estimation of strength of Hydrogen Peroxide solution volumetrically.
6. Estimation of dye powder strength.
7. Cuprammonium Fluidity test to determine.
8. Methylene Blue Exhaustion to determine.
9. Barium Activity Number test.
10. Demonstration of UV-Visible Spectrophotometer
11. Demonstration of FTIR (Fourier Transformation Infra-red Spectroscopy)
12. Evaluation of the Wetting agents.
13. Evaluation of the Detergents.
14. Evaluation of the dye powder purity.
15. Evaluation of Reducing agents (Sodium hydrosulphide, Sodium sulphite).

Course Outcomes:

1. Demonstrate testing of dye powder with their class and sub-class.
2. Identification of dye from the dyed substrate.
3. Estimation strength of common chemicals used in textile industries.
4. Demonstration of instruments used in the technical analysis.
5. Evaluation of degradation of cellulosic textiles.

PEC–TC–304G Textile Chemical Testing

Course code	**PEC-TC–304G**				
Category	Professional Elective Course				
Course title	Textile Chemical Testing				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of the various processes involved in the textile chemical processing like pre-treatments, dyeing, printing and finishing.

Course Objectives:

1. Describe concepts and importance of chemical testing in textiles and standards.
2. Describe testing of textile products such as colour fastness, performance of auxiliaries used in processing.
3. Describe testing of material performance properties and chemical residue, its impact on and related environmental concern and standards on hazards chemicals.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to textile chemical testing with their objective and scope. Introduction to the standards like ISO, ASTM, AATCC and BIS; Certifications like Okö-tex, Organic cotton, GOTS and restricted chemicals (Azo Ban, Formaldehyde).
Analysis of common chemicals used in wet processing: Acids, Bases, Salts, Oxidizing agents, Reducing agents (estimation of bleaching agents like hypochlorite, chlorite and peroxide).

UNIT-II

Estimation of chemical degradation of cotton, wool, silk and polyester (aldehyde and carboxyl group estimation in cellulosics, amino group estimation of protein fibres, fluidity/viscosity measurement, critical dissolution time, etc).

UNIT-III

Identification and evaluation of dyes used for textile chemical processing. Colour Fastness of Dyed and Printed Goods General Principle of fastness testing, sample preparation, multifibres strip and their evaluation with grey scale. Evaluation of Colour fastness to washing, home laundering and various reference detergents; Colour Fastness to Rubbing, Perspiration, Water, Sea water, Chlorinated pool water, Light, Sublimation, Bleaching with hypochlorite and Peroxide, Hot pressing and Dry-cleaning using International Standards (ISO, AATCC, BIS).

UNIT-IV

Testing and Analysis of Auxiliaries: Surfactants, Wetting Agents, Leveling Agents, Detergents, Dispersing agents, Defoamers, Sequestering Agents, Softeners etc. Analysis of fresh water and effluent.

Reading List

Title	**Author**
Chemical Testing of Textiles	Qinguo Fan
Textile Auxiliaries	VA Shanai
Analytical Methods for a Textile laboratory	JW Weaver
Colorants and Auxiliaries Vol-I &II	

John Shore AATCC Technical Manual

Course Outcomes:

At the end of the course, the students will:

1. Explain concepts and importance of testing, test standards and quality matter.
2. Demonstrate testing of textile products such as colour fastness, dyes and auxiliaries used in processing.
3. Explain the testing of chemical damages occur during wet processing.
4. Explain testing of material performance properties and chemical residue, its impact on and related environmental concern; standards on hazards and restricted chemicals.

PEC–TC–305G Textile Auxiliaries

<table>
<tr><td>Course code</td><td colspan="5">PEC-TC–305G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Textile Auxiliaries</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester–VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branch</td><td colspan="5">Textile Chemistry</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Pre–requisites: Basic knowledge of the various processes involved in the textile chemical processing like pre-treatments, dyeing, printing and finishing.

Course Objectives:

1. Describe the various auxiliaries used in textile chemical processing.
2. Describe the chemistry involved in the various auxiliaries used in the wet processing of textiles.
3. Demonstrate testing and evaluation of various chemicals and auxiliaries used in the textile processing.
4. Describe the working principle of some important instruments used in chemical testing.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

General Consideration and classification of textile auxiliaries. Essential requirements of surfactants, mechanism of surface activity and surface active agents. Physical principles involved in detergency conditions for efficient detergency and Preparation of detergents. Scouring auxiliaries, mercerizing auxiliaries and various bleaching agents.

UNIT-II

Dyeing auxiliaries- wetting agents, dispersing agents, leveling agents, sequestering, stripping agents and dye fixing agents.

Printing auxiliaries: thickeners, classification of thickeners, thickeners for reactive dyes, emulsion thickeners, wetting agents, hygroscopic agents, antifoaming agent, pigment binders, reducing agents, oxidizing agents and miscellaneous auxiliaries.

UNIT-III

Finishing agents: Cross linking agents, urea formaldehyde derivatives and melamine formaldehyde. Synthetic resin emulsion used in textile industry like PV alcohol, PVC acrylic polymer, silicon emulsion etc.
Determination of strength of hypochlorite, hydrogen peroxide and hydrosulphite. Estimation of strength of NaOH containing sodium carbonate volumetrically and by Tw meter.

UNIT-IV

Performance evaluation of textile auxiliaries- Testing of wetting agents, detergents, foaming characteristics, soil release agents, leveling agents, flame retarding agents, water repellants. Softeners –different types of softeners.

Reading List

Title	**Author**
Textile Auxiliaries	VA Shenai
Textile Auxiliaries and Finishing Chemicals	AA Vaidaya &
S S Trivedi Textile Scouring and Bleaching	VA Shenai
Hand book of Specialties Chemicals	John E. Nettles
Chemistry of Organic Textile Chemicals	VA Shenai

Course Outcomes:

At the end of the course, the students will be:

1. Explain the various auxiliaries used in textile chemical processing.
2. Explain concepts and importance of testing, test standards and quality matter.
3. Demonstrate testing of chemicals, dyes and auxiliaries used in textile processing.
4. Explain the working principle of instruments used in chemical testing.

PEC–TC-306G Chemistry of Dyes

Course code	**PEC–TC–306G**				
Category	Professional Elective Course				
Course title	Chemistry of Dyes				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic Knowledge of Chemistry

Course Objectives:
The course is designed to impart the following:
1. Sufficient knowledge regarding chemistry of synthetic dyes and its synthesis
2. Classify dyes according to their chemical structure
3. Use of deys-stuf depending on their class and subclass

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Spectral properties of colorants, classification of dyes according to application and constitution, Dye intermediates and its chemistry. Colour & Constitution, Different types of chromophores and auxochromes. Fluorescence and phosphorescence. Isomers (stereoisomerism of Azo dyes and tautomerism).

UNIT-II

Chemistry including the synthesis of a few members of direct, acid, basic dyes. Developments of acid and basic dyes.

UNIT-III

Chemistry of vat dyes (Indigoid, anthraquinonoid and polycyclic quinonoid dyes; solubilised vat dyes), Sulphur dyes and sulphurised vat dyes, Chemistry of azoic colours.

UNIT-IV

Chemistry of Disperse & Reactive dyes. Chemistry and classes of pigments. Developments of colourants (ink for printing, fluorescent colour and other industrial application).

Reading List

Title	**Author**
Colour Chemistry	R L M Allen
Chemistry of Synthetic Dyes	K
Venkatraman Colour Chemistry – Synthesis, Properties and Applications of	
Dyes and Pigments	Zollinger H
Industrial Dyes	Klaus Hunger
Chemistry of Synthetic Dyes and Pigments	Lubs H. A

Course Outcomes:

1. Understand the chemistry involved in manufacturing of dyes and pigments.
2. Use of dyestuff on their class and subclass on textile substrate.
3. Effective use of dyestuff on their fastness properties.
4. Prepare novel dyestuff for textile substrate.

OEC–TC–306G Garment Processing & Quality Control

Course code	**OEC-TC–306G**				
Category	Open Elective Course				
Course title	Garment Processing & Quality Control				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of garment manufacturing and textile chemical processing

Course Objectives:

1. To discuss the process & machinery used for garment dyeing and printing.
2. To understand the role of special print effects in garment industry.
3. To discuss the various specialty Finishes used in garment industry and to understand the role of various parameters.
4. To discuss the process of wash down effects on denim garments & to understand the principle & features of machinery used for laundering & dry cleaning.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction to Garment Processing: Importance of garment processing - advantages and limitations. Characteristics of various fibers used in garment manufacturing with respect to garment processing. Major issues in garment processing.

Garment Dyeing: Concepts of garment stage and pre garment stage dyeing- General precautions for garment dyeing –Various machineries used for Garment dyeing like paddle dyeing machine, drum dyeing machine. Drying of garment dyed goods – Various drying machinery like Hydroextractor, Tumble, dryer, RF dryer. Problems in Garment dyeing and its remedies.

UNIT-II

Garment Printing: Special print recipes for garments – Khadi – Metallic – Flock – Plastizol – Reflective –Pearl – Fluorescent – High density printing – Puff Printing – Foil Printing – Plastic, Printing – Printing of Garments with Photochromatic and Thermo chromatic dyes. Garment Printing Machineries -Multi arm flat bed printing machine, Digital printing introduction and Transfer printing. Garment Finishing: Classification – Flow chart, Fragrance finish – UV protection finish - Cool finish - thermo cat finish – water resistant breathable finishes.

UNIT-III

Garment Washing: Introduction – Various wash down effects – Stone washing – Various stone- less washing effects like enzyme wash, Mud wash, Ion wash, Monkey wash etc. Other novel wash down effects like Acid wash, Antique wash, Denim Hand Sand /Scraping- Sand Blasting – Ball Blasting - Ozone Fading. Back Staining- causes and remedies. Laundering: Objective – Laundering procedure for garments made up of various fibers like cotton, linen, wool, silk and manmade textiles – various laundering equipments. Care labeling and Stain removal of garments.

UNIT-IV

Quality Control: Production technology in garment manufacturing – Manual and Mechanical systems. Inspection systems – Raw material inspection, In-process inspection and Final inspection. Quality Control and tools of quality control; Production planning in garment manufacturing. Introduction to cost structure in garment manufacturing.

Reading List

Title	**Author**
Fundamentals and Practices in Coloration of Textiles	J N
Chakraborty Dyeing and Chemical Technology of Textile Fibres	
	E R
Trotman Textile Finishing	A J
Hall	
Denim A Fabric for all	M S Parmar
An Introduction to Quality Control for Apparel Industry	P V Mehta
Managing Quality for Apparel Industry	P V Mehta & S K Bhardawaj

Course Outcomes:

At the end of the course, the students will be:

1. Explain the working principle of various machineries used for garment processing.
2. Describe the process of garment dyeing and suggest suitable process sequence.
3. Summarize the various special print effects and specialty finishes used in garment industry & to compare the effects given by various wash down processes to analyze problems & suggest possible remedies in denim processing.
4. Describe the quality control aspects of garment manufacturing.

PEC–TT–305G Structure and Properties of Fibres

Course code	**PEC-TT–305G**				
Category	Open Elective Course				
Course title	Structure and Properties of Fibres				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of fibres

Course Objectives:
After completion of the course, students will be able to:
1. familiarize the students with the morphological structure
2. get familiarized with the properties of the fibre to suit their applications
3. appreciate mechanism of absorption of moisture in fibres and their effects
4. understand thermal and optical properties of fibre

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Theories of fine structure of fibres; Methods of determination of molecular structures (crystallinity and orientation, crystal size etc.) by X-Ray methods; Stress-strain, creep and stress-relaxation of fibres, Simple spring and dashpot models simulating fibres.

UNIT-II

Absorption of moisture in fibres, hysteresis. Quantitative analysis of moisture absorption, Pierce’s theory, Fick's laws of moisture diffusion, Swelling, Heat of sorption

UNIT-III

Optical properties: Polarization and refractive index, Birefringence and its measurement.

Thermal properties: Molecular motions and transition phenomenon, First order and second order transition phenomenon, Concept of heat setting and pleating, Measurement of specific heat of fibres

UNIT-IV

Electrical properties: Di-electric properties and its measurement, Effect of frequency and temperature on dielectric constant, Electrical resistance of fibres and its measurement, Static electricity and measurement of static charge in fibres.
Frictional properties of fibres – nature and measurement.

Suggested Reading List:

Title	Author
Physical properties of fibres	Morton and Hearle

Course Outcomes:

After completion of the course, students will be able to:

1. understand the fine structure of the fibres which is an essential tool to predict properties of fibres
2. assess various aspects of structure of fibre
3. blend different fibres to suit for various uses
4. understand the scope and limitations to improve structure and properties of synthetic fibres

OEC–TC–307G Coating and Laminating of Textiles

Course code	**OEC-TC–307G**				
Category	Open Elective Course				
Course title	Coating and Laminating of Textiles				
Scheme and Credits	L	T	P	Credits	Semester–VI
	3	0	0	3	
Branch	Textile Chemistry				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Pre–requisites: Basic knowledge of polymer chemistry and fundamentals of textile finishing.

Course Objectives:

1. To explain concept of coating and chemistry of base material.
2. To discuss coating and lamination technology.
3. To discuss water proof and breathable coating, and various applications of coated and laminated products.
4. To discuss functional material involved in coating and environmental issue in coating and lamination technology.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 06 parts of 2.5 marks from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each Unit.

UNIT-I

Introduction

Advantages & Disadvantages of conventional finishing, Concept of Coating & Lamination, Merits & Demerits of Coating & Lamination, Production, Structure & Properties of Rubbers like- Natural Rubber, Styrene- Butadiene rubber, Isoprene-Isobutylene Rubber, Butyl Rubber, EPM & EPDM, Polychloroprene Rubber, Nitrile Butadiene Rubber & Silicone Rubber, Polymeric materials like Polyvinyl Chloride, Polyurethane, Acrylic Polymers, Foams For Laminates, Radiation-Cured Coating. Test methods of coated materials.

UNIT-II

Coating Methods

Knife Coating- Different types of Knifes, Knife coating with premetering & postmetering, Roll Coating- Mayer rod coating, Direct-roll coating, Kiss roll coating, Gravure coating, Reverse roll coating, Dip Coating, Transfer Coating, Rotary screen Printing, Calendering- Zimmer coating, Hot-Melt Coating, Scatter Coating, Foam Coating, Lamination by Adhesives, Flame Lamination, Hot melt. Lamination Merits & Demerits of each coating methods.

UNIT-III

Waterproof Breathable Fabrics

Mechanism of Water Proof Breathability, Parameters of Water Proof Breathability, Designing of Water Proof Breathability Fabric, Types of Water Proof Breathability Fabric. Application & Evaluation of Water Proof Breathability Fabrics.

Products from Coated & Lamination Fabrics

Protective clothing-Sports & Industrial, Industrial & Functional Products, Automotive applications in Interiors & Air bag fabrics, Marine applications, Building & Architecture, Medical & Military Use, Synthetic leather – Compact coated fabrics, Promeeries, Porous Vinyls, PTFE Laminate, Architectural Textiles- material & structure, Fluid Containers, Tarpaulins, Carpet backing, Flocking, Fusible Interlining.

UNIT-IV

Coating with Functional Materials

Microencapsulation, Thermochromic Fabrics, Temperature – Adaptable Fabrics, Fragrance Release Fabric, Fabrics for Chemical Protection, Camouflage Nets, High Visibility Garments, Intumescent Coating, Metal & Conductive-polymer coated fabrics, Coating of Smart Polymers & Nanomaterials.

Coating and Lamination Effects on the Environment

The effect of pollution, Environmental legislation, Manufacturing concerns, Sustainable developments. Future developments of coating & lamination with eco-friendly concern.

Reading List

Title	**Author**
Coated Textiles	A K Sen, CRC Press
Handbook of Technical Textile	Horrocks and Anand
Handbook of Industrial Textiles	S Adanur
Coated & Laminated Textiles	Walter Fung

Course Outcomes:

At the end of the course students will be able to:

1. Explain concept of coating and chemistry of base material.
2. Illustrate coating and lamination technology.
3. Explain water proof and breathable coating and various applications of coated and laminated products.
4. Explain functional material involved in coating and predict environmental issue in coating and lamination technology.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited ‘A+’ Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (FIRE TECHNOLOGY AND SAFETY)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Fire Technology and Safety) – 5th Semester
w.e.f. 2020-21

SN	Category	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Pr	Total	
1	Professional Core Courses	PCC-FT-301 G	Building Construction & Urban Planning	3	1	0	4	4	25	75		100	3
2	Professional Core Courses	PCC-FT-303 G	Mechanics of Structure	3	1	0	4	4	25	75		100	3
3	Professional Core Courses	PCC-FT-305 G	Passive Measures for Fire Safety	3	1	0	4	4	25	75		100	3
4	Professional Elective Courses	____	Elective-I	3	0	0	3	3	25	75		100	3
5	Professional Elective Courses	____	Elective -II	3	0	0	3	3	25	75		100	3
6	Professional Core Courses	PCC-FT-307G	Mechanics of Structure Lab	0	0	2	2	1	25		25	50	3
7	Seminar	PR-FT-309G	Industrial Seminar-I	0	0	2	2	1	50			50	3
8	Training	PR-FT -311G	Fire Ground Operation-III	0	0	2	2	1	25		25	50	3
9	Mandatory Course	MC-315-G	Essence of Indian Traditional Knowledge	2	0	0							3
							TOTAL	**21**				**650**	

Scheme of Studies and Examination
B.TECH (Fire Technology and Safety) – 6th Semester
w.e.f. 2020-21

S N	**Category**	**Course Code**	**Course Title**	**Hours per week**			**Total Contact hrs/week**	**Credit**	**Examination Schedule (Marks)**				**Duration of Exam (Hours)**
				L	T	P			Internal Assessment	External Examination	Pr	Total	
1	Professional Core Courses	PCC-FT-302 G	Rescue Equipment and Techniques	3	1	0	4	4	25	75		100	3
2	Professional Core Courses	PCC-FT-304G	Fire Protection and Salvage Operation	3	0	0	3	3	25	75		100	3
3	Professional Elective Courses	____	Elective-III	3	0	0	3	3	25	75		100	3
4	Professional Elective Courses	____	Elective-IV	3	0	0	3	3	25	75		100	3
5	Open Elective Courses	____	Open Elective-I	3	0	0	3	3	25	75		100	3
6	Open Elective Courses	____	Open Elective -II	3	0	0	3	3	25	75		100	3
7	Professional Core Courses	PCC-FT-306 G	Computer Applications and CAD Lab	0	0	2	2	1	25		25	50	3
8	Training	PR-FT-308 G	Fire Ground Operation-IV (Rescue Operations)	0	0	2	2	1	25		25	50	3
							TOTAL	**21**				**700**	

NOTE: At the end of 6th semester each student has to undergo Practical Training based on Fire and Safety/ Fire and Safety equipments installation, care and maintenance/Fire and Safety Audits/Any Certificate Course related to Fire and Safety (Min Contact Hours must be 30 Hrs) of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ Training Centre/ other building Occupancy etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 7th Semester.

Professional Elective Courses (Third Year)

Sr. No.	Course Code	Course Title	Total Contact Hrs	Credit
1	PEC-FTEL321	Fire Safety Codes and Standards	3	3
2	PEC-FTEL322	Nuclear Safety and Radioactive Materials	3	3
3	PEC-FTEL323	Fire Risk Calculations	3	3
4	PEC-FTEL324	Salvage Evaluation of Fire Situation	3	3
5	PEC-FTEL325	Special Hazards and Protection	3	3
6	PEC-FTEL326	Building Design and Drawing	3	3
7	PEC-FTEL327	Fire Modeling	3	3
8	PEC-FTEL328	Electrical Systems and Safety in Design	3	3
9	PEC-FTEL329	Safety in Petroleum and Petrochemical Industries	3	3
10	PEC-FTEL330	Design of Pipe, Pressure Vessels and Machine Elements	3	3

Open Elective Courses (Third Year)

Sr. No.	Course Code	Course Title	Total Contact Hrs	Credit
1	OEC-FTEL-331	Materials and Metrology	3	3
2	OEC-FTEL-332	Power Plant Engineering	3	3
3	OEC-FTEL-333	Computer Applications, and CAD-CAM	3	3
4	OEC-FTEL-334	Process Instrumentation and Control Engineering	3	3
5	OEC-FTEL-335	Operation Research	3	3
6	OEC-FTEL-336	Industrial Noise and Vibrations	3	3
7	OEC-FTEL-337	Engineering Economics	3	3
8	OEC-FTEL-338	Artificial Intelligence	3	3
9	OEC-FTEL-339	Environmental Engineering and Management	3	3
10	OEC-FTEL-340	Robotics and Robot Applications	3	3

Note: A Student can not choose the same subject as Professional Elective Courses and Open Elective Courses in Sem V and Sem VI

<table>
<tr><td>Course code</td><td colspan="5">PCC-FT-301 G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Building Construction & Urban Planning</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course, students will be able to:
Recall the types of occupancies according to National Building Code of India (NBC).
Describe building bye laws and provisions of NBC in building construction, prevention and protection in relation to the various type of fire hazards in the buildings.
Explain the topography, its importance in urban planning, housing units and building services.
Calculate Floor Area Ratio, capacity, number and width of exit as per NBC.</td></tr>
<tr><td>Objectives:</td><td colspan="5">To be familiar with National Building Code of India.
To study various components of buildings, behaviour of building materials under fire fighting conditions.
To familiarize with the urban planning, housing units and services.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Provisions of National Building Code of India (NBC), Introduction to building by laws, Classification of building based on occupancy, Classification of types of construction according to Fire Resistance, General exit requirements as per NBC, Planning of location and calculation of capacity, Number and width of exit as per NBC for different types of occupancy, Stairs, sizes layout and various kinds of Stairs in different kind of building, FAR terminology with different modes of construction in stone, timber, steel or RC details.

Unit-II

Walls, Stone, brick masonry walls and their construction, Fire walls and its types, Doors and windows, types and construction.
Roof, Fitched roofs, Various types of roof coverings, Types of roof frame in timber and steel, Roof construction details, Terrace roofs, drainage and water proofing.
Floors, timber floors, steel jointed floors, RCC floors and their modes of construction, floor paving, tiles, flag stones, concrete, terrace for different light and heavy duty uses in buildings.

Unit-III

Behaviour of building materials and elements of structure under fire fighting conditions, Fire hazards, Personnel hazard, Damage hazard, Fire precautions in relation to fire hazard, Grading of occupancies to damage hazard with reference to fire load and fire resistance of elements of structure, Problems of high rise buildings and their safety measures, Behavior of retardant structures under fire.

Unit-IV

Urban Planning, its objectives, Planning surveys, selection of site for urban growth, complexity and its impact on National development, Topography, Types of roads in urban areas, Types of housing units, Detached, Semidetached, Group Housing, Multi story flats or apartments, Skyscraper, Group Ware Housing, Commercial complexes, layout of housing areas with consideration of site orientation.

Principle of building planning, Significance, Criteria under Indian conditions, Introduction of building services like Water Supply and Drainage, Electrification, Lightening and Staircase Fire Safety, Acoustics of buildings, Ventilation, Air conditioning, Thermal insulation.

References:

1. Building Construction by Sushil Kumar, (Standard Publishers & Distributors).
2. Town planning by S.C. Rangwala, Charotar Publishing House.
3. National Building Code of India by Bureau of Indian Standards, New Delhi (Latest Edition)
4. Fire Protection Engineering in Building Design by Jane I. Lataille.
5. Fundamentals of Industrial Safety & Health by K.U.Mistry, Siddharth Prakashan.
6. NFPA Manual
7. Introduction to Town Planning by Robert, Mnotype Publishers, latest edition.
8. Urban Growth and Development : A Problem approach by Andrews, Richard B., New York, Simmons Boardman, latest edition.

Course code	**PCC-FT-303 G**				
Category	Professional Core Courses				
Course title	**Mechanics of Structure**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	3	1	0	4	
Course Outcomes:	After completion of this course, students will be able to: • Understand the theorems, laws and concepts related to force, friction, lifting machines, moment of inertia and centre of gravity. • Apply the laws, principles, theorems and concepts for solving the various problems related to beams, structures and machines performance. • Distinguish the forces, stresses, structures, lifting machines, beams under various loading conditions. • Determine the influence of forces, friction, loads in structures and beams.				
Objectives:	• To understand the concepts of stress and strain, truss and frames, friction, center of gravity, shear force and bending moment of beams under different loading conditions. • To enable students to solve practical problems related to friction, lifting machines, shear force and bending moments.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Force and its effects: Units and measurement of force, Characteristics of force vector representation, Bow's notation, Types of forces, action and reaction, tension & thrust.

Force Systems: Coplanar and space force systems, Coplanar, concurrent and non -concurrent forces, Free body diagrams, Resultant and components of forces, concept of equilibrium, parallelogram law of forces, Equilibrium of two forces, super-position and transmissibility of forces, Newton's third law, triangle law of forces, parallelogram law, Lami's theorem.

Unit-II

Simple Stresses & Strains: Introduction, types of stresses and strains, Poisson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooks law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading, Numericals.

Trusses and Frames: Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Numericals.

Unit-III

Friction: Concept of friction, laws of friction, limiting friction and coefficient of friction, sliding friction and rolling friction, inclined plane.

Simple Lifting Machines: Concept of machine, mechanical advantage, velocity ratio and efficiency of a machine, their relationship, law of machine, simple machines (lever, wheel and axle, pulleys, jacks, winch crabs only).

Unit-IV

Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, problem based on composite figures and solid objects, centroid and center of gravity.

Shear Force & Bending Moments: Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contra-flexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, Numericals.

References:

1. Strength of Materials – G. H. Ryder - Macmillan, India
2. Strength of Materials– Andrew Pytel and Fredinand L. Singer, Addison – Wesley
3. Engineering Mechanics – Irving H. Shames, PHI Publication
4. Engineering Mechanics – Dr. D. S. Kumar, Kataria & Sons
5. Strength of Materials - S. Ramamrutham, Dhanpat Rai Publishing company
6. Mechanics of Materials – B.C. Punamia, Laxmi Publication

<table>
<tr><td>Course code</td><td colspan="5">PCC-FT-305 G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Passive Measures for Fire Safety</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course, students will be able to:
• Understand site planning, protection for explosive, flammable material, fire wall.
• Understand the layout of hazardous pipelines, selection of appropriate extinguishing devices, fire doors, escape routes and their planning, smoke extraction etc.
• Apply the proper standards and rules in site planning, layout of hazardous pipelines, calculating fire loads etc.
• Analyze the suitable extinguishing device after strategic planning, detailed case study for reducing life losses.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To learn about the different passive measures of fire safety.
• To study the site planning of various occupancies from the point of view of fire protection and safety.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Planning and construction of building, Site planning by considering the nature of the plant, Building, Equipment and process from the point of safety and fire protection, Protection where Corrosive, Explosive and easily Combustible materials are handled and processed, Fire wall and its types, Barricades etc. Fire Separation, Segregation and Isolation.

Unit-II

Layout of hazardous pipelines, vessels and equipments, Planning of strategic points and Selection of fire extinguishing devices

Fire doors, their resistance rating, Wire glass windows, Prevention of fire through roofs, Vertical cut off's, Exits guards and Guarding, Protection devices for lightening hazards.

Unit-III

Escape route, Escape route plan, Emergency exits, Components, Compartmentation, Smoke extraction system, Fire dampers, Fire rated smoke extraction ducts, Cable ducts, Vertical and horizontal opening, Steel protection and steel staircase enclosure, Fire escape enclosure, Glazing, Fire load and Fire rating.

Unit-IV

Housekeeping and management, Indoor housekeeping and Outdoor housekeeping, 5's of Housekeeping, Inspection and checklists, Housekeeping of specific industries, Detailed analysis of fire case studies, Especially those fires where large number of people were involved.

References:

1. Industrial Safety, Health & Environment management System by R.K. Jain & Sunil S. Rao, Khanna Publishers.
2. Fire Safety in Buildings by V.K. Jain, New Age International Publishers
3. Manual of Fire Safety by N Sesha Prakash, CBS Publishers and Distributors
4. Fire Protection and Prevention: The Essential Handbook Volume 1 & 2 by B.M. Sen, UBS Publishers
5. NFPA Manual

<table>
<tr><td>Course code</td><td colspan="5">PCC-FT-307 G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Mechanics of Structure Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Practical</td><td colspan="5">25Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Experiments

1. To draw shear force, bending moment diagrams for a simply supported beam under point and distributed loads.
2. To study the universal testing machine and perform the tensile test on UTM.
3. To perform compression & bending tests on UTM.
4. To perform the shear test on UTM.
5. To study the impact testing machine and perform the impact tests (Izod & Charpy).
6. To study the Brinell hardness testing machine & perform the Brinell hardness test.
7. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
8. To study the Vickers hardness testing machine & perform the Vickers hardness test.
9. To determine mechanical advantage and efficiency of single and double purchase winch crab.
10. To determine mechanical advantage and efficiency of simple and compound screw jack.

At least 8 experiments to be performed from the above list and other experiment can be performed depending upon the scope of course as decided by department.

Course code	**PR-FT-309 G**				
Category	Seminar				
Course title	**Industrial Seminar-I**				
Scheme and Credits	L	T	P	**Credits**	Semester-V
	0	0	2	1	
Class work	50 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Note: Industrial Seminar based on the training//project /certificate course/case study done after 4th semester.

<table>
<tr><td>Course code</td><td colspan="5">PR-FT-311G</td></tr>
<tr><td>Category</td><td colspan="5">Training</td></tr>
<tr><td>Course title</td><td colspan="5">Fire Ground Operation-III</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-V</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Practical</td><td colspan="5">25Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Experiments

1. To study and perform rolling of Ropes.
2. To study and perform testing of Ropes.
3. To study different types of Ladders and their parts.
4. To study and perform rolling of Hoses.
5. To perform different Ladder tests
   - Round test
   - String test
   - Extension line test
6. To Perform different Hose tests
   - Suction hose test
   - Delivery hose test
   - Hose reel hose test
7. To study and perform extinguisher drill.
8. To perform foam drill with foam test.
9. To perform four men pump drill with pump test.
10. To perform six men pump drill with pump test.
11. To perform close water pumping drill.
12. To perform open water pumping drill.

At least 8 experiments to be performed from the above list. Other drills and tests can be performed as decided by department (time to time) depending upon the scope of course.

Course code	MC-315G			
Category	Mandatory Course			
Course title	**Essence of Indian Traditional Knowledge**			
Scheme and credits	L	T	P	Credits
	2	0	0	0

Course Contents

- Basic structure of Indian knowledge System: अष्टादशविद्या – वेद, उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थाप्य आदि) वेदांग (शिक्षा, कल्प, निरूक्त, व्याकरण, ज्योतिष, छंद) उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र)
- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case studies

References

1. V. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
2. Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan
3. Swami Jitatmanand, *Holistic Science and Vedant*, Bharatiya Vidya Bhavan
4. Fritzof Capra, *Tao of Physics*
5. Fritzof Capra, *The Wave of life*
6. VN Jha (Eng. Trans.), *Tarkasangraha of Annam Bhatta*, International Chinmay Foundation, Velliarnad, Arnakulam
7. *Yoga Sutra of Patanjali*, Ramakrishna Mission, Kolkata
8. GN Jha (Eng. Trans.), Ed. RN Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakashan, Delhi 2016
9. RN Jha, *Science of Consciousness Psychotherapyand Yoga Practices*, Vidyanidhi Prakashan, Delhi 2016
10. P B Sharma (English translation), *Shodashang Hridayan*

<table>
<tr><td>Course code</td><td colspan="5">PCC-FT-302G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Rescue Equipment and Techniques</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
Define different types of hydraulically and pneumatically operated tools and equipments used in emergency.
Describe small gears, application and working principles, Ladders its constructional features, their types, material and applications, ropes, tools, techniques and equipments and its types, materials and applications.
Examine breathing apparatus, various types of tenders and to calculate the capacity of the BA set in actual rescue operation.
Categorize and select suitable type of tenders, tools, techniques and equipments for different types of emergency situations.</td></tr>
<tr><td>Objectives:</td><td colspan="5">To familiarize with rescue equipments like hydraulic and pneumatic tools, electric power tools, ladders, ropes etc.
To study the various rescue techniques, PPEs, fire fighting vehicles, rescue vehicles and rescue operations.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Hydraulic and Pneumatic Tools: Hydraulic jack, Hydraulic cutter, Hydraulic expender, Hydraulic combi tools, Air lifting bags.
Electric Power Tools: Electric cutter, Electric saw, Chain saw etc.
Small gears: Small gears and their types.
Ladders: Applications and working principles of Ladders, constructional features, their types, materials and applications.
Ropes: Ropes, their types, materials and applications.

Unit-II

Rescue Techniques: Carriers and drags, One rescuers methods, Two rescuers methods, Multi-rescuers methods, Stretcher carry and different types of drags, Different types of knots, hitches and their applications in emergency.

PPE's- IS specification with types and testing for protection of head, Eye and face, Hand and arm, Foot and leg, Ear and body, Safety belt and Harness.

Unit-III

Fire Fighting and Rescue Vehicles: Emergency rescue tenders(ERT), Water tender, Foam tender, Multipurpose tender, Hydraulic platforms, Turntable ladder, Canteen van and ambulance.

Fire Extinguishers: Introduction, types and applications.

Rescue Operations: Rescue by ordinary means, Rescue from fire incidents, Rescue problems & their remedies, Rescue from high rise buildings, Major disasters like earth quake, Flood drought, Tsunami, etc.

Unit-IV

Respiratory Equipments: Respiratory physiology, Composition of air, Breathing, Breathing rate, B.A set- their types, Constructional features, Working principles and applications, Calculation of the capacity and time duration of the B.A. set.

Gas Masks: Introduction, their types, Constructional features, Working and applications.

Respirators and types: Canister type, Chemical cartridge type, Filter type, Compressed air Line type.

Reference:

1. Fire Safety in Buildings by V.K. Jain, New Age International Publishers
2. Safety Management by R.K. Mishra- AITBS Publishers.
3. Manual of Fire Safety by N Sesha Prakash, CBS Publishers and Distributors
4. Fire Protection and Prevention: The Essential Handbook Volume 1 & 2 by B.M. Sen, UBS Publishers
5. NFPA Manual
6. National Building Code of India by Bureau of Indian Standards, New Delhi (Latest Edition)

<table>
<tr><td>Course code</td><td colspan="5">PCC-FT-304G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Fire Protection and Salvage Operation</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
Recall the basic concepts of fire fighting, extinguishing media.
Explain the hose and hose fittings, properties of extinguishing agents and salvage operation.
Apply the principles, IS codes and standards for installation, care inspection and maintenance of portable fire extinguishers.
Classify fire detection systems, alarms.</td></tr>
<tr><td>Objectives:</td><td colspan="5">To learn about various fire fighting equipments.
To evaluate right position for sitting of detector system.
To learn the use of IS codes regarding fire protection.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Hose and Hose fittings: Detailed study of hoses, coupling, branches, branch holders, nozzles, breaching, adaptors, hose ramp, collecting heads, suction hose fittings, stand pipes, monitors.
Foam and foam making equipments: Types of foam, foam making equipments, practical considerations, care and maintenance, Hose reel hose - specifications and installation.

Unit-II

Extinguishing properties of Water, droplet size, heat absorbing capacity, surface tension, Extinguishing Properties of foam, expansion, concentration, bubble size, burn back resistance etc., Extinguishing properties of DCP, composition, particle size, radiation shielding, chain braking mechanism, Extinguishing Properties of CO_2, inert gas and extinguishing agent, FM 200, NOVEC 1230.

Description, working principle and operation methods of portable fire extinguishers, care, inspection and maintenance of portable fire extinguishers, performance criteria and testing of different types of fire extinguishers as per relevant Indian standard IS : 2190, extinguishing agents and their installation techniques.

Unit-III

Alarm Systems: Fire alarm system, classification of fire alarm system, components, testing and maintenance of fire alarm system, basic consideration for installation.

Detectors: Automatic fire detectors, heat detector, smoke detector, gas sensing fire detector, Radiant energy sensing detectors, detector installation, maintenance and testing.

Unit-IV

Salvage: Introduction, equipments-salvage sheets, other gears, procedure at fire- covering up, removal of water, reduction of water damage, reduction of smoke damage, removal of sheets, laying sawdust, drying off, fatal fires, etc. Procedure after the fire- repair of roofs, securing premises against entry.

References:

1. Industrial Safety, Health & Environment Management System by R.K. Jain & Sunil S. Rao, Khanna Publishers.
2. Fire Safety in Buildings by V.K. Jain, New Age International Publishers.
3. Manual of Fire Safety by N Sesha Prakash, CBS Publishers and Distributors.
4. Fire Protection and Prevention: The Essential Handbook Volume 1 & 2 by B.M. Sen, UBS Publishers.
5. Manual of Firemanship 6A, HMSO.

Course code	**PCC-FT-306G**				
Category	Professional Core Courses				
Course title	**Computer Applications and CAD Lab**				
Scheme and Credits	L	T	P	**Credits**	Semester-VI
	0	0	2	1	
Class work	25 Marks				
Practical	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

List of Experiments

1. To study various commands used in Auto- CAD software.
2. Setting up of drawing environment by setting drawing limits, drawing units, naming the drawing, naming layers, setting line types for different layers using various type of lines in engineering drawing, saving the file with .dwg extension.
3. Layout drawing of a building using different layer and line colors indicating all Building details. Name the details using text commands, Make a title Block.
4. To make a Drawing of Line, arc, circle, ellipse, triangle etc.
5. To make a Drawing of a flange.
6. To make a Drawing of a bushing assembly.
7. To make an Isometric dimensioned drawing of a connecting Rod using isometric grid and snap.
8. To make different types of bolts and nuts with internal and external threading in Acme and square threading standards. Save the bolts and nuts as blocks suitable for insertion.
9. To make a quarter sectional isometric view of a cotter joint.
10. To study CNC Machine and perform operations CNC Milling and CNC Lathe.

At least 8 experiments to be performed from the above list and other experiment can be performed depending upon the scope of course as decided by department.

<table>
<tr><td>Course code</td><td colspan="5">PR-FT-308G</td></tr>
<tr><td>Category</td><td colspan="5">Training</td></tr>
<tr><td>Course title</td><td colspan="5">Fire Ground Operation-IV (Rescue Operations)</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-VI</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Practical</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

List of Experiment

1. To practice different lift and carries.
2. To practice different types of knots using ropes.
3. To study different types of tenders (through industrial visits).
4. To study different types of Rescue tools and their applications.
5. To study different types of Power tools and their applications.
6. To Study different types of Fire Fighting Tools and their applications.
7. To study Personal Protecting Equipments and their uses.
8. To study B.A. Set , its technical specifications and to perform drill using B. A. Set.
9. To perform rescue drill using full body harness.
10. To perform drills on Rescue from well.
11. To perform drills on Rescue from confined space like tunnels.
12. To perform drills on Rescue from building.
13. To perform drills on Rescue from accidents/incident.

At least 8 experiments to be performed from the above list. Other drills and tests can be performed as decided by department (time to time) depending upon the scope of course.

<table>
<tr><td>Course code</td><td colspan="5">PEC-FTEL-321</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Fire Safety Codes and Standards</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester----</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
• Recall basics of various fire fighting equipments and appliances.
• Explain various IS codes and NFPA codes related to tenders, Hose Couplings, Fire Extinguishers, Ladders, portable and trailer pumps. Examine industrial fire prevention and protection enforcement.
• Outline codes concerning construction and design of buildings, temporary structures and pandals.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To familiarize with different IS codes and NFPA manuals.
• To understand the use of National Building Code of India, IS codes and standards, Building by laws and NFPA manuals.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fire Extinguishers IS: 940, 6234, 2878, 10204, 2171, 2190, 884, 3844, 636, 903, 944, and 6070.

Unit-II

Fire Tenders IS: 948, 950, 6067, 10460, 4989, 951, 957, 949, and 10993.

Unit-III

National Building Code-2016 (Part-4 Life and Safety).

NFPA: NFPA 704- Identification of hazard of materials for emergency response (NFPA Diamond), IS: 1024, NFPA 1983- Ropes, NFPA 1932- Ground Ladders.

Unit-IV

Code of practice for construction of temporary structures and pandals IS: 8758. Municipal bye-laws in relation to fire prevention, Industrial fire prevention and protection enforcement.

References:

1. Relevant Indian Standards (IS codes)
2. Relevant NFPA standards
3. Delhi Building Bye-Laws by V.K. Puri, A Jba Publication
4. Town Planning by S.C. Rangwala, Charotar Publishing house.
5. NBC, Bureau of Indian Standards.

<table>
<tr><td>Course code</td><td colspan="5">PEC-FTEL-322</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Nuclear Safety and Radioactive Materials</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-----</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
• Describe radioactivity and its monitoring techniques.
• Explain radioactive materials, its handling and storage, its waste, method of disposal, nuclear power stations and possible hazards.
• Apply the fire fighting and rescue operation in nuclear power stations and its safety.
• Analyze the major incidents/accidents, hazards at Nuclear Power Stations and other areas affected with radioactive materials.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To learn the basic concept of radiation, its effects and its monitoring techniques.
• To study various nuclear power stations and safety guidelines.
• To evaluate the various hazards, incidents/accidents occurs in nuclear power stations and rescue technique during radiation hazard.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Radiation Terms: Radioactivity, Alpha, Beta, Gamma Rays, Ionizing Effect, Radiation Exposure, Biological Effects, Radiation Protection Factors, Radioactive Placard and Label Requirement, Fixed site Storage Vessels for Medical Isotopes, Radiation Monitoring Equipment- Geiger- Muller (GM) Counter, Pocket Chamber, Dosimeters, Survey meters, Radiation Detection, Devices.

Unit-II

Special Nuclear Materials: Radioactive Pyrophoric Metals- Uranium, Plutonium, Thorium with Fire Extinguishing guide lines.
Radioactive Material Emergency Response: Hazard Identification, Action Plan, Zoning, Managing the Incident, Assistance and Termination.
Radio Active Waste: Sources and characteristics of radioactive waste and their types, method of disposal, Handling and prevention of radiation emergencies and storage requirements of radioactive materials.

Unit-III

Nuclear Power Plant Safety: Different types of nuclear power plant, Overview and brief description of Pressurized Water Reactor (PWR), Boiling Water Reactor (BWR) and Pressurized Heavy Water Reactor (PHWR-CANDU), Components and equipments, Engineered safety features in each reactors, Nuclear power plant operating states and accident classification as per code of federal regulation, Large break LOCA typical sequence in nuclear power plant.

Fire fighting and rescue operations in the presence of radiation hazard at nuclear power station, Pre plan of Radiation incident.

Unit-IV

Dispersion of Radioactivity: Releases from Nuclear Power Plant, Phenomena of Releases, Diffusion of Radioactive Plume at different heights and temperature condition, Simple Evaluation Techniques, Special Case of Radioactive Iodine release, Biological Absorption and Remedial Plans.

Major Nuclear Power Plant Accidents: Case Studies, Causes and sequence of events, Consequences and follow up actions in Three Mile Island unit-2 Accident, Chernobyl Accident, Fukushima Station Accident and Davis Base Accident.

References:

1. Radioactive Materials, B. M. Rao, Himalaya Publishing House, latest edition
2. J. Misumi, B. Wilpert and R.Miller, Nuclear Safety: A Human Factors Perspective, Taylor & Francis.
3. Principles of Radiation Dosimetry, G .W.White ,John Wiley and Sons,New York, latest edition
4. Radioactive Wastes,their Treatment and disposal ,J.C.Collins,E.F.N Spon Ltd.,London.
5. Industrial Hygience and Toxicology,F.A.Patty (Ed) ,Vols.I and II Interscience,New York
6. Gianni Petrangeli, Nuclear Safety, Elsevier, latest edition
7. John C. Lee and Morman J. McCormick, Risk and Safety Analysis of Nuclear Systems, Wiley, latest edition
8. Joe Varela, Hazardous Materials Handbook for Emergency Response, International Thomson Publishing.

Course code	**PEC-FTEL-323**				
Category	Professional Elective Courses				
Course title	**Fire Risk Calculations**				
Scheme and Credits	L	T	P	**Credits**	Semester-----
	3	0	0	3	
Course Outcomes:	After completion of this course, students will be able to: • Define hazards, risks and their types. • Explain the concept of risk, hazard, explosion and fire. • Apply the different approach and assessment techniques to calculate fire risk. • Analyze the various process in Industries by using HAZOP, FMEA and other techniques.				
Objectives:	• To learn various aspects of hazard identification. • To familiarize with risk assessment and accident investigation. • To understand the concept of risk assessment and risk reduction in various fields.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Risk: Definition, Accepted and imposed risk, Perception and qualification of risk, ALARP, Cost benefit analysis.

Hazards: Definition, types of hazards, Fire explosion and toxic gas release, Structure of Hazard Identification and Risk Assessment. Theories of Accident prevention, Principles of accident causation.

Unit-II

Basic Quantitative Risk Assessment (QRA): Principle of QRA, The Logic Tree Approach, Methodologies for Risk Analysis, Event Tree Analysis (ETA).

Computer aided risk Analysis: Related techniques and approaches

Safety in Design and Operation: Safety assurance in design, safety in operation, maintenance, organizing for safety, Accident investigation and reporting.

Unit-III

HAZOP: Introduction to HAZOP, Conducting a HAZOP study.

FMEA: Introduction to FMEA, Methodology of FMEA, criticality analysis, corrective action and follow up.

Unit-IV

Explosions and fires: Vapour Cloud Explosions (VCE), Unconfined Vapour Cloud Explosion (UVCE), confined explosions, dust collector, silos, Physical explosions, BLEVE, Fire extinguishing ball, Jet fire, Pool fire, Boil over. Major Accident Hazard (MAH) control, On-site and Off-site emergency plan.

References:

1. Industrial Hygine & Chemical Safety by M.H. Fulekar, I.K. International
2. Lees F.P. Loss Prevention in the Process Industries second edition. Butterworths, London, latest edition.
3. Process safety analysis: An introduction by Bob Skelton.
4. An introduction to Risk Analysis by Robert E, Megill.
5. Safety sharing the experience B P process Safety series
6. Fire Safety Risk Assessment HM government.

<table>
<tr><td>Course code</td><td colspan="5">PEC-FTEL-324</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Salvage Evaluation of Fire Situation</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
• Define salvage operation, fire loss, heat release rate and fire investigation.
• Locate various items of equipments necessary in salvage operation.
• Demonstrate Salvage operation in different type of occupancies and follow up action and investigation of different type of fire situations.
• Analyze case studies of salvage operations performed in different type of occupancies and estimate heat release rate and fire losses.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To learn about salvage operation and its planning stage.
• To familiar with various salvage operation equipment and fire investigation.
• To evaluate heat release rate and losses in fire and analyze case studies in various occupancies.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Salvage: Concept, procedure, considerations, salvage operation during fire and after fire, contract salvage and pure salvage, difficulties during in salvage operations, various equipments necessary in salvage operations.

Unit-II

Evaluation of fire situations: Fire loss calculations, Flame temperature measurement, Calculation for heat release rate, Salvage operation in different type of Occupancies like hotel, hospitals, departmental stores and basement godowns etc.

Unit-III

Follow up action and investigation of fire situation such as structural fire, Wild fire and automobile fire etc, Marine salvage operations.

Unit-IV

Case studies of Salvage operations in different type of Occupancy International Salvage convention

References:

1. Manual of Fireman ship, Part 6-A by H.M.S.O.

2. Report and Accounts by Fire Salvage Association of Liverpool limited.
3. The principles and practice of Fire salvage operation by fire salvage association.
4. Loss prevention in process of industries, Vol1, 2 & 3, Frank P. Lees.

<table>
<tr><td>Course code</td><td colspan="5">PEC-FTEL-325</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Special Hazards and Protection</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
• Recall the basic of fire science and thermal engineering.
• Describe the basic fire hazards in aircrafts, ships, high rise buildings and nuclear power plants.
• Apply the basic fire fighting and evacuation strategies in aviation, marine, high rise buildings and nuclear power plants.
• Analyze the level of possible hazards in aviation and marine system, high rise building and nuclear power plant for reducing accidents and improve safety.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To understand the basic working of aviation and marine drive system.
• To obtain the basic fire fighting operation technique in aircraft, cargoes, High Rise Building and Nuclear Power Station.
• To access the various hazards occurs in aircraft and marine system, High rise building and nuclear power plant.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Aviation : Constructional features of an Air Craft, Types of Engines, Basic Fire-Hazards in Aircraft, Nature of Air Crashes, Emergency Landings including belly leading; Access to Fire Service Personnel and Escape of trapped persons problems, Types of Safety Belts, Ejection-Seats; and their methods of release; Rescue and Fires in Air Craft and methods of fire-fighting; Problems of fire-fighting.Hazards in Airport, Protection & Types of Hangers. Categorization of Air-Port, their extinguishing media and determination of the appliances for each category as per International Standard.

Unit-II

Marine Fire : The maritime environment, organizational role, vessel types, construction & systems of fire detection & suppression, cargo vessel hazards & safety. Incident strategies & tactics, training & planning, vessel fire incidents, Marine incidents & Rescue operations.

Unit-III

High rise buildings : Fundamentals of Fire Safe Building design, Life safety systems for high, rise structures, structural integrity during confinement of fire in building, Alarm signaling in high-rise building, Smoke movement in building, High-rise building with complex occupancy, Basic fire-fighting strategy.

Evacuation: Need of Evacuation plans in high rise buildings, Making of Evacuation Plans, types of Evacuation, Procedure of Evacuation.

Unit-IV

Nuclear Safety : Radiation and its types, Components of nuclear power plant , Nuclear Reactors, Radiation emergencies, Pre plan of radiation incident, Fire fighting and rescue operations in the presence of radiation hazard, Radiation Safety in Nuclear Power Plants. Nuclear waste management - Radioactive waste, Sources , characteristics and types, Handing of radioactive waste.

References:

1. Radioactive Materials by B.M. Rao, Himalaya Publishing House
2. Fire Safety in Buildings by V K Jain, New Age publishers, New Delhi
3. National Building Code of India, Bureau of Indian Standards, New Delhi (Latest Edition)
4. Fire protection handbook – NFPA, latest edition

<table>
<tr><td>Course code</td><td colspan="5">PEC-FTEL-326</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Building Design and Drawing</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
• Describe various components of building .
• Apply National Building Code in building planning.
• Judge the necessity of provision of building services like fire safety and thermal insulation etc.
• Evaluate and prepare the detailed drawing of various types of buildings.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To understand the different types of building codes, building components.
• To understand different modes of supply system inside the building.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
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Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Drawing of Building Elements: Drawing of various elements of buildings like various types of footing, open foundation, raft, grillage, pile and well foundation, Drawing of frames of doors, window, various types of door, window and ventilator, lintels and arches, stairs and staircase, trusses, flooring, roofs etc.

Unit-II

Building Planning - Provisions of National Building Code, Building bye-laws, open area, setbacks, FAR terminology, principle of architectural composition (unity, contrast, etc), principles of planning, orientation.
Building Services: Introduction of Building Services like water supply and drainage, electrification, ventilation and lightening and staircases, fire safety, thermal insulation, acoustics of buildings.

Unit-III

Design and Drawing of Building - Design and preparation of detailed drawings of various types of buildings like residential building, institutional buildings and commercial buildings, detailing of doors, windows, ventilators and staircases etc.

Unit-IV

Perspective Drawing - Elements of perspective drawing involving simple problems, one point and two point perspectives, energy efficient buildings.

References:

1. Malik & Meo; Building Design and Drawing

2. Shah, Kale & Patki; Building Design and Drawing; TMH
3. Gurucharan Singh & Jgdish Singh Building Planning, Design and Scheduling

Course code	**PEC-FTEL-327**				
Category	Professional Elective Courses				
Course title	**Fire Modeling**				
Scheme and Credits	L	T	P	**Credits**	Semester------
	3	0	0	3	
Course Outcomes:	After completion of this course students will be able to: • Describe basic simulation approaches. • Use the various simulation approaches while designing a building to reduce the effect of fire. • Apply the different models in investigating fire • Analyze various simulation results and simulation models using tables, graphs, web interfaces.				
Objectives:	• To familiarize with different types simulation and modeling. • To analyze with simulation result using different types of graphs, tables, web interfaces and validation of model.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Simulations: Basic Model Forms, Basic Simulation Approaches, Handling Stepped and Event-based Time in Simulations, Discrete versus Continuous Modeling, Numerical Techniques, Sources and Propagation of Error.
Dynamical, Finite State, and Complex Model Simulations: Graph or Network Transitions Based Simulations, Actor Based Simulations, Mesh Based Simulations, Hybrid Simulations.
Converting to Parallel and Distributed Simulations: Partitioning the Data, Partitioning the Algorithms, Handling Inter-partition Dependencies.
Probability and Statistics for Simulations and Analysis: Introduction to Queues and Random Noise, Random Variates Generation, Sensitivity Analysis.

Unit-II

Simulations Results Analysis and Viewing Tools: Display Forms: Tables, Graphs, and Multidimensional Visualization, Terminals, X and MS Windows, and Web Interfaces, Validation of Model Results, Index notation, matrix operations, Thermodynamics, equation of state, chemical and phase equilibrium, Droplet mass, momentum, and energy transfer, Taylor series, order of accuracy, Numerical time integration, explicit and implicit methods, Finite difference methods, stability restrictions, Lax equivalence theorem, Derivation of mass, momentum, and energy equations Pressure Poisson equation, projection methods, Scalar transport schemes, Godunov's theorem.

Unit-III

Time-splitting methods for source terms, Non-dimensional forms of the governing equations, Compressible and low-Mach Number formulations Velocity divergence constraint for low-Mach Number flows, Thermal radiation, discrete ordinates method, Beer's law.

Turbulence Theory: vortex dynamics, Kolmogorov, Batchelor, power spectra, 2 DNS, length scale requirements, parallel computing, estimating cost, RANS, turbulence models, statistical correlations, LES, subgrid closures, Itering, energy spectrum, Nyquist limit, aliasing.

Unit-IV

Turbulent boundary layers, grid design, mesh quality metrics Models for the mean chemical source term (turbulent combustion) Extinction, ignition, under-ventilated combustion, toxic products (CO, soot) Pyrolysis, ame spread, Fire suppression, Model validation and uncertainty quantification (model input and output).

References:

1. Introduction to Mathematical Fire Modeling, Second Edition By Marc L.Janssens
2. Standard Fire Behavior Fuel Models: A Comprehensive Set for Use with Rothermel's Surface Fire Spread Model by Joe H. Scott, Robert E. Burgan

<table>
<tr><td>Course code</td><td colspan="5">PEC-FTEL-328</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Electrical Systems and Safety in Design</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course, students will be able to:
• Recall the basics of electrical engineering.
• Describe the terminologies related to electrical fires like electrical equipment failure, protection devices, electric shock etc.
• Apply the suitable approach to use protection devices for reducing electrical fires and failures.
• Investigate the different conditions and reasons of electrical fires.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To learn about fire protection devices.
• To evaluate reasons behind different Electrical Fires.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
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Unit-I

Introduction : Conductor, Classification and property of Conductors, Semiconductors, Cables, Wires, Wire splicing and termination, Joints, General Electrical accessories and insulating materials.

Terminology : Electrical Fire, Failure , Defect, Seed defect, Modes and Mechanism of failure, Failure rate, Metal fatigue, Elasticity of metals, Creep, Stress, Strain, Elastic and Endurance Limit.

Unit-II

Wiring System : System of supply, Selection of wiring, Rules and system of wiring, Separation of power and lighting circuit, Necessity of Earthing, System of Earthing, Rules of earthing , Methods of improving the earth resistance.

Protection Devices: Introduction, Features of good protective device, Relays, Fuses, Circuit breaker, General specification of MCB's, Trip mechanism, ELCB , RCCB.

Unit-III

Electrical Fire: Introduction, Causes of Electrical fires, Failure of Insulation, Types and Causes, Transformer Failure, Failure modes. Investigation overheating/ burning of crimped sockets, Failure of plug and socket connectors.

Electrical Shock Phenomenon: Shocks from AC & DC system, Medical analysis of Electrical Shock, Prevention of shocks, Safety precaution in Electrical plant, Safety precaution against contacts shock, Flash shocks and burns.

Unit-IV

Investigation of failures and fires : Process of investigation, Failure investigation: step by step approach, Investigation of electrical fire, action plan.

Role of the Management: Materials and Training:- Preparation of specification, Selection of supplier, Inspection of material , Training of staff, Tools and Instruments.

References:

1. Electrical Wiring Estimating and Costing by S.L. Uppal, Khanna Publishers.
2. Electricl Fires and Failures by A.A. Hattangadi, TMH Publishers.
3. Electricity Fire Risk by G.S. Hoges.
4. NFPA Manual.
5. J.P. Handbook.

<table>
<tr><td>Course code</td><td colspan="5">PEC-FTEL-329</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Safety in Petroleum and Petrochemical Industries</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
Describe the properties, storage and handling methods of petroleum products.
Explain safety measures for accidents arising during handling and transportation of petroleum product like LPG, CNG, Gasoline, etc.
Apply rules and regulations provided by statutory bodies for safety in petrochemical industries.
Analyze the properties and use of different types of fire-fighting installations like hydrant, mobile water monitors, foam pourer, etc.</td></tr>
<tr><td>Objectives:</td><td colspan="5">To familiarize with different types of petroleum products, their properties and methods of their preparations in industries and OISD.
To know more about the refining process of petroleum like cracking, distillation and safety associated with it.
To understand different types of fire using different petroleum products viz. Gasoline, Naphthalene, LPG, and CNG.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
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Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Crude oil :- Introduction, properties & characteristics, Classification of petroleum & its products, MSDS of crude oil, diesel, gasoline, kerosene, LPG, Natural Gas, Naptha, Ammonia, Benzene, toluene, Acetylene.

Refining Processes: Primary Distillation, catalytic cracker, polymerization, reforming, steam cracking, sulphur recovery, Lubricating oil treating. Process units such as desalter, ADU, VDU, FCC, hydrocracker, catalytic reformer etc. Storage tanks & its types. Layout of Refineries, simplified flow diagram of a typical refinery.

Unit-II

Fire Protection and Emergency Planning :- Major fire risks, Use of various media in petroleum & gas fires such as water, foam, DCP. Design criteria for selection of fire water network, fire fighting installations such as hydrant, mobile water monitors, foam pourer, DCP fixed, subsurface injection & steam snuffing systems, Storage tanks protection.

Unit-III

Fighting Refinery and Petrochemical Fires : Potential fire hazards, precautionary measures in case of non-ignited releases, oil & gas leaks, Fire fighting facilities for depots, terminals, onshore offshore drilling platforms and pipelines for transportation of petroleum products & gases.

Fighting Gas Terminal Fires: Fire fighting in case of BLEVE, LPG hazards, Spillage, vehicle using LPG & CNG as a fuel, Fire fighting facilities at LPG bottling plant, water injection into LPG vessel(water bottoming).

Unit-IV

Oil Industry Safety Directorate(OISD) : 105, 116, 117, 244. Petroleum and natural gas regulatory board(PNGRB) drafts. Application of advance technologies used in refineries and petrochemical plants such as SCADA, SAP and various simulation modeling.

Statutory provisions pertaining to refineries, petrochemical plants and gas terminals.

References:

1. Fire Service Manual (Volume 2) Fire Service Operations - Petrochemical Incidents
2. Manual of Firemanship, Part 6-A by H.M.S.O.
3. Oil Industry Safety Directorate (OISD) Norms & Rules
4. Petroleum & Natural Gas Regulatory Board (PNGRB) drafts
5. Loss prevention in Process of Industries, Vol 1,2, & 3 by Frank P. Lees.
6. NFPA Manuals

<table>
<tr><td>Course code</td><td colspan="5">PEC-FTEL-330</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Design of Pipe, Pressure Vessels and Machine Elements</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
1. Recall the basic principles of design.
2. Describe the various types of stresses involved in thick & thin cylinders for safety purpose.
3. Apply the mathematical fundamentals and factor of safety for the design of pressure vessels, pipes and other machine elements.
4. Analyze the various parameters including FOS for designing of pressure vessels pipes and other machine elements.</td></tr>
<tr><td>Objectives:</td><td colspan="5">1. To understand the designing of pressure vessels, pipes and machine elements like couplings, nuts, bolts etc.
2. To evaluate stresses and other parameters for designing of pressure vessels, pipes and other machine elements for safe working.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
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Unit-I

Fundamentals of Design: Principle of design, limits, fits and standardization, Theories of failure under static and dynamic loading, Factor of safety, S-N curve for ferrous material and non ferrous material.

Unit-II

Piping design: Introduction to piping Codes and Standards, bends, tees, bellows and valves, types of piping supports and their behaviour, Flow diagram, Piping layout and piping stress analysis, Flexibility factor and stress intensification factor, Design of piping system as per B31.1 piping code.

Unit-III

Design of Pressure vessel: General theory of membrane stresses in vessel under internal pressure and its application to shells (cylindrical, conical and spherical) and end closures. Bending of circular plates and determination of stresses in simply supported and clamped circular plate. Thermal stresses, Stress concentration in plate having circular hole due to bi-axial loading.

Introduction to ASME codes for pressure vessel design, Pressure vessel and related components' design using ASME codes; Supports for short vertical vessels, Stress concentration at a variable thickness transition section in a cylindrical vessel; Design of nozzles.

Unit-IV

Design of Transmission Elements: Spur, helical, bevel and worm gears; belt and chain drives.
Design of Springs: Leaf Spring, Helical Spring, Flat Spiral Spring.
Design of Joints: Threaded fasteners, pre-loaded bolts and welded joints, Analysis and applications of power screws and couplings, Analysis of clutches and brakes.

References:

1. Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, Fifth Edition, McGraw-Hill International; latest edition
2. Bhandari, V.B., Design of Machine Elements, Latest Edition, TMH Publishers
3. Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan, latest edition
4. Juvinal, R.C., Fundamentals of Machine Component Design, John Wiley, latest edition
5. Spottes, M.F., Design of Machine elements, Prentice-Hall India, latest edition
6. R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall, latest edition

<table>
<tr><td>Course code</td><td colspan="5">OEC-FTEL-331</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Materials & Metrology</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-----</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
Identify crystal structures for various materials and understand the defects in such structures.
Understand the basics of limit, fit and tolerance, material properties of ferrous alloys.
Analyze the various heat treatment processes and various properties of iron and steel.
Evaluate the hardness, tensile strength and creep.</td></tr>
<tr><td>Objectives:</td><td colspan="5">To familiarize with various type of material and their properties.
To Know the various types of defects in materials.
To know various processes used for materials properties modifications.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Introduction to Manufacturing Processes and their Classification.
Engineering Materials: General Properties and Applications of Engineering Materials, Mild Steel, Medium Carbon Steel, High Carbon Steel, High Speed Steel and Cast Iron, Effect on material properties by adding the alloying elements, Crystal imperfection.

Unit-II

Failures of metals: Failure analysis, fracture, process of fracture, types of fracture, fatigue, characteristics of fatigue, fatigue limit, mechanism of fatigue, factors affecting fatigue.
Creep & Corrosion: Definition and concept, creep curve, mechanism of creep, impact of time and temperature on creep, creep fracture, creep testing and prevention against creep. Corrosion: Mechanism and effect of corrosion, prevention of corrosion.

Unit-III

Measurement and Metrology : Limit, fit (clearance fit, transition fit and interference fit) and tolerance, allowance, fundamental deviation, principle of gauge (hole and shaft basis), linear measurement (Vernier caliper, Micrometer etc.) and angular measurement (Bevel protector, Sine bar).

Unit-IV

Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing, normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening. Allotropic transformation of iron and steel, Properties of austenite, ferrite, pearlite, martensite, iron carbon equilibrium diagram, TTT diagram, concept of tension test, hardness test(BHN, VHN, RHT), impact test(IZOD and CHARPY test), creep test

References:

1. Workshop Technology Vol. I &II by Hazra & Chaudhary, Asian Book Comp.
2. Process and Materials of Manufacture by Lindberg, R.A. Prentice Hall of India
3. Principles of Manufacturing Materials and Processes by Campbell, J.S. McGrawHill.
4. Manufacturing Science by Amitabha Ghosh & Ashok Kumar Malik, East-West Press.
5. Elements of Material Science and Engineering by VanVlack, Wesley Pub. Comp.
6. Material Science by Narula, Narula and Gupta. New Age Publishers

<table>
<tr><td>Course code</td><td colspan="5">OEC-FTEL-332</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Power Plant Engineering</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
Recall basics of thermodynamics, power generation cycles, nuclear fission and fusion processes.
Describe conventional and non conventional sources of energy, nuclear power plant, hydro electric power plant.
Explain the principles of operation for different power plants and their economics.
Show energy auditing for the energy consumption of industries.</td></tr>
<tr><td>Objectives:</td><td colspan="5">To provide an overview of power plants and the associated energy conversion issues.
To understand the energy data from industries and carry out energy audit for energy savings.
To understand importance of non conventional sources of energy and their economic utilization.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Types of energy, Energy resources and their availability, Conversion of various forms of energy, Conventional and Non-conventional sources, Need for Non-Conventional Energy based power generation.
Energy Management: General Principles of Energy Management, Energy Management Strategy.
Energy Audit: Need, Types, Methodology and Approach.

Unit-II

Introduction: Types of power plants, selection of the plants, review of basic thermodynamic cycles used in power plants.

Hydro Electric Power Plants : Rainfall and run-off measurements and plotting of various curves for estimating stream flow and size of reservoir, power plants design, construction and operation of different components of hydro-electric power plants, site selection, comparison with other types of power plants.

Unit-III

Steam Power Plants: Flow sheet and working of modern-thermal power plants, super critical pressure steam stations, site selection, coal storage, preparation, coal handling systems, feeding and burning of pulverized fuel, ash handling systems, dust collection-mechanical dust collector and electrostatic precipitator.

Non-Conventional Energy sources: Basic principle, site selection of Solar energy power plant, photovoltaic technologies, PV Systems and their components, Wind energy power plant, Bio energy plants, Geothermal energy plants and tidal energy plants.

Unit-IV

Nuclear Power Plants: Principles of nuclear energy, basic nuclear reactions, nuclear reactors-PWR, BWR, CANDU, Sodium graphite, fast breeder, homogeneous; gas cooled. Advantages and limitations, nuclear power station, waste disposal. Power Plant Economics: load curve, different terms and definitions, cost of electrical energy, tariffs methods of electrical energy, performance & operating characteristics of power plants- incremental rate theory, inputout put curves, efficiency, heat rate, economic load sharing, Problems.

References:

1. Power Plant Engineering : P.K. Nag Tata McGraw Hill latest Edition
2. Power Plant Engg. : M.M. El-Wakil McGraw Hill latest edition
3. Non-conventional energy resources- Shobhnath Singh, Pearson.
4. Soni, Gupta, Bhatnagar: Electrical Power Systems – Dhanpat Rai& Sons
5. NEDCAP: Non Conventional Energy Guide Lines
6. G.D. Roy :Non conventional energy sources

Course code	**OEC-FTEL-333**				
Category	Open Elective Courses				
Course title	**Computer Applications and CAD-CAM**				
Scheme and Credits	L	T	P	**Credits**	Semester-----
	3	0	0	3	
Course Outcomes:	After completion of this course students will be able to: • Understand the basics, importance and necessity of Computer Applications and CAD Software. • Explain Transformation, Computer applications, Group Technology, FMS, CAPP. • Demonstrate the knowledge of computer and its applications in design. • Apply the CAD/CAM programming and coding for operation on CNC Machines.				
Objectives:	• To learn about Computer Aided Design and Computer Added Manufacturing. • To understand the applications of computer, basic concept of transformation, Automation and numerical control. • To make familiarization with Group Technology, FMS and CAPP.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Computer Applications: Evolution of Computers, Generation of Computers, Classification of Computers Analog Digital and Hybrid Computers, Classification of Computers according to size, Super Computers, Mainframe Computers, Personal Computers (Different Types) and Terminals (Different Types), Characteristics of Computers, Block Diagram of a Digital Computer, types of OS.

MS Windows, and its various elements of application windows title bar, menu bar, maximize and close buttons, borders and corners, scroll bars, windows icon, folder icons, dialog box and its items, starting Microsoft windows, searching the files, copying the files, disk clean up, deleting unnecessary files

Unit-II

Introduction: Introduction to CAD, CAM, CIM, Design Process, Importance and Necessity of CAD, Applications of CAD, Hardware and Software requirement of CAD, Basics of geometric and solid modeling, coordinate systems.
Transformations: Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations (No Numericals).

Unit-III

Automation and Numerical Control: Introduction, fixed, programmable and flexible automation, types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, Part program for simple parts, computer assisted part programming.
Group Technology: Part families, part classification and coding, production flow analysis, Machine cell design, Advantages of GT.

Unit-IV

Flexible Manufacturing Systems: Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications.
Computer Aided Process Planning: Conventional process planning, types of CAPP, Steps in variant process planning, planning for CAPP.

References:

1. CAD/ CAM by Groover and Zimmer, Prantice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill
3. Numerical Control and Computer Aided Manufacturing by Kundra, Rao & Tiwari, TMH.
4. CAD/CAM (Principles, Practice & Manufacturing Management) by Chirs Mc Mohan & Jimmie Browne, Published by Addison- Wesley.

<table>
<tr><td>Course code</td><td colspan="5">OEC-FTEL-334</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Process Instrumentation and Control Engineering</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to :
• Recall fundamentals of measurement, define error, precision and accuracy.
• Describe various flow, temperature, humidity and pressure measuring instruments,
• Explain various feedback and response instruments viz. Open loop, close loop, time response system etc.
• Analyze various measuring, feedback and response instruments used in process control.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To study the flow measuring instrument.
• To know the open loop, closed loop and response system.
• To analyze instrumentation and control system.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Elements of measurement : Fundamental standards, Quality of measurement, Meaning of measurement, Errors in measuring instruments, Precision and accuracy, Calibration principle, Static and dynamic characteristics of measuring instruments.
Measurement of temperature: Bimetallic and pressure thermometers, Thermocouples, Resistance thermometers, Pyrometry, Calibration. Pressure and vacuum measurement -Manometers, Measuring element, Absolute pressure measurement, Static accuracy of pressure gauges.

Unit-II

Flow measurement: Orifice installation, Pitot tube, Area flow meters, Open channel meters. Level measurement - Direct method, Measurement of level in open and pressure vessels, Measurement of pH and humidity. Recording Instruments, Indicating and signaling instruments, Signal transmission and codes.

Unit-III

Open loop and Close loop systems - Transfer function, block diagram representation of mechanical, thermal and liquid level systems.
Transient response analysis, Time response of first and second order system for impulse and step inputs, Effect of damping factors on transient response, Characteristics of proportional, integral, derivative, PI, PD and PID controllers, Frequency response method of analysis, polar plot, Bode Plot.

Unit-IV

Introduction to stability, Definition via impulse response function, Routh-Hurwitz stability criterion, Nyquist stability criterion, Control system components, error detectors, modulators and demodulators, Hydraulic controllers, Pneumatic controllers, PLC.
Introduction to computer control in chemical process industry, Comparison between discrete data, digital and analogue control systems.

References:

1. D Patranabis, Principles of Industrial Instrumentation, Second Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, latest edition
2. George Stephanopolous, Chemical Process Control: An Introduction to Theory and Practice, Prentice Hall of India Pvt. Ltd, latest edition
3. Eckman D P, Industrial Instrumentation, Wiley Eastern Ltd, New Delhi, latest edition
4. Ogata, K., Modern Control Engineering, Prentice Hall, latest edition
5. Benjamin C. Kuo., Digital Control Systems, Oxford University Press, latest edition
6. Stefani R.T, Shahian B, Savant J.C and Hostetter G. H, Design of Feedback Control Systems, Oxford University Press, latest edition

<table>
<tr><td>Course code</td><td colspan="5">OEC-FTEL-335</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Operation Research</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-----</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
Identify operational research model from the verbal discussion of real system.
Describe operation research and its applications.
Apply the mathematical tools and simulation models that are needed to solve optimization problem.
Analyze the result and proposed recommendations in language understandable to decision making process in management engineering.</td></tr>
<tr><td>Objectives:</td><td colspan="5">To familiarize students with the basic concepts, models and statements of the operations research theory.
To evaluate the optimum cost in various operations research models.
To analyze various decision making process in certainty, uncertainty and risk environment.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction: Definition, Role of operations research in decision-making, applications in industry. Concept on O.R. model building, Types & methods.

Linear Programming (LP): Programming definition, formulation, solution- graphical, simplex Gauss-Jordan reduction process in simplex methods, BIG-M methods computational, problems.

Unit-II

Deterministic Model: Transportation model-balanced & unbalanced, north west rule, Vogel's Method, least cost or matrix minimal, Stepping stone method, MODI methods, degeneracy, assignment, traveling salesman, problems.

Advanced Topic of LP: Duality, PRIMALDUAL relations-its solution, shadow price, economic interpretation, dual-simplex, post optimality & sensitivity analysis, problems.

Unit-III

Waiting Line Models: Introduction, queue parameters, M/M/1 queue, performance of queuing systems, applications in industries, problems.

Project Line Models: Network diagram, event, activity, defects in network, PERT & CPM, float in network, variance and probability of completion time, project cost- direct, indirect, total, optimal project cost by crashing of network, resources leveling in project, problems.

Unit-IV

Simulation: Introduction, design of simulation, models & experiments, model validation, process generation, time flow mechanism, Monte Carlo methods- its applications in industries, problems. **Decision Theory:** Decision process, SIMON model types of decision making environment- certainty, risk, uncertainty, decision making with utilities, problems.

References:

1. Operation Research by TAHA, PHI, New Delhi.
2. Principle of Operations Research by Ackoff, Churchaman, arnoff, Oxford IBH, Delhi.
3. Operation Research by Gupta & Sharma, National Publishers, New Delhi.
4. Quantitative Techniques by Vohra, TMH, New Delhi
5. Principles of operation Research (with Applications to Managerial Decisions) by H.M.Wagher, Prentice Hall of India, New Delhi.
6. Operation Research by Sharma, Gupta, Wiley Eastern, New Delhi.

<table>
<tr><td>Course code</td><td colspan="5">OEC-FTEL-336</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Industrial Noise and Vibrations</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to :
Explain the merits and demerits of vibrations, sound and noise happened in industries.
Calculate the natural frequency and other response of a system/machine operating under vibratory conditions.
Apply the different methods and techniques to reduce vibrations, noise and sound up to accepted level.
Analyze the mathematical model of a linear vibratory system to determine its response.</td></tr>
<tr><td>Objectives:</td><td colspan="5">To learn the importance of vibrations, sound and noise in context of an industry.
To write the differential equation of motion of vibratory systems having single or multiple degree of freedom.
To understand the basic concepts, techniques and laws that can be used for reduction of vibrations, sound and noise up to accepted level.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Vibrations: Introduction, Causes, Effects, Merits and Demerits , Types of Vibrations, SHM, Addition of harmonic motions, Beats Phenomenon, Work done by harmonic force on harmonic motion, Harmonic series.
Undamped Free Vibration: Equations of motion, Natural frequency, Newton's Method, D'Alemberts Principle, Energy method, Rayleigh's method, Simple pendulum, Compound pendulum, Floating and immersed body.

Unit-II

Damping: Introduction, Equation of motion, Critical damping, Underdamping, Overdamping, Logarithmic decrement, Types of Damping, Viscous damping, Coulomb damping, Hysteresis damping, Slip damping.
Forced Vibrations: Introduction, Equation of motion with harmonic force, Excitation due to unbalance, rotating and reciprocating unbalance, Transmissibility, Whirling of Shaft.

Unit-III

Multi Degrees of Freedom System: Introduction, Equation of Motion, Influence coefficients, Dunkerley's method, Rayleigh's method, Holzer's method, Matrix method, Matrix Iteration method, Stodola's method.

Vibrations Control: Vibrations measuring Instruments, Vibration isolation, Frequency measuring instruments, Vibration absorbers, Centrifugal vibration absorber, Torsional vibration absorber, Vibration dampers, Lanchester damper, Houdaille damper.

Unit-IV

Noise: Introduction, Nature and types of noise, Non Auditory effect of noise, Auditory effects of noise, Noise Standards and limits, Noise Measurement, Hazardous noise explosion, Day Night Noise Level, Noise Sources and control.

Sound: Sound level, Subjective response to sound frequency , human response to sound, Sound pressure human response, Decibel Scale, Relation among sound power, Sound intensity & sound pressure level, Octave band analysis.

References:

1. Mechanical Vibration & Noise by A.G. Ambekar, PHP Publication
2. Mechanical Vibration by G.K. Grover, Nen Chand & Bros.
3. Theory of Vibrations with Applications by W.T. Thomson, Pearson Publication
4. Mechanical Vibrations by J.K. Narwal, VEI Publications
5. Mechanical Vibrations by S.S. Rao, Pearson Publications
6. Vibrations and Noise for Engineers by Kewal Pujara, Dhanpat Rai & Co.

<table>
<tr><td>Course code</td><td colspan="5">OEC-FTEL-337</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Engineering Economics</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
Define the basic terminologies of economics.
Describe the basics laws of economics and their practical applications in various situations.
Determine the relationship between demand and supply, their effect on cost.
Discuss the different features of market, GST, VAT, GATT etc.</td></tr>
<tr><td>Objectives:</td><td colspan="5">To understand laws of economics and their practical application in market.
To evaluate the market according to the highest profit.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Definitions of Economics, Nature of Economic problems, Production possibility curve Economic laws and their nature. Relation between Science, Engineering, Technology and Economics.
Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility, its practical applications and importance.

Unit-II

Demand: Meaning, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, factors effecting elasticity of demand, practical importance & applications of the concept of elasticity of demand. Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale.

Unit-III

Cost: Fixed cost, variable cost, average cost, marginal cost, money cost, real cost opportunity cost. Shape of average cost, marginal cost, total cost etc. in short run and long run. Meaning of Market, Types of Market, Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets).

Unit-IV

Supply and Law of Supply, Role of Demand & Supply in Price Determination and effect of changes in demand and supply on prices. Nature and characteristics of Indian economy (brief and elementary introduction), Privatization - meaning, merits and demerits, Globalisation of Indian economy - merits and demerits, Elementary Concepts of GST, VAT, GATT & TRIPS agreement.

References:

1. Principles of Economics: P.N. Chopra (Kalyani Publishers).
2. Modern Economic Theory – K.K. Dewett (S.Chand)
3. A Text Book of Economic Theory Stonier and Hague (Longman's Landon)
4. Micro Economic Theory – M.L. Jhingan (S.Chand)
5. Micro Economic Theory - H.L. Ahuja (S.Chand)
6. Modern Micro Economics : S.K. Mishra (Pragati Publications)
7. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co.)
8. Indian Economy: Rudar Dutt & K.P.M. Sundhram

Course code	**OEC-FTEL-338**				
Category	Open Elective Courses				
Course title	**Artificial Intelligence**				
Scheme and Credits	L	T	P	**Credits**	Semester------
	3	0	0	3	
Course Outcomes:	After completion of this course students will be able to : • Describe artificial intelligence and neural network. • Understand expert system life cycle and fuzzy logic. • Apply the concepts of artificial intelligence using prolog. • Analyze the problem as a state space, graph, heuristics and game based techniques to solve them.				
Objectives:	• To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning. • To investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models. • To explore the current scope, potential, limitations and implications of intelligent system.				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Foundational issues in intelligent systems: Foundation and history of AI, AI problems and techniques, AI programming languages, Introduction to LISP and PROLOG, problem spaces and searches, blind search strategies, Breadth first- Depth first- heuristic search techniques Hill climbing, best first- A * algorithm AO* algorithm, game tree, Min max algorithms, game playing, alpha beta pruning.

Unit-II

Knowledge representation issues, predicate logic- logic programming, semantic nets, frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems.

Unit-III

Reasoning under uncertainty, review of probability, Baye’s probabilistic interferences and Dempster shafer theory, Heuristic methods, symbolic reasoning under uncertainty, Statistical reasoning, Fuzzy reasoning, Temporal reasoning, Non monotonic reasoning.

Unit-IV

Planning, planning in situational calculus, representation for planning, partial order planning algorithm, learning from examples, discovery as learning, learning by analogy, explanation based learning, neural nets, genetic algorithms, Principles of Natural language processing, rule based systems architecture, Expert systems, knowledge acquisition concepts, AI application to robotics, and current trends in intelligent systems.

References:

1. Artificial Intelligence: A Modern Approach,. Russell & Norvig. Prentice Hall.
2 Artificial Intelligence, Elain Rich and Kevin Knight, TMH.
3. Artificial Intelligence-A modern approach, Staurt Russel and peter norvig, PHI.
4. Artificial intelligence, Patrick Henry Winston: Addition Wesley latest edition

<table>
<tr><td>Course code</td><td colspan="5">OEC-FTEL-339</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Environmental Engineering and Management</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester------</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
• Understand the impact of humans on environment and environment on humans.
• Identify and value the effect of the pollutants on the environment, atmosphere, water and soil.
• Apply strategies to control, reduce and monitor pollution.
• Select the most appropriate techniques for the treatment of water, waste water, solid waste and contaminated air.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To reduce the various types of pollution from our daily life.
• To make our environmental management system effective.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Air pollution: - Sources of air pollution, effects of air pollution, classification of pollutants, Atmospheric transport of pollutants-wind profiles, atmosphere stability, inversion, turbulence, dispersion and diffusion of air pollutants, Gaussian plume dispersion model, Principles and techniques of ambient air and stack emission monitoring, Particulate matter control equipment working principles of gravity settlers, cyclones, wet scrubbers, fabric filters and electrostatic precipitators, Gaseous control methods- an overview of absorption, adsorption and combustion method, Biological methods for VOC and odour control.

Unit-II

Waste water: Physical, chemical and biological characteristic, Effects of pollutants on water quality and aquatic life, Physical unit operations in waste water treatment, flow equalization, sedimentation, and flotation, Biological unit processes, kinetics of microbial growth.
Aerobic treatment systems: working principle and design parameters of trickling filter, activated sludge process, and rotating biological contactor.
Anaerobic treatment systems: mechanism of anaerobic process, low rate and high rate digesters, working principle and applications of anaerobic filters.

Unit-III

Solid Wastes: Environmental, aesthetic and health risk, Sources, quantities and composition of solid wastes, Storage, collection and transportation of urban solid waste, disposal options- sanitary landfills, composting and its variations, anaerobic digestion, incineration and pyrolysis, Vermi composting, Recovery alternative, Monitoring of solid wastes.

Hazardous Wastes: definition and classification, health and environmental effects, treatment, disposal and management of hazardous wastes, legal frame work for hazardous waste management in India.

Unit-IV

Environmental Management in Industries: - Principles and requirements of ISO 14001 EMS, Environmental auditing and auditing for waste minimization, Environmental impact, assessment description of the environmental setting, prediction and assessment of impacts, methods of impact analysis, Indian scenario, public participation in environmental decision making strategies for pollution prevention, recycle and reuse, cleaner technologies.

Life cycle assessment: Principle and methodology, concept of Industrial ecology, Clean development mechanism (CDM) - carbon trading.

References:

1.Environmental Pollution Control Engineering by C.S. Rao, New Age International (P) Ltd Publishers, latest edition.

2. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH, Publishing Co. Pvt. Ltd, New Delhi, latest edition.

3. Handbook of solid waste Disposal and Management by Pavani, J. L

4. Waste Water Engineering: Treatment, Disposal, Reuse by Metcalf and Eddy Inc.

5. Environmental Impact Assessment by Canter. L.W

6. Environmental Engineers Handbook (latest Ed.) by Liu,

<table>
<tr><td>Course code</td><td colspan="5">OEC-FTEL-340</td></tr>
<tr><td>Category</td><td colspan="5">Open Elective Courses</td></tr>
<tr><td>Course title</td><td colspan="5">Robotics And Robot Applications</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-----</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Course Outcomes:</td><td colspan="5">After completion of this course students will be able to:
• Define the basic concept of industrial robotics and the main components of robotics technologies.
• Describe the robot drive system, various robot end effectors, various sensors used in robotics.
• Explain the implementation of modern tools like robots in industries and artificial intelligence.
• Analyze the various movements of robots and design the robot program.</td></tr>
<tr><td>Objectives:</td><td colspan="5">• To study different types of sensors in robotics.
• To know about the control system and components of robotics.
• To Mess up artificial intelligence with robotics for their future scopes.</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Fundamentals of Robotics/Fundamentals of Robot Technology, Programming and Applications: Introduction-Automation and Robotics, brief history of Robotics, the Robotics Market and the Future Prospects, Robot Anatomy, Work Volume, Robot Drive Systems, Control Systems, Precision of Movement, End Effectors, Robotic Sensors, Robot Programming and Work Cell Control, Robot Application

Control Systems and Components : Basic control systems concepts and models, Controllers, Control System Analysis, Robot Sensors and Actuators, Velocity Sensors, Actuators, Power Transmissions Systems

Unit-II

Robot End Effectors: Types of End Effectors, Mechanical Grippers, Other Types of Grippers, Tools as End Effectors, Robot/End Effectors Interface, Considerations in Gripper Selection and Design

Sensors in Robotics: Transducers and Sensors, Sensors in Robotics, Tactile Sensors, Proximity and Range Sensors, Miscellaneous Sensors and Senor Based System, Uses of Sensors in Robotics

Unit-III

Artificial Intelligence: Introduction, Goals of All Research, All Techniques, All and Robotics, Robotic Paradigms

Material Transfer and Machine Loading/Unloading: General Considerations in Robot Material Handing, Material Transfer Applications, Machine Loading and Unloading, Spot Welding, Continuous Arc Welding, Spray Coating, Other Processing Operations using Robots

Unit-IV

Robotics Technology of the Future and Future Applications: Robot Intelligence, Advanced Sensor Capabilities, Tele-presence and Related Technologies, Mechanical Design Features, Mobility, Locomotion and Navigation, The Universal Hand, Systems Integration and Networking, Characteristics of Future Robot Tasks, Future Manufacturing Applications of Robots, Hazardous and Inaccessible Non-Manufacturing Environments, Service Industry and Similar Applications.

References:

1. Industrial Robotic Technology – Programming and Applications by M.P. Groover et. Al., McGrawhill

2. Robotics for Engineers by Y. Koren, McGrawhill

3. Robots Modeling Control and Applications with Software by P.G. Ranky and C.Y. Ho, Springer Verlag Berlin

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Printing Technology)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Printing Technology) – 5th Semester
w.e.f. 2020-21

Sr. No.	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Internal Assessment	External Examination	Practical	Total	
1	PT 301G	Reproduction Technology	3	0	0	3	3	25	75		100	3
2	PT 303G	Gravure Technology	3	0	0	3	3	25	75		100	3
3	PT 305G	Offset Technology-1	3	0	0	3	3	25	75		100	3
4	PT 307G	Printing Image Generation-1	3	0	0	3	3	25	75		100	3
5	PT 309G	Print Media Ethics	3	0	0	3	3	25	75		100	3
6	PT 311G	Advertising and Multimedia	3	0	0	3	3	25	75		100	3
7	PT 313G	Reproduction Technology Lab	0	0	2	2	1	25		25	50	3
8	PT 315G	Gravure Technology Lab	0	0	2	2	1	25		25	50	3
9	PT 317G	Offset Technology Lab	0	0	2	2	1	25		25	50	3
10	PT 319G	Print Image Generation Lab	0	0	2	2	1	25		25	50	3
11	PT 321G	Practical Training	-	-	-	-	-	-	-	* Refer Note 1		
Total							**22**				**800**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.

Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Scheme of Studies and Examination
B.TECH (Printing Technology) – 6th Semester
w.e.f. 2020-21

Sr. No.	Course Code	Course Title	Hours per week			Total Contact hrs/week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Internal Assessment	External Examination	Practical	Total	
1	PT302G	Printing Management	3	0	0	3	3	25	75		100	3
2	PT 304G	Print Finishing	3	0	0	3	3	25	75		100	3
3	PT 306G	Printing Substrates	3	0	0	3	3	25	75		100	3
4	PT 308G	Print Ink Technology	3	0	0	3	3	25	75		100	3
5	PT 310G	Print Image Generation- II	3	0	0	3	3	25	75		100	3
6	PT 312G	Offset Technology- II	3	0	0	3	3	25	75		100	3
7	PT 314G	Print Finishing Lab	0	0	2	2	1	25		25	50	3
8	PT 316G	Printing Ink Technology Lab	0	0	2	2	1	25		25	50	3
9	PT 318G	Print Image Generation Lab	0	0	3	3	1.5	25		25	50	3
10	PT 320G	Offset Technology Lab	0	0	3	3	1.5	25		25	50	3
Total							**23**				**800**	

Note:

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

REPRODUCTION TECHNOLOGY (PT-301G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Basic principles of reproduction photography:line photography; Basic density range of line original Basic line exposure for computerized camera with on-line or off-line densitometer, equipments and accessories.
Difficult line originals - Line originals with color; line originals with fine lines screen; line originals with fluorescence effect.
Contact photography - Spreads and chokes.

Unit-II

Line separation from black and white art work.
Evaluation of line negative.
Halftone photography -Introduction to the concepts, Theories of dot formation, Selection of screen ruling, Introduction to different halftone screens glass screen (brief study), contact screens - Grey and magenta Contact screen manufacture, Density gradient of contact screens, Negative, positive, standard or universal contact screen. Comparative study of glass and contact screens. Pre-screened emulsion.
Half tone exposure: Special features of half tone exposure. Factors affecting the halftone exposure Basic halftone exposure setting on ordinary and computerized camera with off-line and on-line densitometer.

Unit-III

Contrast control : Contrast with glass screen : S.D. variation, multiple stop system (brief study) Contrast control with contact screens Determining B.D.R. and main exposure of the contact screen, Highlight compensation, Use of CC filters with magenta contact screen determining CC filters and exposure calculations.
Auxiliary or supplementary exposures: Contrast control with supplementary exposures.
(a) Flash exposure - Deciding the basic flash exposure, for contact screens Exposure calculations.
(b)No-screen exposure-calculations.
Line and halftone combination
Evaluation of halftone negative

Color reproduction: Definition and concepts Introduction to Corpuscular and Wave nature of light the visible spectrum Additive synthesis and subtractive synthesis Additive and subtractive combination for graphic for reproduction and practical interpretation of color-theories.
Mechanism of vision and theories of color-vision.
Colorimetric Properties, Color and appearance measurement. Introduction to Colorimeter and Spectrometer.

Unit-IV

Color separation:

a) FAKE color reproduction

b) Filters- Color separation filters and other filters; Overlap in the filters. Wide band and Narrow cut Filters
factors and filter ratios.

c) Screen angles-Moiré, juxtaposing rosettes. Basic rules in angular adjustment. Reproduction of
Pre-Printed color originals.

d)Study of quality control aids, gray scale, set of color control patches; Register marks; Register -punch, pin-bars etc.

Introduction to color separation methods and evaluation of direct colour separation.

Digital photography:

Electronics and digital imaging. Introduction. The current state of the market. Digital camera, Image quality, digital camera bags, multiband digital cameras. Choosing the right camera for the application. Resolutions- Introduction, monitor spaitial resolution, photographic film formats, resolution and their digital equivalents.

CCD technologies-Introduction, technology, commercial manufacture of CCD's, construction of CCD application, CCD cameras for the professional photographic market, color resolution.

Implementation-Lighting for digital photography, over & under exposure characteristics, color balance & consistency, image manipulation. Optics & digital photography – Basic principles of lens selection.

References:

Line photography - **Karl Davis Robinson**.

Halftone Photography -**Erwin Jaffe**.

Small Offset Preparation & Process-**Les Crawhurst**

Printing Technology - **Adams, Faux, Rieber**.

Reproduction Systems - **V. S. Raman**.

Digital Photography-**Anthony Hamber, Phill Green**.

GRAVURE TECHNOLOGY (PT-303G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Gravure:
History of gravure, Gravure products and markets - Publication gravure - gravure packaging and converting - product gravure. Gravure Screens. Gravure cylinder preparation - Diffusion etch - Direct TransferElectromechanical process - Laser cutting. Electronic engraving systems today. Chemical engraving methods and equipments -cell configurations-advantages and disadvantages. Cylinder correction methods - Re-etching electro mechanical engravings, Color balance etches, spot plating. Well formation - variables, basic types. Cylinder construction and preparation - Cylinder design, types. Balancing the cylinder. Copper plating and polishing, Reuse of cylinders.

Unit-II

Doctor blade - Doctor Blade assembly - Blade angles. Blade distance from Nip, Blade edge, Blade mounting. Doctor Blade wear - Fatigue, Corrosion, Abrasive, Adhesive wear, Doctor blade materials, Doctor blade Holder configurations, Blade setting procedures, Preparing blade for use, Doctor blade problems. Gravure Impression Roller - function, Roller covering, Roller pressure, Cylinder diameter, Roller design & configuration. Balancestatic & Dynamic. Roller setting. New developments. Storage of impression rollers. Impression roller problems. Impression mechanisms mechanical, Hydraulic, Pneumatic.

Unit-III

Gravure Press and Its components:
A generic printing unit. Sleeve solid cylinder, single and two revolution, sheet fed and web fed machines typical press configurations. Gravure publication presses-characteristics. Packaging Gravure Presses - Folding carton Presses. Flexible Packaging presses, Label presses. Product gravure. Other gravure presses - Intaglio plate printing, offset gravure and flexogravure. Gravure with flexo units. Gravure units as other equipment. Gravure roller coating. Gravure folders - types. Gravure Ink Dryers - Need for ink dryers, Drying water based inks, Dryers functioning, Dryer limitations, supply air valves, balancing the dryer, filters & dampers, roller condition vital. Heat Sources - steam, electric and gas, combination gas/oil, thermal oil, waste heat form incinerators. Solvent Recovery Methods. Gravure cylinder preparation- basic construction, surface finishing, sleeve and integral shafting of cylinder, Electo-mechanical, electron beam & Laser engraving.

Unit-IV

Gravure Substrates:
Paper substrates-Roto news papers, Coated papers, Gravure packaging paper substrates - properties. Label stock, Paper board. Non Paper substrates - surface preparation,

plasticsproperties. Metalized films - Aluminum foil, Foil laminations. Gravure advantages, limitations. Future of Gravure Printing Industry.

References:

Gravure process and technology - **GAA**.
Printing Technology - **Adams, Faux, Rieber**

OFFSET TECHNOLOGY – I (PT-305G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Basic principles in planographic printing:
History of offset process - Principle, advantages, limitations. Press configurations. Infeed unit - pile table, pile height, air blast nozzles, forwarding pickup sucker, rear pickup suckers, separator brushes & fingers. Types of feed board sheet control devices-conveyor assemblies, conveyor tape, hold down rods. Sheet separation system-friction, pneumatic. Forwarding systemsuccession sheet feeder, stream feeder. Front lay, Side lay - push type lays, pull type lays. Side lay settings. Sheet detectors - mechanical types, electromechanical types, photo electric types. No sheet detectors- early or fast detectors. Double sheet detectors. Grippers - spring gripper, pin type gripper, sprung pad gripper - compression spring, tension spring. Plate insertion system - tumbler gripper, rotary gripper. Sheet transfer section - chain transfer, single drum transfer, three drum transfer. Delivery unit- skeleton wheels. Transfer drum. Sheet decurler. Sheet guiding device blow downs. Air cushion transfer drum. Slow down mechanisms. Antisetoff spray equipments. Extended deep pile delivery. Continuous delivery. Metered powder supply. Electrostatic system.

Unit-II

Inking system:
Introduction. Theory of ink-film flow. Dwell time. Ductor, ink duct. Ink feed roller. Oscillating roller. Drive rollers. Intermediate & plate inking rollers. Drum type inking system. Multi roller type inking system. Roller settingSetting form roller to oscillator, setting form roller to plate, setting the duct roller. Roller covering. Roller maintenance-roller removal, replacement, roller storage, roller hardness. Ink agitators.
Dampening system:
Introduction. Fountain roller. Dampening feed roller. Scavenger roller. Dampening solutioncomposition, Iso propanol alcohol - substitute of alcohol. pH of dampening solution. Conductivity of dampening system. Damper setting. Brush system for metering. Air knife system for metering. Conventional dampening system - metering dampening on conventional dampening system. Continuous flow dampening system- plate feed-epic litho dampener plate feed continuous flow damp. systems. Dahlgren inker feed dampening system. Roller covers - molleton fabric cover, stockinette cover, paper damper cover, synthetic damper cover. Damper cleaning machine.

Unit-III

Printing unit:
Introduction. Cylinder gears - spur gear, helical gear, bevel gear. Cylinder design. Plate cylinder - cylinder driving, cylinder body, cylinder gap, plate clamping, plate punching, bearer contact cylinder, bearer gap cylinder. Plate mounting. Determining packing requirements, - Packing material, problems due to improper packing. Blanket cylinder - Introduction, functions, manufacture, selecting grade of blanket performance requirement. Types of blanket. Blanket squaring. Blanket punching. Mounting the blanket. Recovering

from blanket smash. Use of slightly damaged blanket. Care of blanket, blanket cleaning device. Impression cylinder.

Unit-IV

Process of printing operation:

Pre make-ready, make ready, inspection of press sheets, control of press function during press run - maintaining the inking system, maintaining the dampening system, the feeder, the delivery. Color sequence in two color and multicolor operations. Printability & run ability. Weton-wet printing. Wet-on-dry printing. Direct imaging presses. Quality control during the press run - Densitometry, color control bars, press room lighting and standard viewing conditions, plate scanner. Printing unit problems. Proof press - requirements & advantages, progressive proof.

References:

Manual For Lithographic Press Operation - **A. S. Porter** Modern Lithography
Introduction to Printing Technology - **Hugh M Speirs**. Sheetfed Press Operation-**GATF**.
Offset Technology – **C.S.Mishra**. Lithographers Manual
Lithographic Technology - **Erwin A Dennis, Olusegun Odesina**.

PRINTING IMAGE GENERATION - I (PT-307G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Assembly of film images:

Facilities. Equipments and tools required. Materials and supplies. Photographic film- camera film, contact film, room light handling films, duplicating films. Proofing materials - diazo papers, polymer papers, brown print paper, diffusion transfer material, photographic and stabilization paper. Assembly and masking materials - Goldenrod, vinyl, clear film, peelable masking films, photographic masking films. Stripping supplies - screen tints, pressure sensitive tapes, adhesives opaques, cleaning solutions, starch filler, register tabs button & pins. Register masks, GATF image contact masks. Basic steps in planning a film image assembly- Planning the layout, planning the flat, selection of stripping method, changing of information, inspection. Imposition considerations- Sheetfed, web fed. Sheet fed - press considerations, paper, press masks. Web fed - press, paper, press masks. The book signature - parts of a signature. Kinds of press layout - one up layout, one side multiple layout, one side combination layout, sheet wise layout, work and - turn layout, workand- tumble layout. Folding requirements - basic folds, folding dummy, machine folds. Image register system - control from art preparation through press. Film image register systems - Tab-and-button method, Punched - hole method. Film assembly basic - negative film assembly, preparing negativesfor stripping attaching negative to masking material. Attaching negatives to clear polyster. Attaching negatives to peelable masking film. Cutting openings in masking material, Scribing lines. Positive film assembly. Film assembly for single color printing. Assembly for film multiple color printing. Assembly for multiple imaging of plates and film.

Unit-II

Screen printing

Stencil making. Hand painted stencil - Introduction, blockout methods (selective process) - wax resist method. Knife cut stencils. Paper laminates - stages in preparing laminate stencil. Common faults & their cause. Water adhered films. Solvent adhered films. Stencil cutting tools and cutting techniques - swirel knife. Computerized stencil cutting. Photomechanical stencil making - indirect photo stencil film - making an indirect photostencil, indirect photo polymer film. Automatic processing and development - direct emulsion photostencil - making a direct emulsion photostencil, direct emulsion coating m/c. Direct emulsions, direct/indirect photo stencils- making a direct/indirect photostencil, capillary direct film photo stencils- making a capillary direct photostencil. Quality control in photo stencil making.

Unit-III

Heat transfer printing, Collotype:

Heat transfer printing- melts transfer, dry transfer. Collotype.

Unit-IV

Planographic plates:

Introduction. Light sensitive coating -dichromate colloids, diazo compounds, photo polymers, diffusion and transfer methods, electrostatic. Sensitivity of coating to light. Dye-sensitized photo polymerization, dark reaction, post exposure, safe lights, reciprocity law. Action of light sources on coatings, stabilities of coatings. Plate materials - zinc, aluminum, brass, copper, steel, chromium. Action of oil and water on metal - contact angle. Ability to withstand cracking. Susceptibility to dot sharpening. The plate base - cross section of an aluminum plate, cross section of an a plastic plate. Graining of plates - mechanical graining, electrochemical graining. Anodized aluminum, plate washes. Paper plates, paper aluminum laminates, plastic plates. Light sources for plate making - spectral data for various light sources, metal halide, mercury lamps, pulsed - xenon, laser. Treatment of non-image areas - desensitizing gum, chemistry of gum Arabic, other natural & synthetic gums. General processing sequence for a negative working plate. General processing sequence for a positive working plates. Negative working plates- additive presensitized plates, subtractive diazo PS plates, photo polymer presensitized plates, aqueous developable plates, driographic plates, multimetal plates. Producing a multimetal plate. Types- bimetallic, trimetalic. Projection-speed negative plates. Positive working lithographic plates- Presensitized plates, Electrostatic plates. Baking of positive plate Process of making deep etch plate - counter etching, exposing, developing, deep etching, cleaning the image areas, stopping out unwanted areas, comprising the image areas on aluminum plate, applying non blinding lacquer applying deep etch developing ink, remaining the gum stencil, desensitizing, gumming up, putting the plate under asphaltic, removing and adding work. Health and safety in deep-etch plate making.

References:

Heidelberg DI Press- Manual Chemistry for Graphic Arts - **Dr. Nelson R. Eldred**.
Offset Plate Making - **Robert F. Reed**.
Printing Technology 3rd Edition. - **Adams, Fax &Rieber**.
Screen Process Printing - **John Stephens**.
Sheet fed Offset Press Operating - **Lloyd P. Dejidas**.
Flexography Premier - **Donna C. Mulvihill**. Stripping - **Harold L. Peck**.
Gravure Process And Technology –GAA. Selecting The Right Litho Plate - BPIF.

PRINT MEDIA ETHICS (PT-309G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Morality and ethics:
Introduction, Types of ethics, Nature of Ethics, Objective of ethics, Business Ethics, Business Ethics and Profits; Relationship between Business &Ethics - The Unitarian View, The Separatist View, The Integration View. Nature of Ethics in Business; Characteristics of Business Ethics; Need for Business Ethics; Arguments against Business Ethics, An example of Ethical business Practice, Discussion Situation 1;Discussion Situation2;Discussion Situatation 3; Ethical Practice in Management; Evolution of Business Ethics as a field of study.

Workplace Justice Issues:
Automation - De-skilling -Safety -Working hours and tasks privacy -Information Technology Issues in the International Setting- Computer Privacy- Methods of privacy protection: Browser settings- password systems firewalls - anonymous email (proxy) Encryption and virus protection software, and other Internet security related programs- Computer cleaning software.

Unit-II

Electronic Property and Copyright:
Legal protections for computer software. Freedom of expression and Censorship. Paternalism- Freedom and the Internet, Questions about harm- Types of harm- Information Technology and The Future.

Work life In Indian Philosophy:
Indian Ethos for the Work life - Man’s unique inner resource, Holistic relationship between Man and Nature, Cooperation, Self-Management, Yoga and Meditation, Dharma, The spirit of Renunciation, Indian Values for the Workplace - The importance of relationships in the workplace, Respect for Elders, Respect for Hierarchy and Status, Need for Security, Simple Living and High Thinking, The Karta, Internal Orientation, Wisdom, Balance and Moderation. Rights and Duties. Quality of Work life in Indian Philosophy.

Unit-III

Attitudes, Beliefs & Life Positions:
Concept of Attitudes. Attitudes governing ethical behavior. Wrong attitudes resulting in unethical behaviour.Right attitudes resulting in ethical behavior. Beliefs & Ethical Behaviour. Life Positions & Ethical Behaviors.

Overviews of the Ethical Value System:
The System of Universalism, The System of Utilitarianism, The System of Distributive Justice & Social Contracts,

Individual Freedom of Choice, The Legal System & Professional Codes. Culture & Ethics-Social Culture & Individual Ethics-Social Contract Theory, Collective or Socialism Theory, Organic Theory. Idealistic or GroupMind Theory. Similarity of Ethical Values in different Cultures- The Principles, Conclusion. Case Study.

Unit-IV

Role of Legislation & Other Bodies in Enforcing Ethical Business Behaviour:

Relationship between Law and Ethics. Role of the Government of India in enforcing ethical behavior. The Indian Constitution; Indian Business Laws and their impact on Ethical business behavior -(a)Business Laws & (b) Labor

Laws; Conclusion. Relationship Between Ethics & Corporate Excellence- Corporate Mission Statement, Code of Ethics, Organizational Culture,

Ethics & Individual Behavior- Areas of Influence or Areas of Authority and Areas of Interest.Education without Character, Commerce without Morality, Pleasure without Conscience, Wealth without Work, Science without Humanity.

Social and Economic Responsibilities of Business:

Social Responsibilities of Business. Why business must be socially responsible; Interaction between business and Society; Major Social responsibilities of Business - Optimum Utilization of scarce national Resources, Responsibility not to make losses, Improved Quality of Life, Responsibility of Employment and Income, Offering Quality products at fair price, Environmental Protection, Fair Trade Practices, Fulfilling all national obligations under various Laws, Safeguard the health and well-being of customers; A Look at Social Performance of Business. Economic Responsibilities of Business.

References:

Business Ethics Concepts & Cases - **Sadhri Sorab**

ADVERTISING AND MULTIMEDIA (PT -311G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Advertisement

A.Definition, concept, types, principle, objectives, promotion, publicity, propaganda, target audiences, psychology, Product, design, packaging. Message, language,creativity visualization and campaign. B.Layout, scripts, writing.

Unit-II

Advertisement Budgeting

Methods, determining and appropriation.

Advertisement Research

Research methods, sampling, data analysis and representation, surveys, attitudinal research.

Unit-III

Media Planning

Budgeting, allocation of budget, calculating cost of media, media mix. Types of media. Readership, viewership (target audience), OTS, TRP, circulation.

Advertisement Agency

Structure and function, choosing advertisement agency, advertisement law.

Unit-IV

Advertisement and Computers

Introduction, role of computers in advertisement, animation, application of software's like Photoshop, CorelDraw, quark-express etc. **Public Relations**

Definition, concept and role of public relations in public and corporate sector. Tools of public relations including internet. Image building and public relation campaigns. Marketing-Mix and promotional mix

References:

1. Advertising Theory & Practice - **Chunawalla, Kumar, Sethia, Subramanian, Suchak**.
2. The Concept of Marketing-By Philip Kotler
3. Advertising and Promotion-By Belch & Belch

REPRODUCTION TECHNOLOGY LAB. (PT-313G)

1. Setting of Camera.
2. Line negative and positive preparations.
3. Half tone negative and positive preparations
4. Bromide Positive preparations.
5. Exposing difficult line originals; use of filters
6. Finding B.D.R. and main exposure time of contact screen.
7. S.D. calculations and S.D. setting and contrast control with glass screen.
8. Line negative making with density range compensation, use of log Equations.
9. Highlight compensation with log exposure formula.
10. Contrast control with contact screens.
11. Use of CC filters with magenta contact screen.
12. Contrast control with supplementary exposures.
13. Line and half tone combination.
14. Fake color reproduction and introduction to direct and indirect color separation methods.

GRAVURE LAB. (PT-315)

1. Study of various Gravure printing machine configurations.
2. Study of various components of a Gravure printing machine.
3. Pre-make ready in Gravure Printing Process.
4. Plate preparation/ Cylinder preparation. 5.Make-ready in Gravure Printing Process.
6. Study of feeding unit of a Sheet-fed/ Web-fed Gravure printing machine.
7. Single and Multi color printing by using Gravure Printing Process.
8. Printing on different substrates by using Gravure Printing Process.
9. Study of delivery unit of a Sheet-fed/ Web-fed Gravure printing machine.
10. Cylinder setting in a Gravure printing machine.
11. Check the practical problems in a Gravure printing process.

OFFSET TECHNOLOGY – I LAB. (PT-317G)

1. Study of various controls and operations.
2. Study of the various mechanisms.
3. Study of the lubrication system.
4. Setting the feeder, feed board, lays and delivery.
5. Setting the water and ink rollers and fixing the plate.
6. Single colour printing.
7. Two colour printing.
8. Four colour printing.
9. Effect of ink and water on the print quality-use of densitometer.
10. Effect of impression pressure on print quality-use of feeder gauge.
11. Effect on colour sequence on print quality-transparaency and opacity of inks.
12. Ink trapping and back trapping- effect of tack, printing speed, ink film thickness.
13. Printing a second colour on a printed sheet problems involved and overcoming them, adjustment of lays, change of packing etc.
14. Identification of printing faults in the given samples-reasons and remedical actions.
15. Mixing of process inks to the shade for a given colour patch-effect of paper and ink film thickness.

PRINTING IMAGE GENERATION-I(PT-319)

1. Comparative study of various materials and equipments used in Image Generation Department.
2. Preparation of pre-sensitized plate,
3. Preparation of letter set plates.
4. Layout preparation:
5. Study of gripper margin and registration processes, 6.Positioning of images for plate making,
7. Masking techniques.
8. Page makeup -folders, pamphlets, journals/magazines, newspaper, book work.
9. Layout preparation - Single page layout, 2 page layout, 4 page layout, 8 page layout, 16 page layout, 32 page layout, 64 page layout for work & turn, work & tumble, work & twist.

INDUSTRIAL TRAINING (PT 321G)

Students will undergo for 4 weeks Industrial Training in vacation after 4th Semester

PRINTING MANAGEMENT (PT 302G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Business Environment – Printing Industry in India & Abroad. Impact of globalization & IT.

Management –Nature scope and importance of Management, Functions of Management – Scientific, Management, CPM & PERT (Introduction).

Unit-II

Production and operations Management – Locations and Layout of plant, Maintenance management. Quality assurance, Total quality management (TQM), ISO.

Marketing management – Marketing and its functions, distribution channels, salesmanship and advertising.

Unit-III

Human resource management: Manpower planning – recruitment, selection, Training performance appraisal Wage and salary administration.

Financial Management, Nature, Scope objectives and functions of Financial Management.

Unit-IV

Work flow and organizational structure in a printing press.

Cost Accounting: Cost concept, cost sheet, B.E.P.analysis, cost reduction and cost control.

Depreciation - Introduction to different methods and their comparison.

References:

1. T.A. Saifuddin – Management aspects of printing industry by Nirmal Sadanadn Publishers, Mumbai, Ist edition.
2. G.G. Field- Printing Production Management by Graphic Arts Publishing, 1996.
3. Balaraman – PMCA by Ramaya Features & publications, 1987.
4. Mendiratta B.D. – Estimating & Costing by Print Trade Publications, 1999-2000.
5. Ruggles – Printing Estimating Principles and Practices by Delmer Publication 1985.

(1.) Maintenance Engineering Handbook

(2.) Lindley R. Higging, Mc Graw Hill International Edition.

(3.) Operator’s Manually by GATF.

6. R.D. Aggarwal-Organisation and Management-Tata McGraw Hill Publishing Ltd., New

PRINT FINISHING (PT304G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction:
Bindery In The New Millennium, Latest Developments in Print Finishing. Organization and Workshop Layout. Importance Of Book Binding. Growths Factors In Print Finishing. Book Binding Tools- Forwarding Tools, Finishing Tools. Binding Room Equipments- Laying Press, Standing Press, Sewing Frame, Glue Pot, Board Cutting. Book Binders Materials & Quality Control. British Standard Paper Sizes. International Paper Sizes. Ra & Sra Sizes. Advantages Of ISO Paper Sizes. Board - Kinds Of Boards. Reinforcing Materials. Securing Materials, Covering
Materials, Adhesives- Factors Governing The Choice Of Adhesives, Use Of Adhesives In Print Finishing, Effect Of
Wet Adhesives. Theories Of Adhesives. Principles Of Adhesives. Solvent Based Adhesives, Water Based Adhesives, Pressure Sensitive Adhesives. Types Of Adhesives. Adhesion-Physical, Specific. Miscellaneous Material.

Unit-II

Structure Of A Book:
Physical Parts Of a Hard Bound Book. Operations Of Ideal full Cloth Binding Production-Pre- Forwarding Operations, Forwarding Operations, Finishing Operations. Jogging, Counting, Cutting, Slitting, Trimming. Folding Binders Aids, Characteristics Of Printed Sheet, Planning Imposition, Folding Schemes. Hand Folding- Folding To Paper, Folding To Print, Lump Folding, Puckering, Advantages & Limitations Of Hand Folding. Machine Folding - Knife Principles, Buckle Principle, Combination Of Knife & Buckle. Folding & Machine Direction. Advancements & Developments On Folding Machine, Folding Machine Paper Feeders, Tips For Smoother Folding. Tipping - In/ Attachment Of Plates. Gathering - Single Sheet Gathering, Collating - Collating Marks. Insetting - Make Up Of Insetted Work. Inserting.

Securing Methods:
Wire Stitching - Saddle Stiching, Side Stiching, Stabbing. Thread Sewing - Letterpress Binding, & Stationery Binding. Saddle Sewing, Side/Flat Sewing, French Sewing, Sewing On Tapes, Sewing On Cords, Sewing Two Sections On, Whip Sewing, Stub-Binding. Adhesive Binding/Perfect Binding - Advantages. Quality Control In Adhesive Binding. Lay-Flat Adhesive Binding. Mechanical Binding - Loose Leaf Binding - Traditional Styles Used. Spiral Binding. Wire ‘O’ Binding, Plastic Comb Binding. Case Binding. -Stages In Sheet Fed, Stages In Reel Fed, Case Making, Stages in casing-in. Ring Binding - Inter Screw, Ring Metal - Types, Loose Leaf Ring Binding. Ring Shapes. Burst Binding, On Demand Booklet Binding. Preflight In The Bindery. Publishers Binding. Magazine Binding & Book Binding.

Unit-III

End Papers:

Purposes, Kinds of end Rapers, Quality of Paper Required for Pasting End Papers. Pressing, Gluing The Spine, Smashing the Spine, trimming the Book Edges, Rounding- Advantages, Rounding M/C. Backing - Backing M/C. Lining - Advantages. Head-Tail Bands, Caps, Book Marker. Method Of Attaching Head & Tail Bands. Covering - Covering Styles. Pasting Down, Pressing, Inspection.

Finishing Processes:

Cover Decoration & Other Processes. Print Finishing Operations - Embossing & Debossing, Blind Embossing, Gold Blocking /Foil Stamping. Die Printing. Thermography, Velvet Printing, Marbling, Varnishing, Graining,

Laminating, Gumming, Gluing, Punching, Perforating, Drilling. Label Puching, Appliqué. Edge Decoration -

Requirement, Colouring The Edges, Marbling Edges, Edge Guilding. Round Corner Cutting. Numbering - Folio Numbering, Double Numbering, Duplicate Numbering. Principle of Rotary Numbering. Skip Numbering, Automatic Numbering. Kindes of Indexes. Ruling - Principle Of Pen & Disk Ruling M.C. Ruling Terms. Banding & Lacing, Poly Bagging, Mailing, Creasing, Bundling, Tacketing. Ultra Violet Curing & Infra Red Curing.

Unit-IV

Binding & Finishing Machines:

Study Of Various Modern Machines. Modern Guillotines - Single Knife Guillotines. Three Knife Trimmers. Knife Grinding M/C. Gold Blocking/Foil Stamping M/C. Wire Stitching M/C. Straw Board Cutter. Laminating M/C - Small Laminating M/C. Pouch Laminating M/C. Tunnel Laminating M/C. Tipping M/C. Smashing M/C. Back

Gluing M/C. Roller Gliding M/C. Inline Rounding M/C. Lining M/C. Modern Lining M/C. Cloth Cutting M/C. Foil Blocking M/C. Rotary Blocking M/ C. Casing In M/C. Case Making M/C. Box Waste Disposal Process. Box & Carton Manufacturing Process. Adhesive binding machine.

References:

Binding And Finishing - Ralph Lyman Binding And Finishing Part-1 - B.D.Mendiratta
Binding Finishing Mailing - T.J.Tedesco Introduction to Printing & Finishing - Hugh Speirs
Finishing Process in Printing - A.G.Martin.

PRINTING SUBSTRATES (PT 306G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Paper:

Introduction, Paper fibres &pulps paper performance, strengths and durability, absorbency, dimensional stability. Fibre structure- cellulose, hemi celluloses and lignin, Paper manufacture - Stage1 - pulp preparation, mechanical pulp, refiner mechanical pulp, thermo mechanical pulp, chemical processes-sulfate or Kraft process, sulfite process, combined chemical & mechanical process. Bleaching: Stage 2- stock preparation, non fibrous additives, fillers or loading. Stage 3- refining the pulp, pulp freeness, refiners, pulp cleaning. Paper manufacturing process - paper making machine. Wet-end, Head box and slice. Fiber orientation. Angular flow. MD: CD ratio. Wire section. Forming wires. Press and drier sections. Calendaring and Finishing- Hard calendaring, soft nip calendaring, super calendaring, machine glazing, paper coatings. Performance requirements for pigment - coated papers and boards.

Unit-II

Recycled paper:

Introduction:- recycling process, fiber preparation- screening, centrifugal cleaning, flotation, washing, deinking plant function, continuous drum pulped, prescreening and cleaning, primary flotation, cleaning, fine screening, thickening, dispersing, brightness control, washing, thickening and storage. Deinking chemistry. Bleaches - Hydrogen peroxide, Oxygen & Ozone bleaching, reductive bleaching agents, chelating agents, sodium silicate, cataloes enzyme, agglomerating chemicals, surfactants. Biodegradation of surfactants, dispersants and the principles of washing.

Unit-III

Choosing a suitable paper:

Characteristics of paper. Printing process requirement. Paper varieties for printing. Printing defects associated with paper. Reel defects. Testing methods. Measurement and calculations: Paper sizes. Influence of moisture and RH on paper and boards. Paper storage – Requirement. Methods. Variables affecting paper storage. Print quality achievable on different types of paper. Paper properties and printing problems-Introduction, printability, runnability. Surface and directional properties of paper & board-substance, caliper, bulk, compressibility, surface smoothness/ roughness, air permeance, static and dynamic friction. Surface strength and internal bond strength - picking, fluffing, splitting. Strength properties - stiffness, folding endurance, bursting strength, tear resistance. Optical properties - gloss, brightness, whiteness, yellowness and tint indices, fluorescence, opacity.

Unit-IV

Introduction to Non Paper substrates.
Surface preparation, plastics-properties. Metalized films - Aluminium foil, Foil laminations. Advantages, limitations. Future in Printing.

References:
Printing materials science & technology - **Bob Thompson-PIRA**
Advances in printing science & technology Vol.24 - **J. Anthony Bristow**
Hand book of Print & Production - **Micheal Barnard, John Peacock**
Introduction to Printing Technology - **Hugh M.Speirs**

PRINTING INK TECHNOLOGY (PT 308G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Printing Inks

Introduction, solvent based inks, water based ink, ingredients in Ink- pigments- properties, types, carbon black, inorganic pigments, organic pigments, physical characteristics of organic pigments. Vehicles- vehicles for liquid inks, vehicles for paste inks, UV curing vehicles. Additives - driers, extenders, anti oxidants, waxes. Oils- vegetable drying oils, semi drying oils, non drying oils. Drying mechanisms - physical drying mechanisms, absorption drying, evaporation drying, chemical drying systems, oxidation polymerization drying, radiation drying and curing, microwave drying, infrared drying. Viscosity - Newtonian flow, units of viscosity, viscosity & temperature, factors influencing viscosity, simple low viscosity inks, complex high viscosity inks. **Unit-II**

Ink requirements for printing processes – offset, letterpress, flexography, gravure, screen printing. Optical properties of ink films, rheology and ink transfer requirements, ink distribution and transfer on the press, method for the direct measurement of ink setting on coated paper. Printing Ink manufacturing machines & equipments. Paste inks - single roll mill, twin roll mill, triple roll mill, ball mill, twin horizontal mixer, unit-roll mill, high speed stirrer milling. Liquid inks - ball mill, pearl mill, sand mill, bead mill, shot mill. Trends and developments in ink manufacturing process.

Unit-III

Radiation curing

Introduction, radiation curing inks, ink cure considerations, chemistry of uv curing-photo initiation, propagation, termination. Cationic curing, electron beam curing.

Unit-IV

Security Inks

Range of security inks, special security features - fluorescence, phosphorescence, reflected by improved filters, magnetism, security printing inks for cheques-penetrating L/p inks, water fugetive inks, inks reacting with pen evadicators, red-ox reagents, inks reacting with solvents, invisible reactive inks, carbonizing inks. Security inks conformity tests and Q.C.tests-tests for chemical resistance, light fastness, rub resistance test, crumpling resistance test, grinding control, colour control, control of the rheological properties, control of drying time, control of various specific properties. Environmental considerations in security printing.

References:

Printing materials science & technology - **Bob Thompson-PIRA**
Advances in printing science & technology Vol.24 - **J. Anthony Bristow**
Hand book of Print & Production - **Micheal Barnard, John Peacock** Introduction to Printing Technology - **Hugh M.Speirs**. SIGPA - 1987

PRINTING IMAGE GENERATION - II (PT 310G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Driography- Outline, system, structure, processing and use, precautions.
Toray waterless plates – outline, structure, processing and use, advantages and disadvantages.
Role of photopolymer in Image formation – Raised and Recessed.
Diffusion processes – Reflex and Projection plates.
Electro photography – Introduction, process, toner transfer theory, Equipment.
Water soluble photosensitive resin plates – introduction, characteristics, structure, processing, image reproductively.
Laser plate making – introduction, system outline, system performance, implifications. Computer-to-plate: – Thermal plate, Polyester plate.
Surface preparation for screen

Unit-II

Image carriers for flexography:
Introduction. Thickness of flexographic plates. Photopolymer flexographic plates Advantages of photo polymer plates. Disadvantages of photo polymer plates. Solid photo polymer plates. Photo initiators and photo sensitizers. Washout solvents. Liquid photo polymer plates. Base material for photo polymer plates. Rubber flexoplates, photo engravings, duplicate plates. Rubber plate making process – Advantages of rubber plates, disadvantage of rubber plates. Photo polymer plate making process sheet photo polymer plate making, liquid photo polymer plate making. Letter press plates – Introduction, photo polymer letterpress plates.

Unit-III

Gravure image carrier:
Methods of cylinder preparation – diffusion etch, direct transfer, electromechanicalprocess, laser cutting, Well formation- lateral hard dot wells, direct contact wells, conventional gravure wells. Cylinder design – part of gravure cylinder, forms of gravure cylinder- integral shaft, mandrel. Copper plating and polishing. Reuse of cylinders. Ballard shell cylinders. Cylinder layout and film assembly. Carbon printing – Tissue lay down and development, staging and etching. Cylinder proofing – soft copy proofs, single sheet proofing system, direct digital proof, Diazo chrome proofs, overlay proofs. Chemical engraving methods-advantages, disadvantages.

Unit-IV

Digital Image Carriers:
Image generation of a Digital Offset Machine. Basics of other digital image carriers.

1. Auto plate processor.
2. Troubleshooting for plates.
3. Quality control aids for plate making.

References:

1. A. L. Gatehouse; Manual for film planning and plate making; roper – GATF Publication, 1983 edition.
2. Lithographers manual – GATF seventh edition.
3. Paul J.Hartsuch Chemistry for the Graphic Arts, GATF, 1983 edition.
4. Lan Faux, Modern lithography, MacDonald & Evans Publication, 1973. Edition.
5. W.R. Durrant Printing – A guide to systems and their uses, Heinemann Professional Publishing, 1989 edition.
6. D.C. Mulvihill Flexo Primer, GATF & Foundation of FTA 1985 editon.

OFFSET TECHNOLOGY - II (PT 312G)

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

. **Development and growth of web offset presses**
Full size and mini web presses ; four basic types of web offset presses specially used for newspaper and magazine production in single and multicolor Factors to be considered for selecting the press.
Components of web offset press
Infeed, tension control Pre-conditioners, drier and chill rolls, folders, sheeters and winders, Adjustment, operation and maintenance of the major components.
Inking systems and dampening systems for web offset
Conventional and non-conventional dampening systems, UV inks and setting systems Causes and correction of ink-related problems Properties and requirements of heat set inks

Unit-II

Web Control
Roll stands and automatic pasters, Detection of web breaks and control of tension, Web Flutter, causes and correction of misregister Control of fan out, Side lay, cut-off, web-toweb and ribbon control.
Auxiliary equipment
Various types of in-built and optional equipment availability for web-offset and their uses; equipment essentially needed for newspaper & magazine production. **Plate and blankets**
Various types used for web-offset their characteristics, merits and demerits for specific work, Cylinder pressures and Printing Make-ready.

Unit-III

Web-paper
Properties and requirements of paper used for web offset Printability, Care and handling of rolls. **Dry Offset**
Why dry-offset; advantages and disadvantages Comparative study of dry offset, letterset and lithographic offset processes, difference between dry offset and letterset machines and inks job suitability.
Driography or Waterless lithography
Description of the process, Method of producing image and non-image areas Importance of the correct formulation of waterless lithographic inks.
Introduction to types of drives used in web offset machines
Brief introduction to control panels of the web offset machines.

Unit-IV

Folders

Introduction, folding principles, parts of folder, combination folder, ribbon folder, double-former folder, the mechanics of folding process of jaw fold, chopper fold mechanism. Operation of collect cylinder, press folders, double former pre-folder, flow folders, insert folders.

Inline Finishing

Introduction, gluers, paster wheels, re-moisterable pattern gluers, segmented gluers, envelope pattern gluers, backbone gluers. Pattern perforating and numbering unitssheeters, variable rotary cutters. Auxiliary Equipments -Remote control console, Plate scanners, scanning densitometer, closed-loop system, web pre conditioners, sheet cleaners, ink agitators, water coded ink oscillators, fountain solution recirculation systems, fountain solution mixers, refrigerating fountain solution, automatic blanket washers, side lay sensors, web break defectors, re moisturizers-liquid applicator system, roller applicators systems, antistatic devices, Imprinters, Perfectos, cutoff controls, stroboscope, synchroscope, counters-Denex laser counter, stub counter.

References:

Web offset press operating- **David B. Crouse**

Offset M/c II - **C. S. Mishra**

Manual for Lithography Press Operation - **A. S. Porter**

PRINT FINISHING LAB. (PT 314G)

1. Preparation of the following types of books.

I. Quarter bound a/c books by - French sewing method, Tape sewing method, Cord sewing method, Saddle sewing method, Side sewing method, Whip sewing method. II. Half bound a/c books by - French sewing method, Tape sewing method, Cord sewing method, Saddle sewing method, Side sewing method, Whip sewing method.

III. Full bound a/c books by - French sewing method, Tape sewing method, Cord sewing method, Saddle sewing method, Side sewing method, Whip sewing method.

2. Preparation of Writing board.
3. Preparation of Photo Album.
4. Preparation of Receipt books with numbers in duplicate & triplicate.
5. Preparation of Cheque books with 25 leaves.
6. Preparation of following type of Mechanical binding - Spiral wire binding, Wire 'O' binding, Ring binding.
7. Preparation of files of following designs - Loose leaf file - *single piece*, Loose leaf file - *Two piece tab binder*, Loose leaf guard file - *Boards joined with spine strip*, Court case file, Portfolio - *Closed file to keep confidential loose sheets*.
8. Preparation of these types of End papers - *Single End paper*, *Double or Inserted End paper, Made end paper, Cloth joint end paper, Zig Zag end paper, Cloth joint Zig Zag end paper*.
9. Preparation of telephone directory with Indexes and Tabs.
10. Study of various controls, operations and mechanisms of the following machines: Folding machine, Guillotine machine, Cutter and Creaser, Varnishing machine, Laminating machine, Sewing & Stitching machine, Miscellaneous machine.
11. Binding of case bound, publishers binding. Book-emphasis will be given on decoration.
12. Print finishing operation to be conducted - Gold blocking, Embossing, Edge decoration, Thermography, Marbling, Velvet printing, Rubber printing, Die printing, Pouch lamination.
13. Repairing of old books.
14. Study of Pen ruling, Disk ruling, UV curing processes.

PRINTING INK TECHNOLOGY LAB. (PT 316G)

1. Various samples of Paper and their study.
2. Different samples of Inks and their study.
3. Light fastness test.
4. Machine Direction and Cross Direction of paper.
5. Effect of Humidity and Temperature on paper.
6. Ink tackiness Test.
7. Printed samples of different printing processes and their study.
8. Ink Viscosity Test.
9. Introduction to various chemicals used in printing. 10. Consumables and miscellaneous used in printing.

PRINTING IMAGE GENERATION LAB. –II (PT 318G)

1. Drawing layout for different jobs.
2. Assembling negatives for single colour jobs and two colour jobs.
3. Assembling positives for single colour and two colour jobs.
4. Assembling positives for four colour jobs.
5. Preparing wipe-on plates. 6.Preparing albumin plates.
7. Preparing deep-etch plates.
8. Preparing pre-sensitized plates.

OFFSET TECHNOLOGY - II LAB. (PT 320G)

1. Premake ready operations.
2. Make ready operations.
3. Multicolour job printing.
4. Trouble shooting during printing.
5. Study of electronic panel.
6. Blanket and plate cylinder setting.
7. Damping roller setting.
8. Inking roller setting.
9. Study of Web-breaks.
10. Operations of Folding machine.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Electronics & Computer Engineering)

SEMESTER 5th AND 6th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	**Definitions**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Electronics & Computer Engineering) – 5th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Engineering Science Course	ESC-CSE301G	Microprocessor (Common with CSE)	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-CSE303G	Computer Networks (Common with CSE)	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-ECE307G	Digital Signal Processing (Common with ECE)	3	0	0	3	3	25	75		100	3
4	Professional Core Course	PCC-CSE307G	Design & Analysis of Algorithms (Common with CSE)	3	0	0	3	3	25	75		100	3
5	Professional Elective Course	Refer to Annexure- I	Elective –I	3	0	0	3	3	25	75		100	3
6	Professional Core Course	PCC-ECSE301G	Soft Computing	3	0	0	3	3	25	75		100	3
7	Engineering Science Course	LC-ESC-317G	Microprocessor Lab (Common with CSE)	0	0	2	2	1	25	-	25	50	3
8	Professional Core Course	LC-CSE323G	Computer Networks Lab (Common with CSE)	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-ECE325G	Digital Signal Processing Lab (Common with ECE)	0	0	2	2	1	25		25	50	3
10	Mandatory Courses	MC-317G	Constitution of India	2	0	0							
11	Training	PT-ECSE327G	Practical Training	-	-	-	-	-	-	-	* Refer Note 1		
		TOTAL CREDIT						**22**				**750**	

Note:

1. The evaluation of Practical Training-I will be based on seminar, viva-voce, report submitted by the students. According to performance, the students are awarded grades A, B, C, F. A student who is awarded 'F' grade is required to repeat Practical Training.

   Excellent: A; Good : B; Satisfactory: C; Not Satisfactory: F.

Scheme of Studies and Examination
B.TECH (Electronics & Computer Engineering) – 6th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Humanities/ Basic Science	HUM-ECE306G	Engineering Ethics (Common with ECE)	3	0	0	3	3	25	75		100	3
2	Professional Elective Course	Refer to Annexure II	Elective –II Common with CSE	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-ECE309G	Nano Electronics	3	0	0	3	3	25	75		100	3
4	Professional Elective Course	Refer to Annexure III	Elective-III Common with CSE	3	0	0	3	3	25	75		100	3
5	Engineering Science Course	ESC-CSE308G	Mobile and Wireless Communication (Common with CSE)	3	0	0	3	3	25	75		100	3
6	Professional Core Course	PCC-ECE302G	Control Systems (Common with ECE)	3	0	0	3	3	25	75		100	3
7	Project	PROJ-CSE322G	Project-I	0	0	4	4	2	25		25	50	3
8	Professional Core Course	LC-ECE324G	Control System Lab (Common with ECE)	0	0	3	3	1.5	25		25	50	3
		TOTAL CREDIT						**21.5**				**700**	

Note:

Each student has to undergo practical training of 6 weeks during summer vacation after 6th semester and its evaluation shall be carried out in 7th Semester.

Annexure I

Elective –I (Professional Elective Course)

1. PEC-CSE-311G:Software Engineering
2. PEC-CSE-313G : System Programming and System Administration
3. PEC-CSE-315G :Digital Image Processing

Annexure II

Elective –II (Professional Elective Course)

1. PEC-CSE-310G:Advanced Database Management System
2. PEC-CSE-312G :Mobile Application Development
3. PEC-CSE-314G:Computer Graphics
4. PEC-CSE-330G :Communication Engineering

Annexure III

Elective –III (Professional Elective Course)

1. PEC-CSE-316G: Distributed System
2. PEC-CSE-318G :Information Technology & Industry Business Skills
3. PEC-CSE-320G : Data Science
4. PEC-CSE-332G :VHDL and Digital Design

Course code	ESC-CSE-301G				
Category	Engineering Science Course				
Course title	Microprocessor				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objective:

1. To make understand architecture and working of Intel 8085 microprocessor in depth.
2. To make understand architecture and working of Intel 8086 microprocessor in depth.
3. Familiarization with the assembly language programming.
4. Familiarization with various peripheral operations

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

THE 8085 PROCESSOR: Introduction to microprocessor, 8085 microprocessor: Architecture, instruction set, interrupt structure, and Assembly language programming.

Unit: 2

THE 8086 MICROPROCESSOR ARCHITECTURE: Architecture, block diagram of 8086, details of sub-blocks such as EU, BIU; memory segmentation and physical address computations, program relocation, addressing modes, instruction formats, pin diagram and description of various signals.

Unit: 3

INSTRUCTION SET OF 8086: Instruction execution timing, assembler instruction format, data transfer instructions, arithmetic instructions, branch instructions, looping instructions, NOP and HLT instructions, flag manipulation instructions, logical instructions, shift and rotate instructions, directives and operators, programming examples.

Unit: 4

INTERFACING DEVICE: 8255 Programmable peripheral interface, interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller.

TEXT BOOKS:

1. Microprocessor Architecture, Programming & Applications with 8085: Ramesh S Gaonkar; Wiley Eastern Ltd.
2. Intel Microprocessors 8086- Pentium processor: Brey; PHI

REFERENCES:

1. Microprocessors and interfacing: D V Hall; TMH
2. The 8088 & 8086 Microprocessors-Programming, interfacing, Hardware&Applications: Triebel& Singh; PHI
3. Microcomputer systems: the 8086/8088 Family: architecture, Programming &Design: Yu-Chang Liu & Glenn A Gibson; PHI.
4. Advanced Microprocessors and Interfacing: Badri Ram; TMH

COURSE OUTCOMES: After the completion of the course the student will be able to:

1. Understand the operation and architecture of Intel 8085 microprocessor including Instruction Set Architecture, assembly language programming, timing and speed of operation.
2. Learn the operation of circuits for user interaction through switches, keyboard and display devices.
3. Understand the operation and architecture of Intel 8086 microprocessor including Instruction Set Architecture, assembly language programming, timing and speed of operation.
4. Understand the motivation and need for peripheral operations circuits for digital data exchange, timer, serial communication, merits of direct memory access, interrupt controller and other circuits.

Course code	PCC-CSE-303G				
Category	Professional Core Course				
Course title	Computer Networks				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

a. To develop an understanding of modern network architectures from a design and Performance perspective.
b. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
c. To provide an opportunity to do Network programming
d. To provide a WLAN measurement ideas.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: Data communication,Components, Data Representation, Simplex, Half Duplex and Full Duplex Transmission, Modulation and Multiplexing, Computer networks, distributed processing, Internet, Topologies, Packet and circuit switching, connectionless and connection oriented services.

Network Models: OSI model and TCP/IP Model

Physical Layer – LAN: Ethernet, Token Bus, Token Ring, MAN Architecture- DQDB, WAN Architectures- Frame Relay, ATM, SONET/SDH

Unit: 2

Data Link Layer and Medium Access Sub Layer: MAC Addressing, Framing, Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window Protocol.

Medium Access Control: Random access, Controlled Access and channelization protocols.

Network Layer: Logical addressing, classful and classless addressing, subnetting, IPv4, ICMPv4, ARP, RARP and BOOTP, IPv6, IPv6 addressing, DHCP.

Unit: 3

Network Devices: Repeater, hub, switch, router and gateway.
Routing Algorithms: introduction to routing, Shortest Path Algorithm, Flooding, Hierarchical Routing, Link State and Distance Vector Routing

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP connection management,

Unit: 4

Congestion Control, Quality of Service, QoS Improving techniques.

Application Layer: Domain Name Space (DNS), EMAIL, File Transfer Protocol (FTP), HTTP, SNMP

Network Security: Firewalls, security goals, types of attack, symmetric and asymmetric key ciphers.

Suggested books:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

References:

1. Computer Networks, latest Edition, Andrew S. Tanenbaum, Pearson New International Edition.
2. Internetworking with TCP/IP, Volume 1, latest Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

Course Outcomes

1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) and describe the function of each.
3. Identify and connect various connecting components of a computer network.
4. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

PCC-ECE307G DIGITAL SIGNAL PROCESSING

L T P
3 1 -

Theory: 75 Marks
Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objective:

1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations Convolution and correlation.
2. To Study the basics, mathematical analysis and applications of DFT, FFT, etc
3. To study the design and implementation of Digital Filters.
4. To study the analysis of multirate systems.
5. To impart practical knowledge of signal processing

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Discrete-Time Signals and Systems: Sequences; representation of signals on orthogonal basis; representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Z-Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z- transforms, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

Unit II

Frequency Representation of Signal and Systems: Frequency Domain analysis concept, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Circular convolution, Linear Filtering using DFT, Fast Fourier Transform Algorithm, Decimation in time and Decimation in frequency algorithms, Computations Complexity Calculations, Parsevals Identity.

Unit III

Design of Digital Filter : Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling Method, Park-McClellan's method, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.

Unit IV

Implementation of Discrete Time Systems: Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation of fixed point and floating point numbers, Finite word length effects, Parametric and non-parametric spectral estimation. Applications of Digital Signal Processing

Multirate Digital Signal Processing: Introduction to multirate digital signal processing, Multi rate structures for sampling rate conversion, Multistage decimator and interpolators, Polyphase decomposition, Digital Filter Banks

References :

1 John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms And Applications, Prentice Hall, latest edition
1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, latest edition
3. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
4. Digital Signal Processing: Salivahanan, Vallavaraj and Gnanapriya;TMH
5. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, latest edition
6. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, latest edition
7. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. To get an introduction of basics like Sampling, Interpolation, Aliasing and operations, Convolution and Correlation.
2. To Study the basics, mathematical analysis and applications of DFT and FFT
3. To study the design and implementation of Digital Filters.
4. To impart practical knowledge of signal processing operations in MATLAB.

Course code	PCC-CSE-307G				
Category	Professional Core Course				
Course title	Design and Analysis of Algorithms				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

1. Analyze the asymptotic performance of algorithms.
2. Write rigorous correctness proofs for algorithms.
3. Demonstrate a familiarity with major algorithms and data structures.
4. Apply important algorithmic design paradigms and methods of analysis.
5. Synthesize efficient algorithms in common engineering design situations.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Introduction to Algorithms: Algorithm, Performance Analysis (Time and Space complexity), Asymptotic Notation (Big OH, Omega and Theta)-best, average and worst-case behaviour. Elementary Data Structures (Basic terminology of Stacks and Queues, Tree, Graph), Sets and Disjoint Set Union.

Divide and Conquer: General method, Binary Search, Merge Sort, Quick Sort, and other sorting algorithms with divide and conquer strategy, Strassen's Matrix Multiplication algorithms and analysis of these problems.

Unit-II

Greedy Method: General method, Fractional Knapsack problem, Job Sequencing with Deadlines, Minimum Cost Spanning Trees, Single source shortest paths.

Dynamic Programming: General method, Optimal Binary Search Trees, 0/1 knapsack, The Traveling Salesperson problem.

Unit-III

Unit-5: Back Tracking: General method, The 8-Queen's problem, Sum of subsets, Graph Colouring, Hamiltonian Cycles.

Unit-6: Branch and Bound: The method, 0/1 knapsack problem, Traveling Salesperson problem, Efficiency considerations.

Unit-IV

Unit-7: NP Hard and NP Complete Problems: Basic concepts, Cook's theorem, NP hard graph problems, NP hard scheduling problems, NP hard code generation problems, and Some simplified NP hard problems.

Suggested Text Books:

1. Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publ.,
2. Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson and Ronald L Rivest: 1990, TMH

References:

1. The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., Addison Wesley.
2. Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., Johan Wiley & Sons,
3. Writing Efficient Programs, Bentley, J.L., PHI
4. Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetnieni, latest edition MGH.
5. Introduction to Computers Science- An algorithms approach, Jean Paul Trembley, Richard B.Bunt, latest edition, T.M.H.
6. Fundamentals of Algorithms: The Art of Computer Programming Voll, Knuth, D.E.: latest edition, Naresh Publ.

Course Outcomes:

1. To identify and justify correctness of algorithms and to analyse running time of algorithms based on asymptotic analysis.
2. To understand when an algorithmic design situation calls for the divide-and-conquer paradigm. Synthesize divide-and-conquer algorithms.
3. Describe the greedy paradigm and dynamic-programming paradigm. Explain when an algorithmic design situation calls for it.
4. Developing greedy algorithms/dynamic programming algorithms, and analyze it to determine its computational complexity.
5. To write the algorithm using Backtracking and Branch and Bound strategy to solve the problems for any given model engineering problem.

PCC-ECSE301G **SOFT COMPUTING**

B.TECH SEMESTER VI	SESSIONAL:	25
L T P	THEORY EXAM:	75
3 0 0	TOTAL :	100

Course Objectives

1. To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
2. To implement soft computing based solutions for real-world problems.
3. To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
4. To provide students an hand-on experience on MATLAB to implement various strategies.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Detailed contents:

UNIT-I

INTRODUCTION TO SOFT COMPUTING:

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics

UNIT-II

FUZZY LOGIC:

Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-III

NEURAL NETWORKS:

Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks

UNIT-IV

GENETIC ALGORITHMS:

Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning : Machine Learning Approach to Knowledge Acquisition.

Matlab:

Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

Course Outcomes

After completion of course, students would be able to:

a. Identify and describe soft computing techniques and their roles in building intelligent Machines.

b. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.

c. Apply genetic algorithms to combinatorial optimization problems.

d. Evaluate and compare solutions by various soft computing approaches for a given problem.

REFERENCES:

1. George J. Klir and Bo Yuan, "*Fuzzy Sets and Fuzzy Logic: Theory and Applications*", PHI

2. Satish Kumar, "*Neural Networks: A classroom approach*" Tata McGraw Hill.

3. Haykin S., "*Neural Networks-A Comprehensive Foundations*", PHI

4. Anderson J.A., "*An Introduction to Neural Networks*", PHI

5. M.Ganesh, "*Introduction to Fuzzy sets and Fuzzy Logic*" PHI.

6. N P Padhy and S P Simon, " *Soft Computing with MATLAB Programming*", Oxford University Press

Course code	LC-ESC-317G				
Category	Engineering Science Course				
Course title	Microprocessor Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	0	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Hands-on experiments related to the course contents of ESC-CSE-501G.

Course code	LC-CSE-323G				
Category	Engineering Science Course				
Course title	Computer Networks Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	0	
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

LC-ECE325G DIGITAL SIGNAL PROCESSING LAB

L T P
- - 2

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 1 Hour

List of Experiments

Experiments to be performed on MATLAB

1. Introduction to MATLAB.
2. Represent basic signals (unit step, unit impulse, ramp, exponential, sine and cosine)
3. To develop program for Z-Transform in MATLAB
4. To develop program for Convolution of sequences in MATLAB
5. To develop program for Correlation of sequences in MATLAB
6. To develop program for DFT & IDFT of two sequences
7. To develop program for FFT of two Sequences
8. To develop program for Circular Convolution
9. To design analog filter (low-pass, high pass, band-pass, band-stop).
10. To design digital IIR filters (low-pass, high pass, band-pass, band-stop).
11. To develop program for Interpolation and Decimation of sequences
12. To design FIR filters using windows technique.
13. Detection of Signals buried in Noise
14. Effect of noise on signals in MATLAB

Course code	MC-317G			
Category	Mandatory Course			
Course title	**Constitution of India**			
Scheme and credits	L	T	P	Credits
	2	0	0	0

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Unit – I

Philosophy of Indian Constitution: Salient features of Indian Constitution, Preamble, and Nature of Indian Constitution, Procedure for amendment of the Constitution.

Unit – II

Federal structure and distribution of legislative and financial powers between the Union and the States

Unit – III

Organs of Governance: President – Qualification and Powers of the President, Governor- Qualification and Powers of Governor, Parliament: Composition, Qualifications and Disqualifications, Judiciary: Appointment, Tenure and Removal of Judges.

Unit – IV

Fundamental Rights: Origin and development of Fundamental rights, Need for fundamental rights. Introduction to Right to equality , Right to freedom, Right against exploitation, Right to freedom of religion, Cultural and Education rights and Fundamental duties.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S.N. Busi, Dr. B.R. Ambedkar framing of Indian Constitution, latest Edition
3. M.P. Jain, Indian Constitution Law, Lexis Nexis, latest edition
4. D.D. Basu, Introduction to Constitution of India, Lexis Nexis, latest edition.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

The examination of the regular students will be conducted by the concerned college/Institute internally. Each student will be required to score minimum 40% marks to qualify in the paper. The marks will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

HUM-ECE306G ENGINEERING ETHICS

L T P Theory: 75 Marks
3 - - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objective:

To enable the students to create an awareness on

1. Engineering Ethics and Human Values,
2. to instill Moral and Social Values and
3. Loyalty and to appreciate the rights of others.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT I

Ethics and Professionalism: Ethics and Excellence in Engineering, Micro and Macro Issues, Dimensions of Engineering, Potential Moral Problems, What Is Engineering Ethics, Why Study Engineering Ethics? Responsible Professionals, Professions, and Corporations: Saving Citicorp Tower, Meanings of Responsibility, Engineering as a Profession, Ethical Corporations and Senses of Corporate Responsibility. Moral Reasoning and Codes of Ethics, Moral Choices and Ethical Dilemmas, Rights Ethics, Duty Ethics, Utilitarianism, Virtue Ethics, Self-Realization Ethics, Ethical Egoism, Which Ethical Theory Is Best?

UNIT II

Engineering as Social Experimentation: Engineering as Experimentation, Engineers as Responsible Experimenter, Commitment to Safety: The Concept of Safety, Risks, Acceptability of Risk, Assessing and Reducing Risk: Uncertainties in Design, Risk-Benefit Analyses, Personal Risk versus Public Risk, Examples of Improved Safety, Three Mile Island, Safe Exits.

UNIT III

Truth and Truthfulness: Whistle-Blowing, Moral Guidelines, Protecting Whistle-Blowers, Common Sense Procedures, Beyond Whistle-Blowing, Honesty and Research Integrity: Truthfulness, Trustworthiness, Academic Integrity: Students, Research Integrity, Bias and Self-Deception, Protecting Research Subjects, Giving and Claiming Credit.
Computer Ethics: The Internet and Free Speech, Power Relationships, Property, Privacy,Additional Issues.

UNIT IV

Environmental Ethics: Engineering, Ecology, and Economics, Environmental Moral Frameworks, Human-Centered Ethics, Sentient-Centered Ethics, Biocentric Ethics, Ecocentric Ethics, Religious Perspectives.
Global Justice: Multinational Corporations, Technology Transfer and Appropriate Technology, Bhopal, “When in Rome”, International Rights, Promoting Morally Just Measures, Weapons Development and Peace, Involvement in Weapons Work, Defense Industry Problems, Peace Engineering.

References:

1. Mike W. Martin and Roland Schinzinger, “Introduction to Engineering Ethics”, Second Edition, McGraw Hill, New Delhi, latest edition
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, latest edition
3. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, latest edition
4. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, latest edition
5. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, latest edition
6. Edmund G Seebauer and Robert L Barry, “Fundametals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, latest edition
7. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi latest edition
8. World Community Service Centre, " Value Education", Vethathiri publications, Erode, latest edition

9 Web sources:
   i. www.onlineethics.org
   ii. www.nspe.org
   iii. www.globalethics.org
   iv. www.ethics.org

Outcomes:

Upon completion of the course, the student should be able to

1. apply ethics in society
2. discuss the ethical issues related to engineering
3. realize the responsibilities and rights in the society
4. realize the importance of sustainable development

PEC-ECE309G **NANO ELECTRONICS**

L T P Theory: 75 Marks
3 1 - Class work : 25 Marks
Total: 100 Marks
Duration of Exam: 3 Hours

Course Objective:

1. To provide the basic concept about nanoscience and technology
2. To introduce the concept of quantum mechanics
3. To provide the knowledge of miniaturizations and their effect on electronics devices
4. To understand the nanomaterials and their characterization techniques
5. To study the various nanoelectronics devices

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit -I

Introduction to nanotechnology, Basics of Quantum Mechanics: Wave nature of particles and wave-particle duality, Pauli Exclusion Principle, wave functions and Schrodinger's equations, Density of States, Band Theory of Solids, Particle in a box Concepts

Unit -II

Shrink-down approaches: CMOS scaling: advantages and limitations. Nanoscale MOSFETs, FINFETs, Vertical MOSFETs, system integration limits (interconnect issues etc.)

Unit -III

Nanostructure materials, classifications of nanostructure materials, zero dimensional, one dimensional, two dimensional and three dimensional, properties and applications Characterization techniques for nanostructured materials: SEM, TEM and AFM

Unit -1V

Nano electronis devices : Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

References:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, latest edition
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices), Wiley-VCH, latest edition
3. K.E. Drexler, Nanosystems, Wiley, latest edition
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, latest edition
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, latest edition

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.

Course code	ESC -CSE -308G				
Category	Professional Elective Course				
Course title	Mobile and wireless communication				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes

1. Understand the wireless/cellular radio concepts such as frequency reuse, handoff and interference between mobiles and base stations.
2. Identify the techno-political aspects of wireless and mobile communications such as the allocation of the limited wireless spectrum by regulatory agencies.
3. Understand the information theoretical aspects such as channel capacity, propagation effects, modeling the impact of signal bandwidth and motion in mobile systems.
4. Describe the current and future Mobile Communication Systems, GSM, Satellite, Broadcasting, Bluetooth, Wireless LANs, Mobile Adhoc Networks.
5. Describe the mobility support mechanism, WWW and WAPs.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- 1

Introduction: Application, History, Market Scenario, Reference Model and Overview, Wireless Local Loop and Cellular system.

Wireless Transmission: Frequencies, Signals, Antennae, Signal Propagation, Multiplexing, Modulation, Spread Spectrum.

MAC Layer: Specialized MAC, SDMA, FDMA, TDMA – Fixed TDM, Classical ALOHA, Slotted, ALOHA, CSMA, DAMA, PKMA, Reservation TDMA. Collision Avoidance, Polling, Inhibit Sense Multiple Access, CDMA.

Broadcasting: Unidirectional Distribution Systems, Digital Audio Broadcasting, Digital Video Broadcasting, Convergence of Mobile and Broadcasting Techniques.

UNIT 2

GSM: Mobile Services, Architecture Radio, Interface, Protocol, Localization, Calling Handover, Security, New data services.

Wireless LAN: IEEE 802 11- System and Protocol Architecture, Physical Layer, MAC Layered Management.

Bluetooth: User scenarios, Physical layer, MAC Layer, Networking, Security and Link Management.

UNIT 3

Mobile Network Layer: Mobile IP-Goals, Assumptions, Requirement, Entities, Terminology, IP Packet delivery, Agent Advertisement and Discovery, Registration, Tunneling, Encapsulation, Optimization, Reserve Tunneling, Security, IPv6 , DHCP.

Mobile Adhoc Networks: Routing, Destination Sequence Distance Vector, Dynamic Source Routing, Hierarchical algorithms, Performance Metrics.

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping, TCP, Mobile TCP, Fast- retransmission TCP, Transaction oriented TCP.

UNIT 4

Satellite Systems: History, Applications, GEO, LEO, MEO, Routing, Localization, Handover in Satellite System.

Support for Mobility: File System, WWW, HTML, System Architecture.

WAP: Architecture, Wireless Datagram, Protocol, Wireless Transport Layer Security, Wireless Transaction Protocol, Application Environment, Telephony Applications.

References:

1. Jochen Schiller, “MobileCommunication”, Pearson Education, latest edition
2. LEE, “Mobile Cellular Telecommunications”, McGRAW-Hill, latest edition
3. Theodore S Rappaport, “Wireless Communications”, Pearson Education.

Course Outcomes

- Explain the principles and theories of mobile computing technologies.
- Describe infrastructures and technologies of mobile computing technologies.
- List applications in different domains that mobile computing offers to the public, employees, and businesses.
- Describe the possible future of mobile computing technologies and applications.
- Effectively communicate course work through written and oral presentations

PCC-ECE302G CONTROL SYSTEMS

L T P Theory : 75 Marks

3 1 - Class work : 25 Marks

Total : 100 Marks

Duration of Exam : 3 Hours

Course Objective:

1. To introduce the components and their representation of control systems.
2. To learn various methods for analyzing the time response, frequency response and stability of the systems.
3. To learn the various approach for the state variable analysis.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit I

Systems Components and Their Representation

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchronous -Multivariable control system

Unit II

Time Response Analysis And Stability Concept

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control.

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus.

Unit III

Frequency Domain Analysis

Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

Unit IV

Control System Analysis Using State Variable Methods

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations.

References:

1. Gopal. M., “ Control Systems: Principles and Design” , Tata McGraw-Hill, latest edition
2. Kuo, B.C., “Automatic Control System”, Prentice Hall, sixth edition, latest edition
3. Ogata, K., “Modern Control Engineering”, Prentice Hall, second edition, latest edition
4. Nagrath & Gopal, “Modern Control Engineering”, New Age International, New Delhi

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Characterize a system and find its steady state behaviour
2. Analyse the time domain specification and calculate steady state errors..
3. Investigate stability of a system using different tests
4. Illustrate the state space model of a physical system.

Course code	PROG-CSE-322G				
Category	Professional Elective Course				
Course title	PROJECT				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

LC-ECE324G **CONTROL SYSTEM LAB**

L T P
\- - 2

Practical Exam: 25 Marks
Lab work : 25 Marks
Total: 50 Marks
Duration of Exam: 1 Hour

Hands-on experiments related to the course contents PCC-ECE307G

SOFTWARE ENGINEERING

<table>
<tr><td>Coursecode</td><td colspan="5">PEC CSE-311G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Coursetitle</td><td colspan="5">Software Engineering</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives of the course

- Be successful professionals in the field with solid fundamental knowledge of software engineering
- Utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams
- Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction: The process, software products, emergence of software engineering, evolving role of software, software life cycle models, Software Characteristics, Applications, Software crisis.

Software project management: Project management concepts, software process and project metrics Project planning, project size estimation metrics, project estimation Techniques, empirical estimation techniques, COCOMO- A Heuristic estimation techniques, staffing level estimation, team structures, staffing, risk analysis and management, project scheduling and tracking

Unit: 2

Requirements Analysis and specification requirements engineering, system modeling and simulation Analysis principles modeling, partitioning Software, prototyping: , Prototyping methods and tools; Specification principles, Representation, the software requirements specification and reviews Analysis Modeling: Data Modeling, Functional modeling and information flow: Data flow diagrams, BehavioralModeling; The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the control and process specification; The data dictionary; Other classical analysis methods.

System Design: Design concepts and principles: the design process: Design and software quality, design principles; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling;

Unit: 3

Architectural Design: Software architecture, Data Design: Data modeling, data structures, databases and the data warehouse, Analyzing alternative Architectural Designs, architectural complexity; Mapping requirements into a software architecture; Transform flow, Transaction flow; Transform mapping: Refining the architectural design.

Testing and maintenance: Software Testing Techniques, software testing fundamentals: objectives, principles, testability; Test case design, white box testing, basis path testing: Control structure testing: Black box testing, testing for specialized environments, architectures and applications. Software Testing Strategies: Verification and validation, Unit testing, Integration testing, Validation testing, alpha and beta testing; System testing: Recovery testing, security testing, stress testing, performance testing; The art of debugging, the debugging process debugging approaches. Software re-engineering, reverse engineering, restructuring, forward engineering.

Unit: 4

Software Reliability and Quality Assurance :Quality concepts, Software quality assurance , SQA activities; Software reviews: cost impact of software defects, defect amplification and removal; formal technical reviews: The review meeting, review reporting and record keeping, review guidelines; Formal approaches to SQA; Statistical software quality assurance; software reliability: Measures of reliability and availability ,The ISO 9000 Quality standards: The ISO approach to quality assurance systems, The ISO 9001 standard, Software Configuration Management. Computer Aided software Engineering: CASE, building blocks, integrated case environments and architecture, repository.

Suggested books:

- Software Engineering – A Practitioner's Approach, Roger S. Pressman, 1996, MGH.

Suggested reference books

- Fundamentals of software Engineering, Rajib Mall, PHI Software Engineering by Nasib Singh Gill, Khanna Book Publishing Co (p) Ltd
- Software Engineering by Ian Somerville, Pearson Edu, 5 edition, 1999, AW,
- Software Engineering – David Gustafson, 2002, T.M.H
- Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson 1995 JW&S,
- An Integrated Approach to software engineering by Pankaj jalote , 1991 Narosa,

Course Outcomes

1. How to apply the software engineering lifecycle by demonstrating competence in communication, planning, analysis, design, construction, and deployment
2. An ability to work in one or more significant application domains
3. Work as an individual and as part of a multidisciplinary team to develop and deliver quality software
4. Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle
5. Demonstrate an ability to use the techniques and tools necessary for engineering practice

SYSTEM PROGAMMING AND SYSTEM ADMINISTRATION

<table>
<tr><td>Coursecode</td><td colspan="5">PEC CSE-313G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Coursetitle</td><td colspan="5">System Programming and System Administration</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 5</td></tr>
<tr><td>3</td><td>0</td><td></td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives of the course

1. Evolution of the components of system programming.
2. To learn working and different stages of compilation process.
3. To learn basic of assembler and loading schemes.
4. To learn basics of file structure.
5. To know about filters and pipeline.
6. To learn shell programming

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Evolution of Components Systems Programming, Assemblers, Loaders, Linkers, Macros, Compilers. software tools, Text editors, Interpreters and program generators, Debug Monitors, Programming environment.

Compiler: Brief overview of compilation process, Incremental compiler, Assembler: Problem statement, symbol table; Loader schemes, compile and go Loader, general loader schemes, absolute loader, Reallocating loader, Direct linkage Loader, Binders, overlays.

Unit: 2

Theoretical Concept of Unix Operating System: Basic features of operating system; File structure: CPU scheduling; Memory management: swapping, demand paging; file system: block and fragments, inodes, directory structure; User to user communication

Unit: 3

Getting Started with Unix: User names and groups, logging in; Format of Unix commands; Changing your password; Characters with special meaning; Unix documentation; Files and directories; Current directory, looking at the directory contents, absolute and relative pathnames, some Unix directories and files; Looking at the file contents; File permissions; basic operation on files; changing permission modes; Standard files, standard output; Standard input, standard error; filters and pipelines; Processes; finding out about processes; Stopping background process; Unix editor vi.

Unit-4

Shell Programming: Programming in the Borne and C-Shell; Wild cards; Simple shell programs; Shell variables; interactive shell scripts; Advanced features.

System Administration: Definition of system administration; Booting the system; Maintaining user accounts; File systems and special files; Backups and restoration; Role and functions of a system manager. Overview of the Linux operating system

Suggested books:

1. Systems Programming by Donovan, TMH.
2. The unix programming environment by Brain Kernighen& Rob Pike, 1984, PHI & Rob Pike.
3. Design of the Unix operating system by Maurich Bach, 1986, PHI.
4. Introduction to UNIX and LINUX by John Muster, 2003, TMH.

Suggested reference books

1. Advanced Unix programmer's Guide by Stephen Prato, BPB
2. Unix- Concept and applications by Sumitabha Das, 2002, T.M..H

Course Outcomes

1. To understand various file statistics.
2. To work on wildcards.
3.To know about shell programming and AWK utility.

Digital Image Processing

Course Code	PEC-CSE-315G				
Category	Professional Elective Course				
Coursetitle	Digital Image Processing				
Scheme and Credits	L	T	P	Credits	Semester 5
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition method

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation.

Unit: 2

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, colour models, Pseudo colouring, colour transforms, Basics of Wavelet Transforms.

Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphism Filtering

Unit: 3

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression.

Unit-4

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors.

Suggested books:

1. Rafael C. Gonzalez, Richard E. Woods,Digital Image Processing Pearson, Third Edition,2010.
2. Anil K. Jain,Fundamentals of Digital Image Processing Pearson, 2002.

Suggested reference books

1. Kenneth R. Castleman,Digital Image Processing Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,Digital Image Processing using MATLAB Pearson Education, Inc., 2011.
3. D,E. Dudgeon and RM. Mersereau,Multidimensional Digital Signal Processing Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt,Digital Image Processing John Wiley, New York, 2002
5. Milan Sonka et al Image processing, analysis and machine vision Brookes/Cole, Vikas Publishing House, 2nd edition, 1999

Course Outcomes

1. Know and understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
2. Operate on images using the techniques of smoothing, sharpening and enhancement.
3. Understand the restoration concepts and filtering techniques.
4. Learn the basics of segmentation, features extraction, compression and recognition methods for colour models

ADVANCED DATABASE MANAGEMENT SYSTEM

<table>
<tr><td>Course code</td><td colspan="5">PEC-CSE-310G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Elective Course</td></tr>
<tr><td>Course title</td><td colspan="5">Advanced Database Management System</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 6</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objective of the course:

- To understand DBMS Components, Advantages and Disadvantages.
- Understanding Data modeling: ER, EER, Network, Hierarchical and Relational data models.
- Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
- To understand transaction concept, schedules, serializability, locking and concurrency control protocols.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction: Architecture, Advantages, Disadvantages, Data models, relational algebra,SQL, Normal forms.

Query Processing: General strategies for query processing, transformations, expected size, statistics in estimation, query improvement. Query evaluation, view processing, query processor.

UNIT 2

Recovery: Reliability, Transactions, recovery in centralized DBMS, reflecting updates, Buffer management logging schemes, disaster recovery.

Concurrency: Introduction, Serializability, Concurrency control, Locking schemes, Timestamp based ordering, Optimistic, Scheduling, Multiversion techniques, Deadlocks.

UNIT 3

Parallel and Distributed Databases: Distributed Data Storage – Fragmentation & Replication, Location and Fragment.
Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

UNIT 4

Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization, Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases

Suggested Text Book:

1. Elmarsi, Navathe, Somayajulu, Gupta, "Fundamentals of Database Systems", 4^{th} Edition, Pearson Education,2007
2. Garcia, Ullman, Widom, "Database Systems, The complete book", Pearson Education, 2007
3. R. Ramakrishnan, "Database Management Systems", McGraw Hill International Editions, 1998

Suggested References Books:

1. Date, Kannan, Swaminathan, "An Introduction to Database Systems", 8th Edition Pearson Education, 2007
2. Singh S.K., "Database System Concepts, design and application", Pearson Education, 2006.
3. Silberscatz, Korth, Sudarshan, "Database System Concepts", Mcgraw Hill, 6th Edition, 2006
4. W. Kim, "Modern Database Systems", 1995, ACM Press, Addision Wesley,

Course Outcomes:

- Students will get understanding of DBMS Components, Its advantages and disadvantages.
- Understanding about various types of Data modeling: ER, EER, Network, Hierarchical and Relational data models.
- Understanding normalization, general strategies for query processing, query processor, syntax analyzer, Query decomposition, Heuristic Query optimization.
- Understanding transaction concept, schedules, serializability, locking and concurrency control protocols.

MOBILE APPLICATIONS DEVELOPMENT

Course code	PEC-CSE-312G				
Category	Professional Elective Course				
Course title	Mobile applications development				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- Introduce the students with the various "Next Generation Technologies" in the area of mobile computing
- Assist students understand the various Mobile operating Systems
- Explore the findings using Android Technologies

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features

UNIT 2

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova.

UNIT 3

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization.

UNIT 4

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment.

iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment

Suggested text books:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition:
2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.
3. Barry Burd, "Android Application Development All in one for Dummies", Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS

Suggested reference books:

1. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons
2. Henry Lee, Eugene Chuvyrov, "Beginning Windows Phone App Development", Apress, 2012.
3. Jochen Schiller,"Mobile Communications", Addison-Wesley, 2nd edition, 2004.
4. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.

Course Outcomes:

- Explain the principles and theories of mobile computing technologies.
- Describe infrastructures and technologies of mobile computing technologies.
- List applications in different domains that mobile computing offers to the public, employees, and businesses.
- Describe the possible future of mobile computing technologies and applications.
- Effectively communicate course work through written and oral presentations

COMPUTER GRAPHICS

Course code	PEC-CSE-314G				
Category	Professional Elective Course				
Course title	Computer Graphics				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- To have basic understanding of the core concepts of Computer Graphics.
- Understand scan conversion, 2D, 3D – transformation and viewing.
- To be able to create interactive computer Graphics with understanding of shading, image processing and illumination model.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction to Computer Graphics: What is Computer Graphics, Computer Graphics Applications, Computer Graphics Hardware and software; Two dimensional Graphics Primitives: Points and Lines, Scan Conversion: Point, Line, Circle; Region Filling: Scanline algorithm, Polygon filling algorithm, boundary filled algorithm.

UNIT 2

Two dimensional transformations: Geometric, Coordinate and, composite transformation.
Two Dimensional Viewing: window to view port mapping; Clipping: point, line, polygon, curve and text clipping

UNIT 3

Three-dimensional transformations: Three dimensional graphics concept, Geometric and Coordinate transformations, **Viewing in 3D:** Projection, Taxonomy of projection,
Hidden surface removal: Introduction to hidden surface removal, The Z- buffer algorithm, The painter's algorithm, Scanline algorithm, Sub-division algorithm.

UNIT 4

Representing Curves and Surfaces: Parametric representation of curves: Bezier curves, B-Spline curves. Parametric representation of surfaces; Interpolation method.
Illumination, shading, image manipulation: Illumination models, shading models for polygons, shadows, transparency, image processing.

Suggested Text Books:

1. Computer Graphics Principles and Practices second edition by James D. Foley, Andeies van Dam, Stevan K. Feiner and Johb F. Hughes, 2000, Addision Wesley.
2. Computer Graphics by Donald Hearn and M.Pauline Baker, 2 Edition, 1999, PHI
3. Computer Graphics by Z. Xiang, R. Plastock, 2^{nd} Edition, TMH Education.

Suggested Reference Books:

1. Procedural Elements for Computer Graphics – David F. Rogers, 2001, T.M.H Second Edition
2. Fundamentals of 3-Dimensional Computer Graphics by Alan Watt, 1999, Addision Wesley.
3. Computer Graphics: Secrets and Solutions by Corrign John, BPB
4. Graphics, GUI, Games & Multimedia Projects in C by Pilania&Mahendra, Standard Publ.
5. Computer Graphics Secrets and solutions by Corrign John, 1994, BPV
6 Introduction to Computer Graphics by N. Krishanmurthy T.M.H 2002

Course Outcomes:

- Understanding of the software, hardware and applications of Computer Graphics.
- Understanding of Scan conversion, 2D, 3D – transformation and viewing.
- To be able to implement picture on screen using projection, shading, image processing and illumination model.

DISTRIBUTED SYSTEM

Course code	PEC-CSE-316G				
Category	Professional Elective Course				
Course title	Distributed System				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- To examine the fundamental principles of distributed systems, and provide students hands-on experience in developing distributed protocols.
- Analyze the issues in distributed operating systems and to address these distributed systems issues in a broader sense. Emphasis will be placed on communication, process, naming, synchronization and fault tolerance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction: Distributed Operating Systems Definition and goals, Hardware and Software concepts, Design issues.

Communication in Distributed System: Computer Network and Layered protocols, Message passing and related issues, synchronization, Client Server model & its implementation, remote procedure call and implementation issues, Case Studies: SUN RPC, DEC RPC

UNIT 2

Synchronization in Distributed System: Clock synchronization and related algorithms, mutual exclusion, Deadlock in distributed systems

Processes and processors in Distributed systems: Threads, system model, processor allocation, scheduling in distributed systems: Load balancing and sharing approach, fault tolerance, real time distributed systems, Process migration and related issues

UNIT 3

Distributed File systems: Introduction, features & goal of distributed file system, file models, file accessing models, file sharing semantics, file caching scheme, file replication, fault tolerance, trends in distributed file system, case study.

Distributed Shared Memory: Introduction, general architecture of DSM systems, design and implementation issues of DSM, granularity, structure of shared memory space, consistency models, replacement strategy, thrashing

UNIT 4

Security Issues: Introduction of Security in Distributed OS, Overview of security techniques, features, Need, Access Control, Security Management

Distributed Web-based Systems: Architecture, Processes, Communication, Naming, Synchronization

Case Studies: JAVA RMI, Sun Network File System, Google Case Study

Suggested Reference books:

1. Distributed Operating Systems by Andrew S Tannebaum, Pearson
2. Distributed Operating Systems Concepts and Design, Pradeep K. Sinha, PHI
3. Distributed Systems: Concepts and Design by George Coulouris, Jean Dollimore,TimKindberg, Pearson
4. Distributed Computing by Sunita Mahajan & Seema Shah OXFORD
5. Distributed Systems: Principles and Paradigms by Andrew S Tanebaum, Maarten Van Steen, PHI
6. Distributed Computing, Fundamentals, Simulations and Advanced topics, 2nd Edition, HagitAttiya and Jennifer Welch, Wiley India

Course Outcomes:

- List the principles of distributed systems and describe the problems and challenges associated with these principles.
- Understand Distributed Computing techniques, Synchronous and Processes.
- Apply Shared Data access and Files concepts.
- Design distributed system that fulfills requirements with regards to key distributed systems properties.
- Understand Distributed File Systems and Distributed Shared Memory.
- Apply Distributed web-based system and understand the importance of security in distributed system

INFORMATION TECHNOLOGY & INDUSTRY BUSINESS SKILLS

<table>
<tr><td>Course code</td><td colspan="5">PEC-CSE-318G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Information Technology & Industry Business Skills</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 6</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives of the course:

6. To understand the novel information technology techniques and industry business skills.
7. To study about the concept of amazon web services.
8. To understand the use of cloud in web services and their different application.
9. To study business models used in industry and their implementation.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Web Services: History and Introduction to cloud computing, Introduction to AWS, Instances creation methods in AWS, Scalable Computing in AWS, Storage in AWS, Persistence in AWS, Routing from AWS, Delivering strategies with AWS, Messaging management inside AWS, Communicating technique with AWS, AWS Free Tier, Identity Access Management, Security Assertion Markup language, Simple Storage Service, introduction to Google APP Engine, Azure computing method, service models, deployments models of cloud computing, difference between AWS, AZURE, Google Cloud;

Unit: 2

Cloud: Amazon Elastic Compute Cloud, Elastic Block Store, Security Group management, Amazon Machine Images, Storing data in the cloud, storing your objects: S3 and Glacier, ELB and SQS, auto-scaling and Cloud Watch, Cloud Formation, Elastic Beanstalk, and Ops Works, RDS, fault-tolerance, scaling, AZURE architecture and services, Google cloud applications;

Unit: 3

Business: Business models, Building blocks of Sales force, Understand the Security model, Understand the Data model, Configure and manage Sales and Service Cloud, Learn about Sales force Objects, create, rename or modify objects, validation rules, Create different field types and validation rules, Sales Cloud and Service Cloud modules, reports and dashboard, Sales force A Chatter, and Social features, chatter, application lifecycle, visual workflow;

Unit: 4

Security & Applications: security group, NACL, difference between security group and NACL, AWS-Data pipeline, Simple queue services, Simple workflow services, Simple notification Services, Elastic Transcoder.

Suggested reference books:

1. Amazon Web Services in Action by Michael Wittig and Andreas Wittig, Manning Publications;
2. AWS Certified Solutions Architect by Joe Baron, Hisham Baz, Tim Bixler, Biff Gaut, Kevin E. Kelly, Wiley publication;

Course Outcomes:

- Student will understand the concept of web services of amazon, virtual machines and their working.
- For a given region the availability of resources and cost management.
- For a given application scalable model and selection of services.

DATA SCIENCE

Course code	PCC-CSE-320G				
Category	Professional Core Course				
Course title	Data Science				
Scheme and Credits	L	T	P	Credits	Semester 6
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course:

- The objective of this course is to impart necessary knowledge of the basic foundations needed for understanding data science domain and develop programming skills required to build data science applications.
- To introduce the conceptual knowledge of the area of data science domian, feature and scope of applications.
- To impart programming knowledge needed for data sciences.
- To understand the different issues involved in the design and implementation of a data science applications.
- To understand case studies of essential Data sciences applications.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1

Introduction to Data Science: Concept of Data Science, Traits of Big data, Web Scraping, Analysis vs Reporting, Collection, storing, processing, describing and modelling, statistical modelling and algorithm modelling, AI and data science, Myths of Data science

UNIT 2

Introduction to Programming Tools for Data Science: Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK, Visualizing Data: Bar Charts, Line Charts, Scatterplots, Working with data: Reading Files, Scraping the Web,

UNIT 3

Data Science Methodology: Business Understanding, Analytic Approach, Data Requirements, Data Collection, Data Understanding, data Preparation, Modeling, Evaluation, Deployment, feedback

UNIT 4

Data Science Application : Prediction and elections, Recommendations and buisness analytics, clustering and text analytics

Suggested Text books:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
2. AurélienGéron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
3. Jain V.K., “Data Sciences”, Khanna Publishing House, Delhi.
4. Jain V.K., “Big Data and Hadoop”, Khanna Publishing House, Delhi.

Suggested Reference books:

1. Data Science Workflow: Overview and Challenges by Philip Guo
2. Python for Data Analysis, O’Reilly Media Rajiv, “Machine Learning”, Khanna Publishing House, Delhi.
3. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press
4. http://www.deeplearningbook.org
5. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan
6. Kaufmann Publishers

Course Outcomes:

- Understand the value of data science and the process behind using it.
- Use Python to gather, store, clean, analyse, and visualise data-sets.
- Apply toolkits to formulate and test data hypotheses and uncover relationships within data-sets
- Understand the data science methodology in the data science pipeline
- Understand real-world challenges with several case studies

VHDL AND DIGITAL DESIGN

Course code	PEC-CSE-332G (common with ECE)				
Category	Program Elective Course				
Course title	VHDL and Digital Design				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objective:

- To understand the modelling & simulation & its role in digital evaluation.
- To learn basic concepts of VHDL language, its different architecture, designing of various Combinational & sequential circuits.
- To study various PLDs & detail study of FPGAs and implementation of various combinational & sequential logic circuits on FPGAs.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-1

INTRODUCTION: Introduction to Computer-aided design tools for digital systems. Hardware description languages; introduction to VHDL data objects, classes and data types, Operators, Overloading, logical operators. Types of delays, Entity and Architecture declaration. Introduction to behavioural dataflow and structural models.

UNIT- 2

VHDL STATEMENTS: Assignment statements, sequential statements and process, conditional statements, case statement Array and loops, resolution functions, Packages and Libraries, concurrent statements. Subprograms: Application of Functions and Procedures, Structural Modelling, component declaration, structural layout and generics.

UNIT -3

COMBINATIONAL & SEQUENTIAL CIRCUIT DESIGN:VHDL Models and Simulation of combinational circuits such as Multiplexers, Demultiplexers, encoders, decoders , code converters, comparators, implementation of Boolean functions etc. VHDL Models and Simulation of Sequential Circuits Shift Registers, Counters etc.

UNIT-4

DESIGN OF MICROCOMPUTER & PROGRAMMABLE DEVICE: Basic components of a computer, specifications, architecture of a simple microcomputer system, and implementation of a simple microcomputer system using VHDL Programmable logic devices: ROM, PLAs, PALs, GAL, PEEL, CPLDs and FPGA. Design implementation using CPLDs and FPGAs

REFERENCE BOOKS:

1. Ashenden - Digital design,Elsevier
2. IEEE Standard VHDL Language Reference Manual (1993).
3. Digital Design and Modelling with VHDL and Synthesis: KC Chang; IEEE Computer Society Press.
4. "A VHDL Primmer" : Bhasker; Prentice Hall 1995.
5. "Digital System Design using VHDL" : Charles. H.Roth ; PWS (1998).
6. "VHDL-Analysis & Modelling of Digital Systems" :Navabi Z; McGraw Hill.
7. VHDL-IV Edition: Perry; TMH (2002)
8. "Introduction to Digital Systems" :Ercegovac. Lang & Moreno; John Wiley (1999).
9. Fundamentals of Digital Logic with VHDL Design : Brown and Vranesic; TMH (2000)
10. Modern Digital Electronics- III Edition: R.P Jain; TMH (2003).
11. Grout - Digital system Design using FPGA & CPLD 'S,Elsevier

Course Outcome: After the completion of the course the student will be able to:

- Understand the need & application of hardware description language.
- Modelling & simulations of various basic & advanced digital systems using VHDL.
- Implementation of various basic & advanced digital systems using FPGAs.
- Apply knowledge to design & implement combinational circuits & sequential circuits related to research & industry applications.

M.D. UNIVERSITY, ROHTAK

(NAAC Accredited 'A+' Grade)

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Mining Engineering)

SEMESTER 3rd AND 4th

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS:

Course Code	Definitions
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
Pr	Practical

General Notes:

1. Mandatory courses are non credit courses in which students will be required passing marks in internal assessments.
2. Students will be allowed to use non programmable scientific calculator. However, sharing of calculator will not be permitted in the examination.
3. Students will be permitted to opt for any elective course run by the department. However, the department shall offer those electives for which they have expertise. The choice of the students for any elective shall not be binding for the department to offer, if the department does not have expertise. To run the elective course a minimum of 1/3rd students of the class should opt for it.

Scheme of Studies and Examination
B.TECH (Mining Engineering) – 3rd Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Engineering Science Course	ESC-MN-301G	Mathematics – III	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-MN-303G	Mining Geology - I	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-MN-305G	Elements of Mining	3	0	0	3	3	25	75		100	3
4	Engineering Science Course	ESC-MN-307G	Thermodynamics	3	0	0	3	3	25	75		100	3
5	Engineering Science Course	PCC-MN-309G	Strength of Materials	3	0	0	3	3	25	75		100	3
6	Professional Core Course	PCC-MN-311G	Surveying-I	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-MN-313G	Mining Geology - I Lab	0	0	3	3	1.5	25	-	25	50	3
8	Professional Core Course	LC-MN-323G	Strength of Materials Lab	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-MN-325G	Surveying Lab-I	0	0	3	3	1.5	25		25	50	3
10	Mandatory Courses	MC-317G	Constitution of India	2	0	0							
		TOTAL						**22.5**				**750**	

Scheme of Studies and Examination
B.TECH (Mining Engineering) – 4th Semester
w.e.f. 2020-21

Sr. No.	Category	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
				L	T	P			Internal Assessment	External Examination	Practical	Total	
1	Engineering Science Course	ESC-MN-302G	Numerical Methods	3	0	0	3	3	25	75		100	3
2	Professional Core Course	PCC-MN-304G	Mining Geology-II	3	0	0	3	3	25	75		100	3
3	Professional Core Course	PCC-MN-306G	Mine Development	3	0	0	3	3	25	75		100	3
4	Engineering Science Course	ESC-MN-308G	Fluid Mechanics	3	0	0	3	3	25	75		100	3
5	Engineering Science Course	ESC-MN-310G	Industrial Electronics	3	0	0	3	3	25	75		100	3
6	Professional Core Course	PCC-MN-312G	Surveying-II	3	0	0	3	3	25	75		100	3
7	Professional Core Course	LC-MN-314G	Mining Geology-II Lab	0	0	4	4	2	25		25	50	3
8	Professional Core Course	LC-MN-316G	Fluid Mechanics Lab	0	0	3	3	1.5	25		25	50	3
9	Professional Core Course	LC-MN-318G	Industrial Electronics Lab	0	0	3	3	1.5	25		25	50	3
10	Professional Core Course	LC-MN-320G	Surveying-II Lab	0	0	3	2	1	25		25	50	3
		TOTAL						**24**				**800**	

Note:

1. Each student has to undergo practical training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc and its evaluation shall be carried out in the V semester on the basis of seminar, viva-voce, report and certificate of practical training obtained by the student.

ESC-MN-301G **Mathematics – III**

L T P	**Internal Assessment: 25**
3 0 0	**External Examination: 75**
	Total: 100
	Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation;

UNIT-II

Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.

UNIT-III

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Continuous random varibales and their properties, distribution functions and densities, normal,
exponential and gamma densities.Bivariate distributions and their properties, distribution of sums
and quotients, conditional densities, Bayes' rule.

UNIT-IV

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability
distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three
distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least
squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for

single mean, difference of means, and difference of standard deviations. Test for ratio of variances – Chisquare test for goodness of fit and independence of attributes.

Course Outcomes:

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall,
2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

PCC-MN-303G

Mining Geology - I

L T P
3 0 0

Internal Assessment: 25
External Examination: 75
Total: 100
Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction

Branches and scope of geology in mining; weathering of rocks, geological time scale; plate tectonics

Mineralogy

Mineralogy; physical, chemical and optical properties of minerals; polymorphism, isomorphism and crystallography

UNIT-II

Petrology

Petrology; formation, texture, structure and classification of various types of rocks;

UNIT-III

Structural Geology

Structural features of rocks; folds, faults, joints and unconformities;

UNIT-IV

Remote Sensing

Remote sensing; nature of electromagnetic radiation, electromagnetic spectrum and energy; Remote sensing platforms and sensor's characteristics, advantages and limitations of remote sensing in various fields of mining engineering.

References:

1. A Text Book of Engineering and General Geology. Singh Parbin. 3rd Ed. Katson publisher, Ludhiana.
2. A Text Book of Applied Engineering Geology. Maruthesha Reddy M T. New Age International. 2013.
3. A Text Book of Geology, Mukherjee P K. The World Press Pvt. Ltd. Calcutta. 2010.
4. Principles of Engineering Geology. Bangar K.M. Standard Publishers. Delhi, 1995.

PCC-MN-305G

Elements of Mining

L T P
3 0 0

Internal Assessment: 25
External Examination: 75
Total: 100
Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction

Mineral resources of Rajasthan, India and World; Mining of important economic minerals in India; Various terms used in mining; Stages in the life of the mine, Introduction to unit operations, Economical, Social, Environmental and Health impacts of Mining.

Fundamentals of Prospecting

Prospecting: Reconnaissance; principles and methods of prospecting - pit, shaft, trench and boreholes; Principle, method, Work schedule and application of Geologic, Geophysical, Geochemical, Electrical, Electromagnetic, Gravity methods of prospecting, Sampling techniques; planning a prospecting programme Application of Remote Sensing and GIS in mineral prospecting.

Unit-II

Fundamentals of Exploration

Exploration: Boring, Principles of boring, Selection of sites for boreholes; Surface layout of boring; Details of equipment, Core recovery, Borehole logging; Maintenance of records; Deflection of boreholes; Difficulties inboring; Fishing tools and their uses; Methods of exploratory drilling for oil; Interpretation of borehole data

Unit--III

Explosives & Blasting

Explosives: Classification and comparative properties of explosive; Modern explosives, Mechanisms of rock blasting; Blasting devices; Electric and non -electric methods; Delay blasting techniques; Priming; Charge distribution; Blasting with cut and solid blasting, General application and uses; Safety considerations.

Unit--IV

Development of Deposits

Pre mining, mining and post-mining: ancillary mining operation, Types of entries to mineral deposits – Shaft, Incline, Adit –applicable conditions- limitations. Basic concepts of surface and underground mining, Comparison of underground and surface mining.

References:

1. High Technology in Drilling and Exploration. Chugh C. P. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
2. Diamond Drilling. Chugh C.P. Oxford & IBH Publisher.
3. Introductory Mining Engineering. Howard & Hartman L. John Willey & Sons
4. Engineering Rock Blasting Operations. Bhandari S. A .A. Balkema Publisher. USA
5. Principles & Practices of Modern Coal Mining. Singh R. D. New Age International Pvt. Ltd. New Delhi.

ESC-MN-307G **Thermodynamics**

L T P	**Internal Assessment: 25**
3 0 0	**External Examination: 75**
	Total: 100
	Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Basic Concepts & definitions

Thermodynamics and its importance, Macroscopic and Microscopic view point, Concept of Continuum, Thermodynamic System, Surrounding and Boundary, Control Volume approach and Systems approach, Equilibrium – Thermal ,Chemical, Mechanical and thermodynamic, Pure Substance, Property – Intensive and Extensive, State, Path, Process and Cycle. Point Function and Path Function, Quasi Static Process and processes like Isobaric, Isochoric, Isothermal, Polytropic Process, Temperature and different scales, Zeroth Law of Thermodynamics, Energy, sources of energy; forms of energy, Energy transfer by work and forms of work ; free Expansion, Energy transfer by heat ; Adiabatic Process, Equations of state, Ideal gas Equation-; Specific gas constant and Universal Gas Constant

UNIT-II

First Law of Thermodynamics

Relation between Heat and Work- Joules Constant, First law of thermodynamics for a cyclic process, First law of thermodynamics for a closed system undergoing a process, Conservation principle, First Law of Thermodynamics applied to open system – Steady Flow Energy Equation, Perpetual motion Machine of First kind, Application of first law of thermodynamics to closed system or Non flow Process, Application of first law of thermodynamics to Open Systems like Steam Nozzle, Boiler, Steam Turbine, Pump, Heat Exchanger, Throttling Process – Joules Thompson Coefficient and its significance

Second Law of Thermodynamics

Limitations of first law of thermodynamics, Thermal Reservoir - Source and Sink, Concept of Heat Engine, Heat Pump and Refrigerator, Second law of thermodynamics – Kelvin Planck and Clausius Statements. Equivalence of Clausius and Kelvin Planck Statement, Reversible and Irreversible Process. Causes of Irreversibility, Perpetual Motion Machine of Second Kind, Need of Carnot theorem and its corollaries, Carnot cycle, Thermodynamic Temperature Scale and its equivalence with Ideal Gas Scale Entropy: Clausius Inequality, Clausius Theorem, Entropy is Property of a system, Isentropic Process, Temperature Entropy Plot and its relationship with heat interactions, Entropy Principle, Entropy change During a Process. Interpretation of concept of entropy

UNIT-III

Thermodynamic Relations

Reciprocal Relation, Cyclic Relation Property relations, Maxwell Relations, TdS equations, Heat capacity relations, Volume Expansivity, Isothermal Compressibility, Clausius-Clapeyron Equation

Availability: High grade and Low Grade Energy, Available and Unavailable Energy, Dead State, Available energy with respect to a process and a cycle, Decrease of Available Energy When heat is transferred through a finite temperature Difference, Second Law efficiency

Properties of Pure Substance:Pure substance and Phase changes: Phase change processes of pure substance, Property diagrams for phase change process (T-v, T-s and p-h diagrams), Understanding of Steam Table and Mollier chart with suitable examples.

UNIT-IV

Compressors

Reciprocating Air Compressor: Single stage compressor – computation of work done, isothermal efficiency, effect of clearance volume, volumetric efficiency, Free air delivery, Theoretical and actual indicator diagram

Multistage compressors: Constructional details of multistage compressors, Need of multistage, Computation of work done, volumetric efficiency, Condition for maximum efficiency, Inter cooling and after cooling (numerical), Theoretical and actual indicator diagram for multi stage compressors

Rotary Air Compressors: Classification, Difference between compressors and blowers, Working and constructional details of roots blower, Screw type and vane type compressors

Power cycles

Vapour Power cycle:Carnot cycle and its limitations as a vapour cycle, Rankine cycle with different turbine inlet conditions, Mean temperature of heat addition, Methods to improve thermal efficiency of Rankine cycle – Reheat cycle and Regeneration Cycle.

Gas Power cycles:Assumptions of Air Standard Cycle, Otto cycle, Diesel Cycle and Dual cycle, Brayton Cycle, Sterling Cycle and Ericsson Cycle and Lenoir cycle and Atkinson cycle

References:

1. Thermodynamics: An Engineering Approach. Yunus A. Cengel and Michael A Boles, 7th Ed. TMH
2. Basic Engineering Thermodynamics by Rayner Joel, Longman Publishers Engineering
3. Engineering Thermodynamics. P Chattopadhyay, 2nd Ed. Oxford University Press India
4. Thermodynamics. P K Nag. 5th Ed, TMH
5. Thermodynamics. Onkar Singh, New Age International
6. Thermodynamics. C P Arora, TMH

PCC-MN-309G

Strength of Materials

L T P
3 0 0

Internal Assessment: 25
External Examination: 75
Total: 100
Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Moment of Inertia

Area moment of Inertia, Principal Axes and Principal Moment of Inertia, , Parallel Axis theorem, Polar moment of Inertia.

Stresses and Strains: Definition – Stress, Strain, Hooke's law, elastic limit, uni-axial, bi-axial and tri-axial stresses, tensile & compressive stresses, shear stress, Principal stresses and strains, Mohr's circle.

Elastic Constants: Poisson's ratio, Modulus of elasticity, Modulus of rigidity, Bulk Modulus, yield stress, Ultimate stress. Factor of safety, state of simple shear, relation between elastic constants, volumetric strain, volumetric strain for tri-axial loading,
deformation of tapering members, deformation due to self –weight, bars of varying sections, composite sections, thermal stress and strain.

UNIT-II

Shear Force and Bending Moment in Beams

Axial force, shear force and bending moment diagrams for statically determinate beams including beams with internal hinges for different types of loading, relationship between rates of loading, shear force and bending moment.

Stresses in Beams

Theory of pure bending, Assumptions, Flexural formula for straight beams, moment of resistance, bending stress distribution, section modulus for different sections, beams for uniform strength, Flitched beams.

Direct and Bending Stresses: Core of sections, Chimneys subjected to wind pressure. Shear Stress in Beams: Distribution of shear stress, across plane sections used commonly for structural purposes, shear connectors.

UNIT-III

Torsion:

Torsion of circular shafts- solid and hollow, stresses in shafts when transmitting power, shafts in series and parallel.

Strain Energy: Resilience, Proof Resilience, strain energy stored in the member due to gradual, sudden and impact loads, Strain energy due to shear, bending and torsion.

UNIT-IV

Deflection of Beams

Deflection of Cantilever, simply supported and overhangs beams using double integration and Macaulay's Method for different types of loadings

Thin Cylindrical and Spherical Shells: Cylinders and Spheres due to internal pressure, cylindrical shell with hemi spherical ends

Columns and Struts

Buckling load, Types of end conditions for column, Euler's column theory and its limitations, Rankine and Johnson formula.

References:

1. Strength of Materials. R. Subramanian, Oxford University Press. 3rd Ed 2016
2. Strength of Materials. Ryder, Macmillan
3. Mechanics of Materials. James M. Gere and Barry J. Goodno, Cengage Learning, 6th Ed, 2009
4. Mechanics of Materials. Gere and Timoshenko, 2nd Ed CBS

5. Strength of Materials. Basavrajaiah and Mahadevappa, Khanna Publishers, New Delhi
6. Elements of Strength of Materials. Timoshenko and Youngs, Affiliated East -West Press
7. Mechanics of Materials by Beer. Jhonston, D Ewolf and Mazurek, TMH Pvt Ltd., New Delhi
8. Mechanics of Structures. S.B. Junnarkar. Charotar Publication
9. Mechanics of Materials. S.S. Ratan. Tata McGraw Hill Pvt. Ltd
10. Introduction to Solid Mechanics. Shames, PHI
11. Strength of Materials. Nag and Chandra, Wiley India
12. Strength of Materials. S. Ramamrutham, Dhanpat Rai Pvt. Ltd
13. Strength of Materials. W. Nash, Schaum's Outline Series, McGraw Hill Publication, Special Indian

PCC-MN-311G **Surveying-I**

L T P	**Internal Assessment: 25**
3 0 0	**External Examination: 75**
	Total: 100
	Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction

Definition, principles, objectives, classification, technical terms, uses and necessity of surveying. Units of measurement, surveying measurement and errors, type of errors and their corrections (including numerical), corrections for wrong scales, accuracy and precision, stages of survey operations.

Chaining, Ranging and offsetting: Definitions, Principles, Types, Instruments required, methods, obstacles (including numerical), sources of errors, conventional signs and symbols.

Electronic Distance Measurement: Working Principles, types, applications in surveying

UNIT-II

Measurement of Directions and Angles

Basic definitions, meridians, bearings, magnetic and true bearings, compasses,

prismatic and surveyor's, temporary adjustments, declination, dip, local attraction

Types of traverse, procedures, control establishments, Conversion of WCB into RB and vice-versa, Traverse Survey and Computations of interior angles of a closed Traverse.

Adjustment of closing error, correction for local attraction.

Levelling and its application

Introduction to levelling, basic terms and definitions, types of instruments, construction and use of dumpy level, auto level, digital level and laser level in construction industry, principle axes of dumpy level, temporary and permanent adjustments

Booking and reduction of levels, plane of collimation (HI) and rise-fall methods, computation of missing data, distance to the visible horizon, corrections due to curvature and refraction, reciprocal levelling, Numerical problems

Differential levelling, profile levelling, fly levelling, check levelling, precise levelling, sources of errors, difficulties in levelling work, corrections and precautions in levelling work.

UNIT-III

Plane Tabling, Contouring, Area and Volume

Plane Table Surveying: Definition, principles, accessories required for plane table surveying, merits and demerits, temporary adjustments, Different methods of plane table surveying, Errors in plane table surveying, Use of telescopic alidade.

Contouring: definitions, contour interval, equivalent, uses and characteristics of contour lines, direct and indirect methods of contouring. Grade contour: definition and use. Area: Area of an irregular figure by trapezoidal rule, average ordinate rule, Simpson's 1/3 rule, various coordinate methods.

Planimeter: types including digital planimeter, area of zero circle, uses of planimeter.

Volume: Computation of volume by trapezoidal and prismoidal formula, volume from spot levels, volume from contour plans.

UNIT-IV

Theodolite Traversing

Various parts and axis of transit, technical terms, temporary and permanent adjustments of a transit, horizontal and vertical angles, methods of repetition and reiteration.

Different methods of running a theodolite traverse, Latitudes and departures, rectangular coordinates, traverse adjustments by Bowditch's, transit and modified transit rules, Gales Traverse Table, Numerical Problems.

Use of theodolite for various works such as prolongation of a straight line, setting out an angle, bearing measurements. Omitted measurements, Problems in using theodolite traversing, errors in theodolite traversing;

Trigonometrical Levelling: Problems on one plane and two plane methods,

Tachometric surveying

Principle, purpose, uses, advantages and suitability of tacheometry, different methods of tacheometry, stadia formula, Stadia diagram and tables. Sub-tense bar method.

Application in plane table and curve setting.

Radial Contouring.

References:

1. Surveying & Leveling. Vol. I & Vol. II. Kanetkar T.P. & Kulkarni S.V. Pune Vidyarthi Griha Prakshan. Latest edition
2. Surveying. Vol. I & Vol. II. Punmia B.C. & Jain A.K. Laxmi Publication. Latest edition
3. Remote Sensing & Image Interpretation. Lillesand T.M. & Kiefer R.W. John Wiley & Sons. Latest edition

LC-MN-313G

Mining Geology – I Lab

L T P	**Internal Assessment: 25**
0 0 3	**External Examination: 25**
	Total: 50
	Hours: 3 Hrs

Practicals based on the theory subject.

LC-MN-323G

Strength of Materials Lab

L T P	**Internal Assessment: 25**
0 0 3	**External Examination: 25**
	Total: 50
	Hours: 3 Hrs

Practicals based on the theory subject.

LC-MN-325G

Surveying Lab - I

L T P	**Internal Assessment: 25**
0 0 3	**External Examination: 25**
	Total: 50
	Hours: 3 Hrs

Practicals based on the theory subject.

ESC-MN-302G **Applied Numerical Technique & Computing**

L T P	**Internal Assessment: 25**
3 0 0	**External Examination: 75**
	Total: 100
	Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

ERRORS IN NUMERICAL CALCULATIONS Introduction, Numbers and their accuracy, Absolute, relative and percentage errors and their analysis, General error formula.

INTERPOLATION AND CURVE FITTING Taylor series and calculation of functions, Introduction to interpolation, Lagrange approximation, Newton Polynomials, Chebyshev Polynomials, Least squares line, curve fitting, Interpolation by spline functions.

UNIT-II

NUMERICAL DIFFERENTIATION AND INTEGRATION Approximating the derivative, Numerical differentiation formulas, Introduction to Numerical quadrature, Newton-Cotes formula, Gaussion Quadrature. SOLUTION OF NONLINEAR EQUATIONS Bracketing methods for locating a root, Initial approximations and convergence criteria, Newton-Raphson and Secant methods, Solution of problems through a structural programming language such as C or Pascal.

UNIT-III

SOLUTION OF LINEAR SYSTEMS Direct Methods, Gaussian elimination and pivoting, Matrix inversion, UV factorization, Iterative methods for linear systems, Solution of problems through a structured programming language such as C or Pascal.

EIGEN VALUE PROBLEMS Jacobi, Given's and Householder's methods for symmetric matrices, Rutishauser method for general matrices, Power and inverse power methods.

UNIT-IV

SOLUTION OF DIFFERENTIAL EQUATIONS Introduction to differential equations, Initial value problems, Euler's methods, Heun's method, Runge-Kutta methods, Taylor series method, Predictor-Corrector methods, Systems of differential equations, Boundary valve problems, Finite-difference method, Solution of problems through a structured programming language such as C or Pascal.

PARTIAL DIFFERENTIAL EQUATIONS, EIGENVALUES AND EIGENVECTORS Solution of hyperbolic, parabolic and elliptic equations, The eigenvalue problem, The power method and the Jacobi's method for eigen value problems, Solution of problems through a structural programming language such as C or Pascal.

Text Books:

1. Numerical Methods for Mathematics, Science and Engineering by John H.Mathews, PHI New Delhi.
2. Applied Numerical Methods – Carnahan, B.H., Luthar, H.A. and Wilkes, J.O., Pub.- J.

Wiley, New York

References:

1. Numerical Solution of Differential Equations, by M.K. Jain, Published by Wiley Eastern, New York.
2. Introductory Methods of Numerical Analysis by S.D. Sastry, Published by Prentice Hall of India.
3. Numerical Methods – Hornbeck, R.W. , Pub.- Prentice Hall, Englewood Cliffs, N.J.

PCC-MN-304G # Mining Geology- II

L T P
3 0 0

Internal Assessment: 25
External Examination: 75
Total: 100
Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Stratigraphy & Indian Geology

Stratigraphy; its introduction, standard stratigraphic scale, principle of stratigraphic correction; geology of India in brief; fossil fuels;

UNIT-II

Economic Geology

Economic geology; ore, gangue, tenore and grade; classification of mineral deposits; occurrence, shape, form, size, mineral composition and texture of various process generated mineral deposits;

UNIT-III

Hydrogeology & Maps

Hydrogeology and its impact on mining; geological mapping, topographic maps; effects of topography on outcrops, computer based geological data plotting and preparation of map;

UNIT-IV

Sampling

Sampling and reserves estimation; mine sample reduction;

Prospecting and Exploration

Prospecting and exploration; definition' kind and degree of exploration; geological, geophysical, geo-chemical and remote sensing methods.

References:

1. A Text Book of Engineering and General Geology. Singh Parbin. Latest Ed. Katson publisher, Ludhiana.
2. A Text Book of Applied Engineering Geology. Maruthesha Reddy M T. New Age International. Latest edition
3. A Text Book of Geology. Mukherjee P K. The World Press Pvt. Ltd. Calcutta. Latest edition
4. Principles of Engineering Geology. Bangar K.M. Standard Publishers, Delhi, Latest edition

PCC-MN-306G

Mine Development

L T P
3 0 0

Internal Assessment: 25
External Examination: 75
Total: 100
Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Introduction

Introduction to primary and secondary mine development. Mine Entries: Choice, location and size of mine entries- shafts, inclines, declines and adits; their merits and applicability

Mine Structures

Mine Structures: Construction and layouts of structures - Shaft insets, ore and waste bins, skip-pockets, engine chambers, ore passes, chutes, garages, grizzlies and sumps

UNIT-II

Shaft Sinking

Shaft Sinking: Conventional methods; Preparatory arrangement; Drilling, blasting, loading and hoisting of muck; Lining, ventilation, drainage and lighting; Sinking through loose, fractured, flowing and water bearing ground; Widening and deepening of shafts; Shaft boring; staple shaft

UNIT-III

Mine Development

Drifting: Conventional methods, different types of drilling patterns, blasting, loading, transport of muck, support, ventilation, drainage and lighting; Drifting through loose, fractured, flowing and water bearing ground; Drifting by road headers and tunnel boring machines. Cross- measure drifts and laterals

UNIT-IV

Stope Development

Stope Development: Conventional methods of raising and winzing; Modern methods of Raising - Raise climbers, Long hole raising and Raise borers; Slot preparation.

References:

1. Introductory Mining Engineering. Howard & Hartman L. John Willey & Sons.
2. SME Mining Reference Handbook. Lowrie R. SME Publication. Latest edition
3. Underground Mining Methods. Hustrulid W A & Bullock R. SME Publication.

ESC-MN-308G # Fluid Mechanics

L T P	**Internal Assessment: 25**
3 0 0	**External Examination: 75**
	Total: 100
	Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Fluid properties and fluid statics

Fluid Definition and properties, Newton's law of viscosity concept of continuum, Classification of fluids

Fluid Statics: Definition of body and surface forces, Pascal's law, Basic hydrostatic equation, Forces on surfaces due to hydrostatic pressure, Buoyancy and Archimedes' principle.

Fluid Kinematics

Eulerian and Lagrangian approach to solutions; Velocity and acceleration in an Eulerian flow field; Definition of streamlines, path lines and streak lines; Definition of steady/unsteady, uniform/non-uniform, one-two and three dimensional flows; Definition of control volume and control surface, Understanding of differential and integral methods of analysis. Definition and equations for stream function, velocity potential function in rectangular and cylindrical co-ordinates, rotational and irrotational flows; Definition and equations for source, sink, irrotational vortex, circulation

UNIT-II

Fluid Dynamics

Integral equations for the control volume: Reynold's Transport theorem, equations for conservation of mass, energy and momentum, Bernoulli's equation and its application in flow measurement, pitot tube, venture, orifice and nozzle meters. Differential equations for the control volume: Mass conservation in 2 and 3 dimension in rectangular, Euler's equations in 2,3 dimensions and subsequent derivation of Bernoulli's equation; Navier-Stokes equations (without proof) in rectangular Cartesian co-ordinates; Exact solutions of Navier-Stokes Equations to viscous laminar flow between two parallel planes (Couette flow and plane Poiseuille flow)

UNIT-III

Real fluid flows

Definition of Reynold's number, Laminar flow through a pipe (Hagen-Poiseuille flow), velocity profile and head loss; Turbulent flows and theories of turbulence-Statistical theory, Eddy viscosity theory and Prandtl mixing length theory; velocity profiles for turbulent flows-universal velocity profile, 1/7th power law; Velocity profiles for smooth and rough pipes. Darcy’s equation for head loss in pipe (no derivation),Moody’s diagram, pipes in series and parallel, major and minor losses in pipes.

UNIT-IV

Boundary Layer Flows

Concept of boundary layer and definition of boundary layer thickness, displacement, momentum and energy thickness; Growth of boundary layer, laminar and turbulent boundary layers, laminar sub-layer; Von Karman Momentum Integral equation for boundary layers (without proof), analysis of laminar and turbulent boundary layers, drag, boundary layer separation and methods to control it, streamlined and bluff bodies. Aerofoil theory: Definition of aerofoil, lift and drag, stalling of aerofoils, induced drag.

Compressible Fluid flow

Propagation of sound waves through compressible fluids, Sonic velocity and Mach number; Application of continuity , momentum and energy equations for steady state conditions; steady flow through nozzle, isentropic flow through ducts of varying cross-sectional area, Effect of varying back pressure on nozzle performance, Critical pressure ratio, Normal shocks, basic equations of normal shock, change of properties across normal shock

Reference:

1. Fluid Mechanics. Yunus A Cengel and John M Cimbala. Latest Ed. McGraw Hill.
2. Fluid Mechanics and Machinery. C S P Ojha, Chandramouli and R Berndtsson. Oxford University Press.
3. Introduction to Fluid Mechanics. Fox and McDonald.
4. Fluid Mechanics. R K Bansal.
5. Fluid Mechanics. Victor Streeter, Benjamin Wylie and K W Bedford. Latest Ed. McGraw Hill.
6. Fluid Mechanics. K. L. Kumar.
7. Introduction to Fluid Mechanics. James A. Fay.
8. Fluid Mechanics. B. M. Massey.
9. Mechanics of Fluids. Irving Shames.
10. Fluid Mechanics and Hydraulics. S. K. Ukarande. Ane Books Pvt. Ltd.

ESC-MN-310G

Industrial Electronics

L	T	P
3	0	0

Internal Assessment:	**25**
External Examination:	**75**
Total:	**100**
Hours:	**3 Hrs**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Semiconductor Devices

Diodes: Principles V-I characteristics and Application of: rectifier diode, zener diode, LED, photodiode, SCR V-I characteristics, UJT triggering circuit, turning-off of a SCR (preliminary discussion), basics of Gate Turn-off thyristor (GTO). Structure and V-I characteristics of Triac (modes of operation not needed) and Diac, Applications of Triac-Diac circuit. Characteristics and principle of Power BJT, power MOSFET, IGBT, comparison of devices, MOSFET/IGBT Gate driver circuit Comparison of SCR, Triac, Power BJT, power MOSFET, IGBT

Phase controlled rectifiers and Bridge inverters

Full wave controlled rectifier using SCR's(semi controlled, fully controlled) with R load only, Derivation of output voltage, Block diagram of closed loop speed control of DC motors, Necessity of inner current control loop, Basic principle of single phase and three phase bridge inverters , block diagrams including rectifier and inverter for speed control of AC motors (frequency control only).

UNIT-II

Operational amplifiers and 555 Timer

Operational amplifier circuits, Ideal OPAMP behaviour, common OPAMP ICs; Basic OPAMP circuits- Inverting amplifier, Non-inverting amplifier, Voltage follower (Buffer), Instrumentation Amplifier, Active first order filter: Low pass and high pass filter; Power Op Amps, Optical Isolation amplifier; 555 timer-Operating modes: monostable, astable multivibrator.

UNIT-III

Digital logic and logic families

Digital signals, combinational and sequential logic circuits, clock signals, Boolean algebra and logic gates. Integrated circuits and logic families: Logic Levels, Noise Immunity, Fan Out, Propagation Delay, TTL logic family CMOS Logic family, comparison with TTL family, Flip flops: Set Reset(SR),Trigger(T), clocked F/Fs; Registers, decoders and encoders, Multiplexer and Demultiplexer, applications

UNIT-IV

Microprocessor and Microcontrollers

Overview of generic microprocessor, architecture and functional block diagram, Comparison of microprocessor and microcontroller, MSP430 architecture, assembly language programming, C compiler programming, basics of interfacing with external input / output devices (like reading external analog voltages, digital input output)

Applications of microcontroller: Temperature measurement, Speed Measurement using Proximity Sensor, Piezoelectric Actuator Drive

Motors

Review and comparison of DC motors and AC induction motors, Basic principles of speed control of AC induction motor, Basics of BLDC motor, Linear Actuator motor, Servo Motor, Motor Specifications, suitability of each motor for various industrial applications, Selection and sizing of motors for different applications. Applications for pumps, conveyors, machine tools, Microcontroller based speed control for Induction Motor.

References:

1. Power Electronics. M.H. Rashid. Prentice-Hall of India
2. Power Electronics. P S Bhimbra
3. Power Electronics. Vedam Subramanyam, New Age International
4. Power Electronics. Ned Mohan, Undeland, Robbins, John Wiley Publication
5. Electronic Devices and Circuits. Robert Boylestad and Louis Nashelsky, Prentice-Hall
6. Industrial Electronics and Control. S K Bhattacharya, S Chatterjee, TTTI Chandigarh
7. Modern Digitals Electronic. Jain R P, Tata. McGraw Hill, latest edition
8. Digital principal and Application. Malvino and Leach. Tata McGraw Hill, latest edition
9. Fundamentals of Microcontrollers and Embedded System. Ramesh Gaonkar, PENRAM
10. MSP430 Microcontroller Basics. John H. Davies, Newnes. Latest edition.

PCC-MN-312G **Surveying - II**

L T P
3 0 0

Internal Assessment: 25
External Examination: 75
Total: 100
Hours: 3 Hrs

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT-I

Curves-Horizontal

Definitions of different terms, necessity of curves and types of curves

Simple circular curves and compound curves, office and field work, linear methods of setting out curves,

Angular methods of setting out curves, two theodolites and Rankine deflection angle method.

Reverse and transition curves, their properties and advantages, design of transition curves, shift, spiral angle. Composite curves office and field level. Setting out of curves by angular method, composite curves problems. Difficulties in setting out curves and solution for the same.

Curves-Vertical

Sight distance on a vertical curve

Tangent correction and chord gradient methods.

Sight distance on a vertical curve

UNIT-II

Setting out works

General horizontal and vertical control, setting out of foundation plan for load bearing and framed structure, batter board, slope and grade stakes, setting out with theodolite, setting out a foundation plans for building, sewer line, culvert, and use of laser for works; Setting out centre line for tunnel, transfer of levels for underground works. Project/route survey for bridge, dam and canal; Checking verticality of high-rise structures.

UNIT-III

Special Survey Instruments

Electronic Theodolite, Total Station: Principles, Types, Applications, Topographical Survey and Stake-out, Transferring data to and from other software’s for further processing, advantages and limitations. Introduction to Site square, Penta Graph, Auto-set Level, Transit level, Special Compasses, Brunton Universal Pocket Transit, Mountain Compass Transit

UNIT-IV

Modern Methods of Surveying

Global Positioning System (GPS): Basic principles, GPS segments, receivers, computations of coordinates, Applications in surveying

Remote Sensing: Definition, basic concepts, electromagnetic radiation and spectrum, energy source and its characteristics, image acquisition and image interpretation. Application of remote sensing.

Global Information System (GIS): Geographical concepts and terminology, advantages, basic components of GIS, data types, GIS analysis, Applications of GIS.

Field Astronomy: Introduction, purposes, astronomical terms, determination of azimuth, latitude, longitude and time corrections to the observations.

Aerial photogrammetry: Introduction, Principle, Uses, Aerial camera, Aerial photographs, Definitions, Scale of vertical and tilted photograph, Ground Co-ordinates, Displacements and errors, Ground control, Procedure of aerial survey, Photomaps and mosaics, Stereoscopes, Parallax bar

Hydrographic Survey: Introduction, Organizations, National and International Maritime Hydrography, Hydrographic survey Methods, Lead lines, sounding poles, and single-beam, echo sounders.

Cadastral Surveying

Interpreting and advising on boundary locations, on the status of land ownership and on the rights, restrictions and interests in property. Legal requirements relating to property boundary surveys in India. Role of revenue department in maintaining survey records, introduction to local survey terminologies like tehsildar, 7/12, utara, namuna8, etc. Introduction to Survey of India Department; Department of Registration and Stamps of any state of India.

References:

1. Surveying & Leveling. Vol. I & Vol. II. Kanetkar T.P. & Kulkarni S.V. Pune Vidyarthi Griha Prakshan. Latest edition
2. Surveying. Vol. I & Vol. II. Punmia B.C. & Jain A.K. Laxmi Publication Pvt. Latest edition
3. Remote Sensing & Image Interpretation. Lillesand T.M. & Kiefer R.W. John Wiley & Sons. Latest edition

LC-MN-314G **Mining Geology – II Lab**

L T P
0 0 3

Internal Assessment: 25
External Examination: 25
Total: 50
Hours: 3 Hrs

Practicals based on the theory subject.

LC-MN-316G **Fluid Mechanics Lab**

L T P
0 0 3

Internal Assessment: 25
External Examination: 25
Total: 50
Hours: 3 Hrs

Practicals based on the theory subject.

LC-MN-318G **Industrial Electronics Lab**

L T P
0 0 3

Internal Assessment: 25
External Examination: 25
Total: 50
Hours: 3 Hrs

Practicals based on the theory subject.

LC-MN-320G **Surveying Lab - II**

L T P
0 0 3

Internal Assessment: 25
External Examination: 25
Total: 50
Hours: 3 Hrs

Practicals based on the theory subject.

M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Computer Science and Technology)

Common with

B.Tech. (Computer Science and Engineering)

Scheme effective from 2020-21

COURSE CODE AND DEFINITIONS

Course Code	Definition
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar

B.Tech. (Computer Science and Technology)

Common with B.Tech. (Computer Science & Engineering)

Scheme of Studies/Examination w.e.f. 2020-21

Semester- 3

Sr. No.	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Mark of Class work	Theory	Practical	Total	
1	PCC-CSE-201G	Database Management Systems	3	0	0	3	3	25	75		100	3
2	PCC-CSE-203G	Data Structures & Algorithms	3	0	0	3	3	25	75		100	3
3	PCC-CSE-205G	Digital Electronics	3	0	0	3	3	25	75		100	3
4	PCC-CSE-207G	Python Programming	2	0	0	2	2	25	75		100	3
5	BSC-MATH-203G	Mathematics - III (Multivariable Calculus and Differential Equations)	2	0	0	2	2	25	75		100	3
6	HSMC-01G	Economics for Engineers	3	0	0	3	3	25	75		100	3
7	LC-CSE-209G	Database Management Systems LAB	0	0	4	4	2	25		25	50	3
8	LC-CSE-211G	Digital Electronics LAB	0	0	4	4	2	25		25	50	3
9	LC-CSE-213G	Data Structures & Algorithms LAB Using C	0	0	4	4	2	25		25	50	3
10	LC-CSE-215G	Python Programming LAB	0	0	2	2	1	25		25	50	3
						Total	23				800	

B.Tech. (Computer Science and Technology)

Common with B.Tech. (Computer Science & Engineering)

Scheme of Studies/Examination w.e.f. 2020-21

Semester- 4

Sr. No.	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Mark of Class work	Theory	Practical	Total	
1	PCC-CSE-202G	Discrete Mathematics	3	1	0	3	4	25	75		100	3
2	PCC-CSE-204G	Computer Organization & Architecture	3	0	0	3	3	25	75		100	3
3	PCC-CSE-206G	Operating System	3	0	0	3	3	25	75		100	3
4	PCC-CSE-208G	Object Oriented Programming	3	0	0	3	3	25	75		100	3
5	HSMC-02G	Organization Behavior	3	0	0	3	3	25	75		100	3
6	*MC-106G	Environmental Sciences	3	0	1	4	0	-	-	-	-	3
7	PCC-CSE-210G	Web Technologies	2	0	0	2	1	25	75		100	3
8	LC-CSE-212G	Operating System LAB	0	0	4	4	2	25		25	50	3
9	LC-CSE-214G	Object Oriented Programming LAB Using C++	0	0	4	4	2	25		25	50	3
10.	LC-CSE-216G	Web Technologies Lab	0	0	2	2	1	25		25	50	3
						Total	22				750	

*[*]***MC-ES-106G** is a mandatory non –credit course in which the students will be required passing marks in theory.

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

Database Management System

Course code	PCC-CSE-201G				
Category	Professional Core Course				
Course title	Database Management System				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

a. To understand the different issues involved in the design and implementation of a database system.
b. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
c. To understand and use data manipulation language to query, update, and manage a database
d. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
e. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). **Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit: 2

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit: 3

Storage strategies: Indices, B-trees, hashing,

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Unit: 4

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.

Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Suggested books:

"Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Suggested reference books

"Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

"Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

"Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

Course Outcomes

1. For a given query write relational algebra expressions for that query and optimize the developed expressions
2. For a given specification of the requirement, design the databases using E R method and normalization.
3. For a given specification, construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
4. For a given query optimize its execution using Query optimization algorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Data Structure & Algorithms

Course code	PCC-CSE-203G				
Category	Professional Core Course				
Course title	Data Structure & Algorithms				
Scheme and Credits	L	T	P	Credits	
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

1. To impart the basic concepts of data structures and algorithms.
   To understand concepts about searching and sorting techniques
   To understand basic concepts about stacks, queues, lists, trees and graphs.
   To enable them to write algorithms for solving problems with the help of fundamental data structures

Unit 1:

Introduction: Basic Terminologies: Concept of Data Structure, Choice of right Data Structure, Algorithms , how to design and develop algorithm , Complexity of algorithm. Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

Unit 2:

Stacks and Queues: Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation -corresponding algorithms and complexity analysis. queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Unit 3:

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Unit 4:

Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Selection Sort Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Suggested books:

"Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Suggested reference books:

Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company

"How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

Course outcomes

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

DIGITAL ELECTRONICS

Course code	PCC-CSE-205G				
Category	Professional Core Course				
Course title	Digital Electronics				
Scheme and Credits	L	T	P	Credits	Semester 3
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1:
FUNDAMENTALS OF DIGITAL SYSTEMS AND LOGIC FAMILIES
Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes.

UNIT 2:
COMBINATIONAL DIGITALCIRCUITS
Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

UNIT 3:
SEQUENTIAL CIRCUITS AND SYSTEMS
A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous)

counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

UNIT 4:

A/D AND D/A CONVERTERS

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, Analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter,

SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Use PLDs to implement the given logical problem.

REFERENCES:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
4. Nasib Singh Gill and J B Dixit, "Digital Design and Computer Organization", University Science Press, New Delhi

Python Programming

Course code	PCC-CSE-207G				
Category	Professional Core Course				
Course title	Python Programming				
Scheme and Credits	L	T	P	Credits	Semester 3
	2	0	0	2	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

- To impart the basic concepts of Python programming.
- To understand syntax of Python language
- To create dynamic applications in Python language.
- To implement object oriented concepts using Python language

Detailed contents:

Unit 1:

Introduction: Fundamental ideas in computer science; modern computer systems, installing Python; basic syntax, interactive shell, editing, saving, and running a script; The concept of data types; variables, assignments; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Control statements: if-else, loops (for, while)

Unit 2:

Strings, text files: String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated).

Unit 3:

Lists, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries. Hiding redundancy, complexity; arguments and return values; Program structure and design. Recursive functions.

Unit 4:

Object Oriented concepts: Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, Inheritance, polymorphism, operator overloading; abstract classes; exception handling, try block.

Course outcomes

- For a given conceptual problem student will able to analyze the problem and write a program in python with basic concepts.
- For a given problem of Strings and texts, student will able to analyze the problem and write a program in python with basic concepts involving strings and texts.
- The knowledge of list and dictionary will enable student to implement in python language and analyze the same.
- Student will able to write a program using functions to implement the basic concepts of object oriented programming language

Suggested books:

"Fundamentals of Python: First Programs" Kenneth Lambert, Course Technology, Cengage Learning, 2012

Suggested reference books:

"Introduction to Computer Science Using Python: A Computational Problem-Solving Focus", By Charles Dierbach, John Wiley & Sons, December 2012,

Mathematics-III (Multivariable Calculus and Differential Equations)

<table>
<tr><td>Course code</td><td colspan="5">BSC-MATH-203G</td></tr>
<tr><td>Category</td><td colspan="5">Basic Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Mathematics-III (Multivariable Calculus and Differential Equations)</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 3</td></tr>
<tr><td>2</td><td>0</td><td></td><td>2</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Multivariable Differential Calculus: Limit, Continuity and Partial derivatives, Homogeneous functions, Euler's Theorem, Total derivative, Maxima, Minima and Saddle points, Lagrange's method of undetermined multipliers

Unit-II

Multivariable Integral Calculus: Double integral, Change of order of integration, Change of variables, Applications of double integral to find area enclosed by plane curves, Triple integral

Unit-III

Ordinary Differential Equations of first order: Linear and Bernoulli's equations, Exact differential equations, Equations reducible to exact differential equations, Applications of differential equations of first order and first degree to simple electric circuits, Newton's law of cooling, Heat flow and Orthogonal trajectories

Unit-IV

Ordinary Differential equations of second and higher order: Linear differential equations of second and higher order, Complete solution, Complementary function and Particular integral, Method of variation of parameters to find particular integral, Cauchy's and Legendre's linear equations, Simultaneous linear differential equations with constant coefficients, Applications of linear differential equations to oscillatory electric circuits

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
4. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
5. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
6. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems,Wiley India.
7. S. L. Ross, Differential Equations, Wiley India.
8. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India.
9. E. L. Ince, Ordinary Differential Equations, Dover Publications

Course Outcomes

The students will learn:

1. To deal with functions of several variables and evaluate partial derivative.
2. The mathematical tools needed in evaluating multiple integrals and their usage.
3. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.

ECONOMICS FOR ENGINEERS

Course code	HSMC- 01G				
Category	Humanities/ Social Sciences/ Management				
Course title	Economics For Engineers				
Scheme and Credits	L	T	P	Credits	
	3	0	0	3	
Branches (B. Tech.)	Common For All Branches				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Objectives:

1. Acquaint the students to basic concepts of economics and their operational significance.
2. To stimulate the students to think systematically and objectively about contemporary economic problems.

UNIT-1

Definition of Economics- Various definitions, types of economics- Micro and Macro Economics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, Elasticity of Demand- meaning, factors effecting it, its practical application and importance,

UNIT 2

Production- Meaning of Production and factors of production, Law of variable proportions, and Returns to scale, Internal external economies and diseconomies of scale. Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Real cost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-3

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly,
Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination and effect of changes in demand and supply on prices.

UNIT-4

Indian Economy- Nature and characteristics of Indian economy as under developed, developing and mixed economy (brief and elementary introduction), Privatization - meaning, merits and demerits.

Globalization of Indian economy - merits and demerits.

Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions, Difference between Commercial & Central Bank.

COURSE OUTCOMES:

1. The students will able to understand the basic concept of economics.
2. The student will able to understand the concept of production and cost.
3. The student will able to understand the concept of market.
4. The student will able to understand the concept of privatization, globalization and banks.

REFERENCES:

1. Jain T.R., Economics for Engineers, VK Publication.
2. Chopra P. N., Principle of Economics, Kalyani Publishers.
3. Dewett K. K., Modern economic theory, S. Chand.
4. H. L. Ahuja., Modern economic theory, S. Chand.
5. Dutt Rudar & Sundhram K. P. M., Indian Economy.
6. Mishra S. K., Modern Micro Economics, Pragati Publications.
7. Singh Jaswinder, Managerial Economics, dreamtech press.
8. A Text Book of Economic Theory Stonier and Hague (Longman's Landon).
9. Micro Economic Theory – M.L. Jhingan (S.Chand).
10. Micro Economic Theory - H.L. Ahuja (S.Chand).
11. Modern Micro Economics : S.K. Mishra (Pragati Publications).
12. Economic Theory - A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co).

Database Management System Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-209G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Database Management System Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2"></td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Course Objectives:

- Keep abreast of current developments to continue their own professional development
- To engage themselves in lifelong learning of Database management systems theories and technologies this enables them to purse higher studies.
- To interact professionally with colleagues or clients located abroad and the ability to overcome challenges that arises from geographic distance, cultural differences, and multiple languages in the context of computing.
- Develop team spirit, effective work habits, and professional attitude in written and oral forms, towards the development of database applications.

Contents:

i. Creation of a database and writing SQL queries to retrieve information from the database.
ii. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
iii. Creation of Views, Synonyms, Sequence, Indexes, Save point.
iv. Creating an Employee database to set various constraints.
v. Creating relationship between the databases.
vi. Study of PL/SQL block.
vii. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
viii. Write a PL/SQL block that handles all types of exceptions.
ix. Creation of Procedures.

x. Creation of database triggers and functions

xi. Mini project (Application Development using Oracle/ MySQL)

a) Inventory Control System

b) Material Requirement Processing.

c) Hospital Management System.

d) Railway Reservation System.

e) Personal Information System.

f) Web Based User Identification System.

g) Time Table Management System.

h) Hotel Management

Digital Electronics Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-211G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Digital Electronics Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-3</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Implementation all experiments with help of Bread- Board.

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
2. Half Adder / Full Adder: Realization using basic and XOR gates.
3. Half Subtractor / Full Subtractor: Realization using NAND gates.
4. 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter: Realization using XOR gates.
5. 4-Bit and 8-Bit Comparator: Implementation using IC7485 magnitude comparator chips.
6. Multiplexer: Truth-table verification and realization of Half adder and Full adder.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor.
8. Flip Flops: Truth-table verification of JK Master Slave FF, T-type and D-type FF.
9. Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter.
10. Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter.
11. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations.
12. DAC Operation: Study of 8-bit DAC , obtain staircase waveform.
13. ADC Operations: Study of 8-bit ADC

Data Structures and Algorithms Lab Using C

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-213G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Data Structures and Algorithms Lab Using C</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-3</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Data Structures Lab List of practical exercises, to be implemented using object-oriented approach in C++ Language.

1. Write a menu driven program that implements following operations (using separate functions) on a linear array:
   - Insert a new element at end as well as at a given position
   - Delete an element from a given whose value is given or whose position is given
   - To find the location of a given element
   - To display the elements of the linear array
2. Write a menu driven program that maintains a linear linked list whose elements are stored in on ascending order and implements the following operations (using separate functions):
   - Insert a new element
   - Delete an existing element
   - Search an element
   - Display all the elements
3. Write a program to demonstrate the use of stack (implemented using linear array) in converting arithmetic expression from infix notation to postfix notation.
4. Program to demonstrate the use of stack (implemented using linear linked lists) in evaluating arithmetic expression in postfix notation.
5. Program to demonstration the implementation of various operations on a linear queue represented using a linear array.
6. Program to demonstration the implementation of various operations on a circular queue represented using a linear array.
7. Program to demonstration the implementation of various operations on a queue represented using a linear linked list (linked queue).

8. Program to illustrate the implementation of different operations on a binary search tree.
9. Program to illustrate the traversal of graph using breadth-first search
10. Program to illustrate the traversal of graph using depth-first search.
11. Program to sort an array of integers in ascending order using bubble sort.
12. Program to sort an array of integers in ascending order using selection sort.
13. Program to sort an array of integers in ascending order using insertion sort.
14. Program to sort an array of integers in ascending order using radix sort.
15. Program to sort an array of integers in ascending order using merge sort.
16. Program to sort an array of integers in ascending order using quick sort.
17. Program to sort an array of integers in ascending order using heap sort.
18. Program to sort an array of integers in ascending order using shell sort.
19. Program to demonstrate the use of linear search to search a given element in an array.
20. Program to demonstrate the use of binary search to search a given element in a sorted array in ascending order.

Python Programming Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-215G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Python Programming Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-3</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- Read and write data from/to files in Python.

List of Programs

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

Outcome:

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops

- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

Discrete Mathematics

Course code	PCC-CSE-202G				
Category	Professional Core Course				
Course title	Discrete Mathematics				
Scheme and Credits	L	T	P	Credits	Semester - 4
	3	1		4	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Sets, Relation, Function and Propositional Logic: Operations and Laws of Sets, Cartesian Products, Representation of relations, Binary Relation, Equivalence Relation, Partial Ordering Relation, POSET, Hasse Diagram, Lattices and its types, Function, Bijective functions, Inverse and Composite Function, Finite and infinite Sets, Countable and Uncountable Sets, Cantor's diagonal argument and The Power Set theorem, **S**chroeder-Bernstein theorem, Propositions, Logical operations, Conditional Statements, Tautologies, Contradictions, Logical Equivalence, The use of Quantifiers

Unit-II

Basic Counting Techniques and Recurrence Relation: Pigeon-hole principle, Permutation and Combination**,** the Division algorithm: Prime Numbers, The GCD: Euclidean Algorithm, The Fundamental Theorem of Arithmetic., Linear recurrence relation with constant coefficients, Homogenous Solutions, Particular Solutions, Total Solutions, Solving recurrence relation using generating functions

Unit-III

Algebraic Structures: Definitions and examples of Algebraic Structures with one Binary Operation: Semi Groups, Monoids, Groups; Congruence Relation and Quotient Structures, Permutation Groups, Cyclic groups, Normal Subgroups, Definitions and examples of Algebraic Structures with two Binary Operation: Rings, Integral Domain, Fields; Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Unit-IV

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Multigraph and Weighted graph, Shortest path in Weighted graphs, Eulerian paths and circuits, Hamiltonian path and circuits, Planar Graphs, Euler's formulae, Graph Colouring, Trees, Binary trees and its traversals, Trees Sorting, Spanning tree, Minimal Spanning tree

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Satinder Bal Gupta: A Text Book of Discrete Mathematics and Structures, University Science Press, Delhi.
3. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, Tata McGraw – Hill.
4. J.P. Tremblay and R. Manohar, Discrete mathematical structures with applications to computer science, TMG Edition, TataMcgraw-Hill
5. Discrete Mathematics, Babu Ram, Pearson Publication
6. Discrete Mathematics, Semyour Lipschutz and Marc Lipson, Schaum's outline

Course Outcomes

The students will learn

1. To solve mathematical problems based on concepts of set theory, relations, functions and lattices.
2. To express logic sentence in terms of quantifiers and logical connectives.
3. To apply basic counting techniques to solve permutation and combination problems.
4. To solve recurrence relations.
5. To classify algebraic structure of any given mathematical problem.
6. To evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
7. To develop the given problem as graph networks and solve with techniques of graph theory.

Computer Organization & Architecture

Course code	PCC-CSE-204G				
Category	Professional Core Course				
Course title	Computer Organization & Architecture				
Scheme and Credits	L	T	P	Credits	Semester-IV
	3	0	0	3	
Branches (B. Tech.)	Computer Science and Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

To expose the students to the following:

- How Computer Systems work & the basic principles
- Instruction Level Architecture and Instruction Execution
- The current state of art in memory system design
- How I/O devices are accessed and its principles.
- To provide the knowledge on Instruction Level Parallelism
- To impart the knowledge on micro programming
- Concepts of advanced pipelining techniques.

Unit 1

Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes.

Register Transfer and Microoperations : Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit 2

Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Central Processing Unit : General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

Unit 3

Pipelining: Basic Concepts of Pipelining, Throughput and Speedup, Pipeline Hazards.

Parallel Processors: Introduction to Parallel Processors, Concurrent access to memory and Cache Coherency.

Unit 4

Input-output Organization : I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts.

Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

Suggested books:

1) “Computer System Architecture”, 3rd Edition by M.Morris Mano, Pearson.
2) “Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
3) “Computer Organization and Embedded Systems”, 6th Edition by CarlHamacher, McGraw Hill Higher Education.

Suggested reference books:

1) “Computer Architecture and Organization”, 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2) “Computer Organization and Architecture: Designing for Performance”, 10th Edition by William Stallings, Pearson Education.
3) “Computer System Design and Architecture”, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course outcomes :

1) Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.

2) Write assembly language program for specified microprocessor for computing

   16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).
3) Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
4) Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.
5) Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

Operating System

Course code	PCC-CSE-206G				
Category	Professional Core Course				
Course title	Principles of Operating System				
Scheme and Credits	L	T	P	Credits	Semester-4
	3	0	0	3	
Branches (B. Tech.)	Computer Science and Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1:

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Multithreading.

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, SRTF, RR Scheduling.

UNIT 2:

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, and Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT 3:

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Optimal Page Replacement and Least Recently used (LRU).

UNIT 4:

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks. Case study on UNIX and WINDOWS Operating System.

Suggested books:

- Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
- Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Suggested reference books:

- Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
- Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
- Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
- Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Outcomes:

CO1: Understand the structure and architectural components of OS to analyze and design the applications to run in parallel. Moreover, students would be able to develop scheduling algorithms to optimize various parameters like CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time for research purpose.

CO2: Understand the design issues associated with Operating system (e.g. Mutual exclusion, Deadlock detection etc.) to gain insight towards developing algorithms/techniques for efficient deadlock handling.

CO3: For a given specification of memory organization, develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4: Design and implement file management system for a given specification. Identify, use and evaluate the disk management policies with respect to various performance evaluation parameters.

Object Oriented Programming

Course code	PCC-CSE-208G				
Category	Professional Core Course				
Course title	Object Oriented Programming				
Scheme and Credits	L	T	P	Credits	Semester-4
	3	0	0	3	
Branches (B. Tech.)	Computer Science and Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit - I

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.

Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

Unit - II

Inheritance: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors.

Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using new and delete operators, pointer to an object, this pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures.

Unit - III

Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initializer lists.

Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract clasess, virtual destructors.

Unit - IV

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

Templates and Generic Programming: Template concepts, Function templates, class templates, illustrative examples.

TEXT BOOKS, AND/OR REFERENCE MATERIAL:

1. Bjrane Stroustrup, "C++ Programming language",3rd edition, Pearson education Asia(1997)

2. Lafore R."Object oriented Programming in C++",4th Ed. Techmedia,New Delhi(2002).

3. Yashwant Kenetkar,"Let us C++",1stEd.,Oxford University Press(2006)

4. B.A. Forouzan and R.F. Gilberg,CompilerScience,"A structured approach using C++" Cengage Learning, New Delhi.

Course code	**HSMC-02G**				
Category					
Course title	**ORGANIZATION BEHAVIOR**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**0**	0	**3**	
Branches (B. Tech.)					
Class work	25				
Exam	75				
Total	100 Marks				
Duration of Exam	03 Hours				

The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

SYLLABUS

UNIT - 1

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Difference between management and administration.

UNIT - 2

Introduction of organization:- Meaning and process of Organization, Management v/s Organization; **Fundamentals of Organizational Behavior:** Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB. **Individual Processes and Behavior**-**Personality**- Concept, determinants and applications; **Perception-** Concept, process and applications, **Learning**- Concept (Brief Introduction) ; **Motivation-** Concept, techniques and importance

UNIT - 3

Interpersonal Processes- **Teams and Groups**- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict-** Concept, sources, types, management of conflict; **Leadership:** Concept, function, styles & qualities of leadership. **Communication –** Meaning, process, channels of communication, importance and barriers of communication.

UNIT 4

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; **Organizational culture -** Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

Course Outcomes: By the end of this course the student will be able to:

1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change

Suggested Books:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.
2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications- New Delhi.

Environmental Sciences

Course code	MC-106G				
Category	Mandatory Course				
Course title	Environmental Sciences				
Scheme and Credits	L	T	P	Credits	
	3	0	1	0	
Branches (B. Tech.)	Common For All Branches				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Unit-1 The Multidisciplinary nature of environmental studies. Definition, scope and importance. (2 lecture)

Unit-2 Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

* Role of an individual in conservation of natural resources.

* Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit-3 Ecosystems :

* Producers, consumers and decomposers.
* Energy flow in the ecosystem.
* Ecological succession.
* Food chains, food webs and ecological pyramids.
* Introduction, types, characteristic features, structure and function of the following ecosystem :

a. Forest ecosystem.

b. Grassland ecosystem.

c. Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lectures)

Unit-4 Biodiversity and its conservation

* Introduction - Definition : Genetic, Species and ecosystem diversity.
* Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.
* Biodiversity at global, National and local levels.
* India as a mega-diversity nation.
* Hot-spots of biodiversity.
* Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
* Endangered and endemic species of India.
* Conservation of biodiversity : In-situ and ex-situ conservation of biodiversity.

(8 lectures)

Unit-5 Environmental pollution :

Definition, causes, effects and control measures of :

a) Air pollution.

b)

Water

pollution c)

Soil

pollution

d)

Marine

pollution e)

Noise

pollution

f)

Thermal

pollution g)

Nuclear

hazards

* Solids waste management: causes, effects and control measures of urban and industrial wastes.
* Role of an individual in prevention of pollution.
* Pollution case studies.
* Disaster management : floods, earthquake, cyclone and landslides.

(8 lectures)

Unit-6 Social issues and the Environment:

* From unsustainable to sustainable development.
* Urban problems related to energy.
* Water conservation, rain water harvesting, watershed management.
* Resettlement and rehabilitation of people : its problems and concerns case studies.
* Environmental ethics : Issues and possible solutions.
* Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
* Wasteland reclamation.

* Consumerism and waste products.

* Environment Protection Act.

* Air (Prevention and Control of pollution) Act.

* Water (Prevention and Control of pollution) Act.

* Wildlife Protection Act.

* Forest Conservation Act.

* Issues involved in enforcement of environmental legislation.

* Public awareness. (7 lectures)

Unit-7 Human population and the Environment.

Population growth, variation among nations.

Population explosion- Family Welfare

Programme. Environment and human

health.

Human

Rights.

Value

Educatio

n.

HIV/AI

DS.

Woman and Child Welfare

Role of Information Technology in Environment and human health.

Case Studies. (6 lectures)

Unit-8 Field Work :

* Visit to a local area to document environmental assets - river/forest/grassland/hill/mountain.

* Visit to a local polluted site-urban/Rural/ Industrial/ Agricultural.

* Study of common plants, insects, birds.

* Study of simple ecosystems- pond, river, hill slopes, etc. (Field work equal to 10 lecture hours).

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Pub. Ltd. Bikaner.
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3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw Hill Inc. 480p.
4. Clark R.S., Marine pollution, Slanderson Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai 1196 p.
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R).
8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute, Oxford Univ. Press, 473p.
9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).
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11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.
12. Mackinney, M.L. & Schoch, RM 1996, Environmental Science systems & solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Mayyer Hazardous, Tekchno-Science Publications (TB).
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing

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15. Odum, E.P. 1971, Fundamentals of Ecology. W.B. Saunders
Co.
USA,
574p.

16. Rao M.N. & Datta, A.K. 1987 Waste Water Treatment. Oxford
& TBH Publ. Co. Pvt.
Ltd. 345p.

17. Sharma, B.K. 2001, Environmental Chemistry, Goal Publ.
House,
Meerut.

18. Survey of the Environment, The Hindu (M).

19. Townsend C., Harper J. and Michael Begon. Essentials of
Ecology, Blackwell
Science (TB).

20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Comliances and Standards, Vol. I and II Enviro Media (R).

21. Tridevi R.K. and P.K. Goal, Introduction to air pollution, Techno
Science
Publications (TR).

22. Wagner K.D., 1998, Environmental Management, W.B.
Saunders co. Philadelphia,
USA 499p.

23. A text book environmental education G.V.S. Publishers by Dr.
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The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory : 75 marks, Practical/ Field visit : 25 marks. The structure of the question paper will be :

Part- A : Short Answer Pattern : 15

marks Part- B : Essay Type with inbuilt choice :

60 marks

Part-C : Field Work (Practical) : 25

marks Instructions for Examiners :

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

Web Technologies

Course code	LC-CSE-210G				
Category	Professional Core Course				
Course title	Web Technologies				
Scheme and Credits	L	T	P	Credits	
	2	0	0	1	
Branches (B. Tech.)	Computer Science and Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

- To impart the basic concepts of Web Technologies
- To understand various client side technologies
- To create web pages
- To create dynamic applications on web through server side technologies

Detailed contents:

Unit 1:

Introduction: Concept of Internet- History of Internet, Protocols of Internet, World Wide Web, URL, Web Server, Web Browser, HTML, HTTP, SMTP, POP3, MIME, IMAP.
Web site design principles, planning the site and navigation,

Unit 2:

HTML and CSS: History of HTML, Structure of HTML Document: Text Basics, Document: Images and Multimedia, Links and webs, Document Layout, Cascading Style Sheet: 4 Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS,

Unit 3:

XML: Introduction of XML- Some current applications of XML, Features of XML, Anatomy of XML document, The XML Declaration, Element Tags- Nesting and structure, XML text and text formatting element, Table element, Mark-up Element and Attributes, Document Type Definition (DTD), types. XML Objects, Checking Validity, Understanding XLinks, XPointer, Event-driven Programming, XML Scripting.

Unit 4:

PHP: PHP Introduction, Structure of PHP, PHP Functions, AJAX with PHP, PHP Code and the Complete AJAX Example. AJAX Database, Working of AJAX with PHP, Ajax PHP Database Form, AJAX PHP MySQL Select Query.

Suggested books:

1. Steven Holzner,"HTML Black Book", Dremtech press.
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel & H.M. Deitel Pearson.

Suggested reference books:

1. Paul Deitel , Harvey Deitel, Abbey Deitel ,"Internet and world wide web – How to Program", Prentice Hall

Course outcomes

- For a given conceptual problem student will able to understand the basic process of Web Technologies and their application domains
- For a given problem the student will able to analyze the problem and select which technique is most suitable for developing a website.
- The knowledge of various techniques will enable student to implement in these dynamic techniques using various tools to make interactive web pages.
- Student will able to write a program using these technologies to implement the basic concepts of web.

Operating System Lab

<table>
<tr><td>Course code</td><td colspan="4">LC-CSE-212G</td></tr>
<tr><td>Category</td><td colspan="4">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="4">Operating System Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td></tr>
<tr><td>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="4">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="4">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="4">25 Marks</td></tr>
<tr><td>Total</td><td colspan="4">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="4">03 Hours</td></tr>
</table>

Contents:

1 Introduction to UNIX File System.

2. File and Directory Related Commands in UNIX.
3. Essential UNIX Commands for working in UNIX environment.
4. I/O Redirection and Piping
5. Introduction to VI Editors.
6. Introduction of Processes in UNIX
7. Communication in UNIX and AWK.
8. Introduction of the concept of Shell Scripting.
9. Decision and Iterative Statements in Shell Scripting.
10. Writing the Shall Scripts for unknown problems.

Suggested Books:

1. UNIX Shell Programming by Yashavant Kanetkar.
2. UNIX Concepts and Applications by Sumitabha Das

Course Outcomes.

Co1: Understand the structure and architectural components of UNIX Operating System to analyze and design the problem. Moreover, students would be able to know the Basic Introduction of UNIX Operating System.

Co2: Basic Introduction of UNIX Commands that are used for operating the UNIX.

Co3: Introduction of Shell Scripting and VI Editor.so that the students get familiar with writing the UNIX scripts in UNIX editor.

Co4: Students will establish themselves as effective professionals by solving real problems with UNIX Shell Scripting knowledge and with attention to teamwork, critical thinking and problem solving skills by Writing Shell Scrips of unknown problems

Object Oriented Programming Lab Using C++

Course code	LC-CSE-214G			
Category	Professional Core Course			
Course title	Object Oriented Programming Lab Using C++			
Scheme and Credits	L	T	P	Credits
	0	0	4	2
Branches (B. Tech.)	Computer Science and Engineering			
Class work	25 Marks			
Exam	25 Marks			
Total	50 Marks			
Duration of Exam	03 Hours			

Contents:

1. [Classes and Objects] Write a program that uses a class where the member functions are defined inside a class.
2. [Classes and Objects] Write a program that uses a class where the member functions are defined outside a class.
3. [Classes and Objects] Write a program to demonstrate the use of static data members.
4. [Classes and Objects] Write a program to demonstrate the use of const data members.
5. [Constructors and Destructors] Write a program to demonstrate the use of zero argument and parameterized constructors.
6. [Constructors and Destructors] Write a program to demonstrate the use of dynamic constructor.
7. [Constructors and Destructors] Write a program to demonstrate the use of explicit constructor.
8. [Initializer Lists] Write a program to demonstrate the use of initializer list.
9. [Operator Overloading] Write a program to demonstrate the overloading of increment and decrement operators.
10. [Operator Overloading] Write a program to demonstrate the overloading of binary arithmetic operators.
11. [Operator Overloading] Write a program to demonstrate the overloading of memory management operators.
12. [Inheritance] Write a program to demonstrate the multilevel inheritance.
13. [Inheritance] Write a program to demonstrate the multiple inheritance.
14. [Inheritance] Write a program to demonstrate the virtual derivation of a class.
15. [Polymorphism] Write a program to demonstrate the runtime polymorphism.

16. [Exception Handling] Write a program to demonstrate the exception handling.
17. [Templates and Generic Programming] Write a program to demonstrate the use of function template.
18. [Templates and Generic Programming] Write a program to demonstrate the use of class template.

Web Technologies Lab

Course code	LC-CSE-216G				
Category	Professional Core Course				
Course title	Web Technologies Lab				
Scheme and Credits	L	T	P	Credits	
	0	0	2	1	
Branches (B. Tech.)	Computer Science and Engineering				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Contents:

HTML :

1. Simple HTML using
   a. Heading elements
   b. Text Elements
   c. Logical Styles
   d. Physical Styles
   e. Ordered , Unordered and Definition list
2. Hyper Links
   a. Image Link → Link to page containing Images and Videos
   b. File Link
   c. Single Page Link
3. Using Frames
   a. Navigation Frame
   b. Floating Frame
   c. Inline Frame
4. Registration Form with Table

CSS:

Inline Style , Internal Style ,and External Style Sheets

XML :

1. Create a any catalog
2. Display the catalog created using CSS or XSL

PHP:

1. File operation
2. Regular Expression, Array, Math, String, Date functions

MC-106G : (ENVIRONMENT SCIENCE)

Theory 75 Marks   Field Work 25 Marks (Practical/Field visit)

Unit-1 The Multidisciplinary nature of environment studies. Definition, scope and importance. (2 lecture)

Unit-2 Natural Resources :

Renewable and non-renewable resources :

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non-renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

* Role of an individual in conservation of natural resources.
* Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit-3 Ecosystems :

* Producers, consumers and decomposers.
* Energy flow in the ecosystem.
* Ecological succession.
* Food chains, food webs and ecological pyramids.
* Introduction, types, characteristic features, structure and function of the following eco-system :

a. Forest ecosystem.

b. Grassland ecosystem.

c. Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit-4 Biodiversity and its conservation

* Introduction - Definition : Genetic, Species and ecosystem diversity.
* Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
* Biodiversity at global, National and local levels.
* India as a mega-diversity nation.
* Hot-spots of biodiversity.
* Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
* Endangered and endemic species of India.
* Conservation of biodiversity : In-situ and ex-situ conservation of biodiversity.

(8 lectures)

Unit-5 Environmental pollution :

Definition, causes, effects and control measures of :

a) Air pollution.

b) Water pollution

c) Soil pollution

d) Marine pollution

e) Noise pollution

f) Thermal pollution

g) Nuclear hazards

* Solids waste management: causes, effects and control measures of urban and industrial wastes.
* Role of an individual in prevention of pollution.
* Pollution case studies.
* Disaster management : floods, earthquake, cyclone and landslides.

(8 lectures)

Unit-6 Social issues and the Environment:

* From unsustainable to sustainable development.
* Urban problems related to energy.
* Water conservation, rain water harvesting, watershed management.
* Resettlement and rehabilitation of people : its problems and concerns case studies.
* Environmental ethics : Issues and possible solutions.
* Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
* Wasteland reclamation.
* Consumerism and waste products.
* Environment Protection Act.
* Air (Prevention and Control of pollution) Act.
* Water (Prevention and Control of pollution) Act.
* Wildlife Protection Act.
* Forest Conservation Act.
* Issues involved in enforcement of environmental legislation.
* Public awareness. (7 lectures)

Unit-7 Human population and the Environment.

Population growth, variation among nations.

Population explosion- Family Welfare Programme.

Environment and human health.

Human Rights.

Value Education.

HIV/AIDS.

Woman and Child Welfare

Role of Information Technology in Environment and human health.

Case Studies. (6 lectures)

Unit-8 Field Work :

* Visit to a local area to document environmental assets - river/forest/grassland/hill/mountain.
* Visit to a local polluted site-urban/Rural/ Industrial/ Agricultural.
* Study of common plants, insects, birds.
* Study of simple ecosystems- pond, river, hill slopes, etc. (Field work equal to 10 lecture hours).

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8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute, Oxford Univ. Press, 473p.
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(M) Magazine

(R) Reference

(TB) Textbook

The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory: 75 marks, Practical/ Field visit : 25 marks. The structure of the question paper will be :

Part- A: Short Answer Pattern	:	15marks
Part- B : EssayType with inbuilt choice	:	60marks
Part-C : Field Work (Practical)	:	25marks

Instructions for Examiners :

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

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M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

B.TECH (Computer Science and Engineering)

Common with

B.Tech. (Information Technology)

&

B.Tech. (Computer Science and Information Technology)

SEMESTER 3rd& 4th

Modified Scheme effective from 2020-21

COURSE CODE ANDDEFINITIONS

Course Code	Definition
L	Lecture
T	Tutorial
P	Practical
BSC	Basic ScienceCourses
ESC	EngineeringScienceCourses
HSMC	Humanities and Social Sciences includingManagementcourses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar

B.Tech. (Computer Science and Engineering)

Common with B.Tech. (Information Technology) &

B.Tech. (Computer Science and Information Technology)

Scheme ofStudies/Examination w.e.f. 2019-20

Semester-3

Sr. No.	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Mark of Class work	Theory	Practical	Total	
1	PCC-CSE-201G	Database Management Systems	3	0	0	3	3	25	75		100	3
2	PCC-CSE-203G	Data Structures & Algorithms	3	0	0	3	3	25	75		100	3
3	ESC-CSE-205G	Digital Electronics	3	0	0	3	3	25	75		100	3
4	PCC-CSE-207G	Python Programming	3	0	0	3	3	25	75		100	3
5	BSC-MATH-203G	Mathematics - III (Multivariable Calculus and Differential Equations)	2	0	0	2	2	25	75		100	3
6	HSMC-01G	Economics for Engineers	3	0	0	3	3	25	75		100	3
7	LC-CSE-209G	Database Management Systems LAB	0	0	3	3	1.5	25		25	50	3
8	LC-ESC-211G	Digital Electronics LAB	0	0	3	3	1.5	25		25	50	3
9	LC-CSE-213G	Data Structures & Algorithms LAB Using C	0	0	3	3	1.5	25		25	50	3
10	LC-CSE-215G	Python Programming LAB	0	0	3	3	1.5	25		25	50	3
						Total	23				800	

B.Tech. (Computer Science and Engineering)

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B.Tech. (Computer Science and Information Technology)

Scheme ofStudies/Examination w.e.f. 2019-20

Semester-4

Sr. No.	Course Code	Course Title	Hours per week			Total Contact Hrs. per week	Credit	Examination Schedule (Marks)				Duration of Exam (Hours)
			L	T	P			Mark of Class work	Theory	Practical	Total	
1	PCC-CSE-202G	Discrete Mathematics	3	1	0	3	4	25	75		100	3
2	PCC-CSE-204G	Computer Organization&Architecture	3	0	0	3	3	25	75		100	3
3	PCC-CSE-206G	OperatingSystem	3	0	0	3	3	25	75		100	3
4	PCC-CSE-208G	ObjectOriented Programming	3	0	0	3	3	25	75		100	3
5	HSMC-02G	Organizational Behaviour	3	0	0	3	3	25	75		100	3
6	*MC-106G	Environmental Sciences	3	0	1	4	0	-	-	-	-	3
7	PCC-CSE-210G	Web Technologies	3	0	0	3	3	25	75		100	3
8	LC-CSE-212G	OperatingSystem LAB	0	0	3	3	1.5	25		25	50	3
9	LC-CSE-214G	ObjectOriented Programming LAB Using C++	0	0	3	3	1.5	25		25	50	3
10.	LC-CSE-216G	Web Technologies Lab	0	0	2	2	1	25		25	50	3
						Total	23				750	

***MC-106G** is a mandatory non –credit course in which the students will be required passing marks in theory.

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

Database Management System

Coursecode	PCC-CSE-201G				
Category	Professional Core Course				
Coursetitle	Database Management System				
Scheme and Credits	L	T	P	Credits	Semester 3
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Objectives of the course

a. To understand the different issues involved in the design and implementation of a database system.
b. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
c. To understand and use data manipulation language to query, update, and manage a database
d. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
e. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit: 1

Database system architecture: Data Abstraction, Data Independence, Data Definition Language(DDL),DataManipulationLanguage(DML). **Data models:** Entity-relationshipmodel,networkmodel,relationalandobjectorienteddata models, integrityconstraints, datamanipulation operations.

Unit: 2

Relationalquerylanguages: Relationalalgebra,Tuple anddomainrelationalcalculus,SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server.

Relational database design: Domain and data dependency, Armstrong's axioms,Normal forms, Dependency preservation, Lossless design.

Query processing and optimization: Evaluation of relational algebra expressions, Queryequivalence, Join strategies, Query optimization algorithms.

Unit: 3

Storage strategies: Indices, B-trees, hashing,

Transaction processing: Concurrency control, ACID property, Serializability ofscheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Unit: 4

Database Security: Authentication, Authorization and access control, DAC, MAC andRBAC models, Intrusion detection, SQL injection.

Advanced topics: Object oriented and object relational databases, Logical databases, Webdatabases, Distributed databases, Data warehousing and data mining.

Suggested books:

"Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Suggested reference books

"Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.

"Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

"Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

Course Outcomes

1. For a given query write relational algebra expressions for that query and optimize the developed expressions
2. For a given specification of the requirement, design the databases using E R method and normalization.
3. For a given specification, construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
4. For a given query optimize its execution using Query optimization algorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Data Structure & Algorithms

Coursecode	PCC-CSE-203G				
Category	Professional Core Course				
Coursetitle	Data Structure & Algorithms				
Scheme and Credits	L	T	P	Credits	Semester 3
	3	0		3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

Unit 1:

Introduction: Basic Terminologies: Concept of Data Structure, Choice of right Data Structure, Algorithms , how to design and develop algorithm , Complexity of algorithm. Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

Unit 2:

Stacks and Queues: Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation -corresponding algorithms and complexity analysis. queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Unit 3:

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded BinaryTree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Unit 4:

Sorting and Hashing: Objective and properties of different sorting algorithms:Selection Sort, Bubble Sort, Insertion Sort, Selection Sort Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms andcomplexity analysis.Minimum Spanning Tree: Kruskal's Algorithm, Prim's Algorithm.

Suggested books:

"Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Suggested reference books:

Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company

"How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

Course outcomes

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

DIGITAL ELECTRONICS

Coursecode	PCC-CSE-205G				
Category	Professional Core Course				
Coursetitle	Digital Electronics				
Scheme and Credits	L	T	P	Credits	Semester 3
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT1:

FUNDAMENTALSOFDIGITAL SYSTEMSAND LOGICFAMILIES

Digitalsignals,digital circuits,AND, OR,NOT, NAND, NORand Exclusive-ORoperations, Booleanalgebra,examples ofICgates,numbersystems-binary, signed binary, octal hexadecimal number,binary arithmetic,one'sandtwo'scomplementsarithmetic,codes,error detectingand correctingcodes.

UNIT2:

COMBINATIONAL DIGITALCIRCUITS

Standardrepresentationfor logicfunctions,K-maprepresentation,and simplificationoflogic functionsusingK-map,minimizationoflogicalfunctions.Don'tcareconditions,Multiplexer, De-Multiplexer/Decoders,Adders,Subtractors,BCDarithmetic,carry lookaheadadder,serial adder,ALU,elementaryALUdesign,popularMSI chips,digitalcomparator,parity checker/generator,codeconverters,priorityencoders,decoders/drivers fordisplay devices,Q-M method of function realization.

UNIT3:

SEQUENTIAL CIRCUITSAND SYSTEMS

A1-bitmemory,thecircuitpropertiesofBistablelatch,theclockedSRflipflop, J-K-TandD typesflipflops,applicationsof flipflops,shift registers,applicationsof shiftregisters, serialto parallelconverter, paralleltoserialconverter,ringcounter, sequencegenerator,ripple

(Asynchronous)counters, synchronouscounters,counters design using flipflops, specialcounter IC’s,asynchronous sequential counters, applications of counters.

UNIT4:

A/D ANDD/A CONVERTERS

Digitaltoanalog converters: weightedresistor/converter,R-2RLadderD/Aconverter, specificationsforD/Aconverters,examplesofD/AconverterICs,sampleandholdcircuit, Analogto digital converters: quantization and encoding, parallel comparator A/Dconverter, successiveapproximationA/Dconverter,countingA/Dconverter,dualslopeA/Dconverter,

SEMICONDUCTOR MEMORIES AND PROGRAMMABLE LOGIC DEVICES

Memoryorganization and operation, expandingmemorysize, classificationand characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), contentaddressablememory (CAM),ROMasaPLD,Programmablelogicarray,Programmablearray logic,complex Programmable logic devices (CPLDS), Field Programmable GateArray(FPGA).

CourseOutcomes:

At the end ofthis course,students will demonstrate the abilityto

1. Understand workingof logic families andlogicgates.
2. Designand implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Use PLDs to implement the given logical problem.

REFERENCES:

1. R. P. Jain, "Modern DigitalElectronics",McGrawHillEducation, 2009.
2. M. M.Mano, "Digital logic and Computerdesign",Pearson Education India,2016.
3. A. Kumar,"Fundamentals ofDigitalCircuits",Prentice HallIndia, 2016.
4. Nasib Singh Gill and J B Dixit, “Digital Design and Computer Organization”, University Science Press, New Delhi

Python Programming

Coursecode	PCC-CSE-207G				
Category	Professional Core Course				
Coursetitle	Python Programming				
Scheme and Credits	L	T	P	Credits	Semester 3
	3	0	0	3	
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

- To impart the basic concepts of Python programming.
- To understand syntax of Python language
- To create dynamic applications in Python language.
- To implement object oriented concepts using Python language

Detailed contents:

Unit 1:

Introduction: Installing Python; basic syntax, interactive shell, editing, saving, and running a script; data types; variables, assignments; numerical types; arithmetic operators and expressions; Loops and selection statements, Control statementsString manipulations: subscript operator, indexing, slicing a string; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file

Unit 2: Lists, dictionary and Design with functions: Basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding, and removing keys, accessing and replacing values; traversing dictionaries. Hiding redundancy, complexity; arguments and return values; Program structure and design. Recursive functions.

Unit 3: **Simple graphics and image processing**: Simple graphics, Turtle operations, Manipulating turtle screen, Drawing two dimensional shapes, examining an object attributes, Taking a random walk, Color and RGB scheme, Image processing: Image manipulation operations, properties of images, image module, copying, blurring and reducing image. Graphical User Interfaces: Terminal based and GUI based programs,Simple GUI-Based Programs, Windows and Window Components, Input and Output with Entry Fields, Defining and Using Instance Variables, Other Useful GUI Resources.

Unit 4: Object Oriented concepts: Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modelling; persistent storage of objects, Inheritance, polymorphism, operator overloading; abstract classes; exception handling, try block. Multithreading: Threads and Processes,Sleeping Threads,Producer, Consumer, and Synchronization,The Readers and Writers Problem, SharedCell Class,Thread-Safe Class

Course outcomes

- For a given conceptual problem student will able to analyze the problem and write a program in python with basic concepts.
- For a given problem of Strings and texts, student will able to analyze the problem and write a program in python with basic concepts involving strings and texts.
- The knowledge of list and dictionary will enable student to implement in python language and analyze the same.
- Student will able to write a program using functions to implement the basic concepts of object oriented programming language

Suggested books:

"Fundamentals of Python: First Programs" Kenneth Lambert, Course Technology, Cengage Learning, 2012

Suggested reference books:

"Introduction to Computer Science Using Python: A Computational Problem-Solving Focus",By Charles Dierbach, John Wiley & Sons, December 2012,

Mathematics-III (Multivariable Calculus and Differential Equations)

<table>
<tr><td>Coursecode</td><td colspan="5">BSC-MATH-203G</td></tr>
<tr><td>Category</td><td colspan="5">Basic Science Course</td></tr>
<tr><td>Coursetitle</td><td colspan="5">Mathematics-III (Multivariable Calculus and Differential Equations)</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 3</td></tr>
<tr><td>2</td><td>0</td><td></td><td>2</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Multivariable Differential Calculus: Limit, Continuity and Partial derivatives, Homogeneous functions, Euler's Theorem, Total derivative, Maxima, Minima and Saddle points, Lagrange's method of undetermined multipliers

Unit-II

Multivariable Integral Calculus: Double integral, Change of order of integration, Change of variables, Applications of double integral to find area enclosed by plane curves, Triple integral

Unit-III

Ordinary Differential Equations of first order: Linear and Bernoulli's equations, Exact differential equations, Equations reducible to exact differential equations, Applications of differential equations of first order and first degree to simple electric circuits, Newton's law of cooling, Heat flow and Orthogonal trajectories

Unit-IV

Ordinary Differential equations of second and higher order: Linear differential equations of second and higher order, Complete solution, Complementary function and Particular integral, Method of variation of parameters to find particular integral, Cauchy's and Legendre's linear equations, Simultaneous linear differential equations with constant coefficients, Applications of linear differential equations to oscillatory electric circuits

Reference Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson Education.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited.
4. N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications.
5. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
6. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems,Wiley India.
7. S. L. Ross, Differential Equations, Wiley India.
8. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India.
9. E. L. Ince, Ordinary Differential Equations, Dover Publications

Course Outcomes

The students will learn:

1. To deal with functions of several variables and evaluate partial derivative.
2. The mathematical tools needed in evaluating multiple integrals and their usage.
3. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.

ECONOMICSFORENGINEERS

<table>
<tr><td>Course code</td><td colspan="5">HSMC- 01G</td></tr>
<tr><td>Category</td><td colspan="5">Humanities and Social Sciences includingManagementcourses</td></tr>
<tr><td>Course title</td><td colspan="5">Economics For Engineers</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 3</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Common For All Branches</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
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CourseObjectives:

1.Acquaintthestudentstobasicconceptsofeconomicsandtheiroperationalsignificance.

2.Tostimulatethestudentstothinksystematicallyandobjectivelyabout contemporary economicproblems.

UNIT-1

Definition of Economics- Various definitions, types of economics- Micro and MacroEconomics, nature of economic problem, Production Possibility Curve, Economic laws and their nature, Relationship between Science, Engineering, Technology and Economic Development.

Demand- Meaning of Demand, Law of Demand, Elasticity of Demand- meaning,factors effecting it, its practical application and importance,

UNIT 2

Production- Meaning of Production and factors of production, Law of variable proportions, and Returns to scale, Internal external economies and diseconomies of scale. Various concepts of cost of production- Fixed cost, Variable cost, Money cost, Realcost, Accounting cost, Marginal cost, Opportunity cost. Shape of Average cost, Marginal cost, Total cost etc. in short run and long run.

UNIT-3

Market- Meaning of Market, Types of Market- Perfect Competition, Monopoly,
Monopolistic Competition and Oligopoly (main features).

Supply- Supply and law of supply, Role of demand & supply in price determination andeffect of changes in demand and supply on prices.

UNIT-4

Indian Economy- Nature and characteristics of Indian economy as under developed,developing and mixed economy (brief and elementary introduction), Privatization - meaning, merits and demerits.

Globalization of Indian economy - merits and demerits.

Banking- Concept of a Bank, Commercial Bank- functions, Central Bank- functions,Difference between Commercial & Central Bank.

COURSEOUTCOMES:

1.Thestudentswillabletounderstandthebasicconceptofeconomics.

2.Thestudentwillabletounderstandtheconceptofproductionandcost.

3.Thestudentwillabletounderstandtheconceptofmarket.

4.Thestudentwillabletounderstandtheconceptofprivatization,globalizationandbanks.

REFERENCES:

1.JainT.R.,EconomicsforEngineers,VKPublication.

2.ChopraP.N.,PrincipleofEconomics,KalyaniPublishers.

3.DewettK.K.,Moderneconomictheory,S.Chand.

4.H.L.Ahuja.,Moderneconomictheory,S.Chand.

5.DuttRudar&SundhramK.P.M.,IndianEconomy.

6.MishraS.K.,ModernMicroEconomics,PragatiPublications.

7.SinghJaswinder,ManagerialEconomics,dreamtechpress.

8.ATextBookofEconomicTheoryStonierandHague(Longman’sLandon).

9.MicroEconomicTheory–M.L.Jhingan(S.Chand).

10.MicroEconomicTheory-H.L.Ahuja(S.Chand).

11.ModernMicroEconomics:S.K.Mishra(PragatiPublications).

12.EconomicTheory-A.B.N.Kulkarni&A.B.Kalkundrikar(R.Chand& Co).

Database Management System Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-209G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Database Management System Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 3</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
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Course Objectives:

- Keep abreast of current developments to continue their own professional development
- To engage themselves in lifelong learning of Database management systems theories and technologies this enables them to purse higher studies.
- To interact professionally with colleagues or clients located abroad and the ability to overcome challenges that arises from geographic distance, cultural differences, and multiple languages in the context of computing.
- Develop team spirit, effective work habits, and professional attitude in written and oral forms, towards the development of database applications.

Contents:

i. Creation of a database and writing SQL queries to retrieve information from the database.
ii. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
iii. Creation of Views, Synonyms, Sequence, Indexes, Save point.
iv. Creating an Employee database to set various constraints.
v. Creating relationship between the databases.
vi. Study of PL/SQL block.
vii. Write a PL/SQL block to satisfy some conditions by accepting input from the user.
viii. Write a PL/SQL block that handles all types of exceptions.
ix. Creation of Procedures.

x. Creation of database triggers and functions

xi. Mini project (Application Development using Oracle/ MySQL)

a) Inventory Control System

b) Material Requirement Processing.

c) Hospital Management System.

d) Railway Reservation System.

e) Personal Information System.

f) Web Based User Identification System.

g) Time Table Management System.

h) Hotel Management

Digital Electronics Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-211G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Digital Electronics Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-3</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Implementation all experiments with help of Bread- Board.

1. Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
2. Half Adder / Full Adder: Realization using basic and XOR gates.
3. Half Subtractor / Full Subtractor: Realization using NAND gates.
4. 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter: Realization using XOR gates.
5. 4-Bit and 8-Bit Comparator: Implementation using IC7485 magnitude comparator chips.
6. Multiplexer: Truth-table verification and realization of Half adder and Full adder.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor.
8. Flip Flops: Truth-table verification of JK Master Slave FF, T-type and D-type FF.
9. Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter.
10. Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter.
11. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations.
12. DAC Operation: Study of 8-bit DAC , obtain staircase waveform.
13. ADC Operations: Study of 8-bit ADC

Data Structures and Algorithms Lab Using C

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-213G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Data Structures and Algorithms Lab Using C</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-3</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Data Structures Lab List of practical exercises, to be implemented in C Language.

1. Write a menu driven program that implements following operations (using separate functions) on a linear array:
   - Insert a new element at end as well as at a given position
   - Delete an element from a given whose value is given or whose position is given
   - To find the location of a given element
   - To display the elements of the linear array
2. Write a menu driven program that maintains a linear linked list whose elements are stored in on ascending order and implements the following operations (using separate functions):
   - Insert a new element
   - Delete an existing element
   - Search an element
   - Display all the elements
3. Write a program to demonstrate the use of stack (implemented using linear array) in converting arithmetic expression from infix notation to postfix notation.
4. Program to demonstrate the use of stack (implemented using linear linked lists) in evaluating arithmetic expression in postfix notation.
5. Program to demonstration the implementation of various operations on a linear queue represented using a linear array.
6. Program to demonstration the implementation of various operations on a circular queue represented using a linear array.
7. Program to demonstration the implementation of various operations on a queue represented using a linear linked list (linked queue).
8. Program to illustrate the implementation of different operations on a binary search tree.

9. Program to illustrate the traversal of graph using breadth-first search
10. Program to illustrate the traversal of graph using depth-first search.
11. Program to sort an array of integers in ascending order using bubble sort.
12. Program to sort an array of integers in ascending order using selection sort.
13. Program to sort an array of integers in ascending order using insertion sort.
14. Program to sort an array of integers in ascending order using radix sort.
15. Program to sort an array of integers in ascending order using merge sort.
16. Program to sort an array of integers in ascending order using quick sort.
17. Program to sort an array of integers in ascending order using heap sort.
18. Program to sort an array of integers in ascending order using shell sort.
19. Program to demonstrate the use of linear search to search a given element in an array.
20. Program to demonstrate the use of binary search to search a given element in a sorted array in ascending order.

Python Programming Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-215G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Python Programming Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-3</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Objectives

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, and dictionaries.
- Read and write data from/to files in Python.

List of Programs

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

Outcome:

- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops

- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

Discrete Mathematics

<table>
<tr><td>Coursecode</td><td colspan="5">PCC-CSE-202G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Coursetitle</td><td colspan="5">Discrete Mathematics</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester - 4</td></tr>
<tr><td>3</td><td>1</td><td></td><td>4</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit-I

Sets, Relation, Function and Propositional Logic: Operations and Laws of Sets, Cartesian Products, Representation of relations, Binary Relation, Equivalence Relation, Partial Ordering Relation, POSET, Hasse Diagram, Lattices and its types, Function, Bijective functions, Inverse and Composite Function, Finite and infinite Sets, Countable and Uncountable Sets, Cantor's diagonal argument and The Power Set theorem, **S**chroeder-Bernstein theorem, Propositions, Logical operations, Conditional Statements, Tautologies, Contradictions, Logical Equivalence, The use of Quantifiers

Unit-II

Basic Counting Techniques and Recurrence Relation: Pigeon-hole principle, Permutation and Combination**,** the Division algorithm: Prime Numbers, The GCD: Euclidean Algorithm, The Fundamental Theorem of Arithmetic., Linear recurrence relation with constant coefficients, Homogenous Solutions, Particular Solutions, Total Solutions, Solving recurrence relation using generating functions

Unit-III

Algebraic Structures: Definitions and examples of Algebraic Structures with one Binary Operation: Semi Groups, Monoids, Groups; Congruence Relation and Quotient Structures, Permutation Groups, Cyclic groups, Normal Subgroups, Definitions and examples of Algebraic Structures with two Binary Operation: Rings, Integral Domain, Fields; Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Unit-IV

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Multigraph and Weighted graph, Shortest path in Weighted graphs, Eulerian paths and circuits, Hamiltonian path and circuits, Planar Graphs, Euler's formulae, Graph Colouring, Trees, Binary trees and its traversals, Trees Sorting, Spanning tree, Minimal Spanning tree

Reference Books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Satinder Bal Gupta: A Text Book of Discrete Mathematics and Structures, University Science Press, Delhi.
3. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, Tata McGraw – Hill.
4. J.P. Tremblay and R. Manohar, Discrete mathematical structures with applications to computer science, TMG Edition, TataMcgraw-Hill
5. Discrete Mathematics, Babu Ram, Pearson Publication
6. Discrete Mathematics, SemyourLipschutz and Marc Lipson, Schaum's outline

Course Outcomes

The students will learn

1. To solve mathematical problems based on concepts of set theory, relations, functions and lattices.
2. To express logic sentence in terms of quantifiers and logical connectives.
3. To apply basic counting techniques to solve permutation and combination problems.
4. To solve recurrence relations.
5. To classify algebraic structure of any given mathematical problem.
6. To evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
7. To develop the given problem as graph networks and solve with techniques of graph theory.

Computer Organization & Architecture

<table>
<tr><td>Course code</td><td colspan="5">PCC-CSE-204G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Computer Organization & Architecture</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-IV</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

To expose the students to the following:

- How Computer Systems work & the basic principles
- Instruction Level Architecture and Instruction Execution
- The current state of art in memory system design
- How I/O devices are accessed and its principles.
- To provide the knowledge on Instruction Level Parallelism
- To impart the knowledge on micro programming
- Concepts of advanced pipelining techniques.

Unit 1

Data representation: Data Types, Complements, Fixed-Point Representation, Conversion of Fractions, Floating-Point Representation, Gray codes, Decimal codes, Alphanumeric codes, Error Detection Codes.

Register Transfer and Microoperations : Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations, Arithmetic Logic Shift Unit.

Unit 2

Basic Computer Organization and Design : Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instruction, Input-Output Instruction, Complete Computer Description, Design of Basic Computer, Design of Accumulator Logic.

Central Processing Unit : General Register Organization, Stack organization, Instruction Format, Addressing Modes, Data Transfer and Manipulation, Program Control, RISC, CISC.

Unit 3

Pipelining: Parallel Processing, Amdahl's law, Pipelining, Arithmetic Pipeline, Instruction Pipeline, Pipeline Hazards, RISC Pipeline.

Parallel Processors: Introduction to Parallel Processors, Concurrent access to memory andCache Coherency.

Vector Processing : Vector Operations, Memory Interleaving, Supercomputers, Array Processors: Attached Array Processor, SIMD Array Processor.

Unit 4

Input-output Organization : I/O deviceinterface, I/O transfers–program controlled, interrupt driven and DMA, Privileged and Non-Privileged Instructions, Software Interrupts.

Memory organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Associative Mapping, Direct Mapping, Set-Associative Mapping, Writing into Cache, Cache Initialization, Virtual Memory.

Suggested books:

1) "Computer System Architecture", 3rd Edition by M.Morris Mano, Pearson.
2) "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
3) "Computer Organization and Embedded Systems", 6th Edition by CarlHamacher, McGraw Hill Higher Education.

Suggested reference books:

1) "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2) "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3) "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course outcomes :

1) Draw the functional block diagram of a single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
2) Write assembly language program for specified microprocessor for computing

   16 bit multiplication, division and I/O device interface (ADC, Control circuit, serial port communication).
3) Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
4) Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.
5) Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

Operating System

<table>
<tr><td>Course code</td><td colspan="5">PCC-CSE-206G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Principles of Operating System</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-4</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT 1:

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching. Thread: Definition, Various states, Benefits of threads, Types of threads, Multithreading.

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, SRTF, RR Scheduling.

UNIT 2:

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, and Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT 3:

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.
Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Optimal Page Replacement and Least Recently used (LRU).

UNIT 4:

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), efficiency and performance.
Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks. Case study on UNIX and WINDOWS Operating System.
Comparative Study of Latest Operating System: Evolution, Architecture and Characteristics of various Operating systems like MS-Windows, Ubuntu, Mac OS, Fedora, Solaris, Free BSD, Chrome OS, CentOS, Debian, Deepin

Suggested books:

- Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
- Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Suggested reference books:

- Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
- Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
- Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
- Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Outcomes:

CO1: Understand the structure and architectural components of OS to analyze and design the applications to run in parallel. Moreover, students would be able to develop scheduling algorithms to optimize various parameters like CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time for research purpose.

CO2: Understand the design issues associated with Operating system (e.g. Mutual exclusion, Deadlock detection etc.) to gain insight towards developing algorithms/techniques for efficient deadlock handling.

CO3: For a given specification of memory organization, develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4: Design and implement file management system for a given specification. Identify, use and evaluate the disk management policies with respect to various performance evaluation parameters.

Object Oriented Programming

<table>
<tr><td>Course code</td><td colspan="5">PCC-CSE-208G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Object Oriented Programming</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester-4</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">75 Marks</td></tr>
<tr><td>Total</td><td colspan="5">100 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

1. To understand how the C++ is superset of C by incorporating the Object oriented features in C language.
2. To apply the syntax and semantics of C++ Programming language.
3. To learn the designing of C++ classes.
4. To learn how to efficiently use the memory using Pointers and Dynamic Memory Management
5. To learn how to implement different types of constructors and the use of destructor.
6. To learn how to implement the concept of data abstraction and encapsulation.
7. To learn how to perform different types of overloading i.e. operators and functions.
8. To learn how inheritance helps to reuse the code.
9. To learn how we can implement dynamic binding with polymorphism.
10. To learn the use of exception handling in C++ programs.
11. To learn how to design and use of generic classes with templates.

Unit - I

Object-Oriented Programming Concepts: Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging.

Classes and Objects: Specifying a class, creating class objects, accessing class members, access specifiers, static members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes.

Unit - II

Inheritance: Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors.

Pointers and Dynamic Memory Management: Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using new and delete operators, pointer to an object, this pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures.

Unit - III

Constructors and Destructors: Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initializer lists.

Operator Overloading and Type Conversion: Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type.

Virtual functions & Polymorphism: Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract clasess, virtual destructors.

Unit - IV

Exception Handling: Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions.

Templates and Generic Programming: Template concepts, Function templates, class templates, illustrative examples.

TEXT BOOKS, AND/OR REFERENCE MATERIAL:

1. BjraneStroustrup, “C++ Programming language”,3rd edition, Pearson education Asia(1997)

2. LaforeR.”Object oriented Programming in C++”,4th Ed. Techmedia,New Delhi(2002).

3. Yashwant Kenetkar,”Let us C++”,1stEd.,Oxford University Press(2006)

4. B.A. Forouzan and R.F. Gilberg,CompilerScience,”A structured approach using C++” Cengage Learning, New Delhi.

Course Outcomes

After the completion of the course, the students will

- Understand the concept of Object Oriented Programming through C++.
- Identify importance of object oriented programming and difference between Procedural programming and object oriented programming features.
- be able to make use of objects and classes for developing programs.
- be able to use various object oriented concepts to solve different problems.
- be able to develop the programs /Projects using some advanced features of C++ Programming.

ORGANIZATIONAL BEHAVIOUR

Course code	HSMC-02G				
Category	Humanities and Social Sciences includingManagementcourses				
Course title	ORGANIZATIONAL BEHAVIOUR				
Scheme and Credits	L	T	P	Credits	Semester 4
	3	0	0	3	
Branches (B. Tech.)	Common to all branches				
Class work	25				
Exam	75				
Total	100 Marks				
Duration of Exam	03 Hours				

The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

SYLLABUS

UNIT - 1

Introduction of Management- Meaning, definitions, nature of management; Manageriallevels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Difference between management and administration.

UNIT - 2

Introduction of organization:- Meaning and process of Organization, Management v/s Organization; **Fundamentals of Organizational Behavior:** Concepts, evolution, importance andrelationship with other Fields; Contemporary challenges and opportunities of OB. **Individual Processes and Behavior**-**Personality**- Concept, determinants andapplications; **Perception-** Concept, process and applications, **Learning**- Concept (Brief Introduction) ; **Motivation-** Concept, techniques and importance

UNIT - 3

Interpersonal Processes- **Teams and Groups**- Definition of Group, Stages of groupdevelopment, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict-** Concept, sources, types, management of conflict; **Leadership:** Concept, function, styles & qualities of leadership. **Communication –** Meaning, process, channels of communication, importance and barriersof communication.

UNIT 4

Organizational Processes: Organizational structure - Meaning and types oforganizational structure and their effect on human behavior; **Organizational culture -** Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

Course Outcomes: By the end of this course the student will be able to:

1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change

Suggested Books:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.

2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, OrganisationalBehaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding OrganisationalBehaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., OrganisationalBehaviour, Prentice Hall of India, New Delhi.
7. GhumanKarminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications-New Delhi

Web Technologies

Course code	LC-CSE-210G				
Category	Professional Core Course				
Course title	Web Technologies				
Scheme and Credits	L	T	P	Credits	Semester 4
	3	0	0	3	
Branches (B. Tech.)	Computer Science and Engineering				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objectives of the course:

- To impart the basic concepts of Web Technologies
- To understand various client side technologies
- To create web pages
- To create dynamic applications on web through server side technologies

Detailed contents:

Unit 1:

Introduction: Concept of Internet- History of Internet, Protocols of Internet, World Wide Web, URL, Web Server, Web Browser.

HTML and CSS: History of HTML, Structure of HTML Document: Text Basics, Document: Images and Multimedia, Links and webs, Document Layout, Cascading Style Sheet: Need for CSS, introduction to CSS, basic syntax and structure using CSS, inline, internal and external CSS

Unit 2: XML: Introduction of XML- Some current applications of XML, Features of XML, Anatomy of XML document, structuring data, XML namespace, Document Type Definitions and Schemas, Document object model, DOM methods, XSL, SAX, SOAP

Unit 3: **PHP:** PHP Introduction, Structure of PHP, PHP Functions, String processing and regular expression, viewing client/server environment variable, form processing, Connecting to a database, cookies, operator precedence

Unit 4:AJAX: AJAX with PHP, PHP Code and the Complete AJAX Example, AJAX Database, Working of AJAX livesearch with PHP, Ajax PHP Database Form, AJAX PHP MySQL Database, connect, create DB, create table, insert data, select query

Suggested books:

1. Steven Holzner,"HTML Black Book", Dremtech press.
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications : Concepts and Real World Design, Knuckles, Wiley-India
4. Internet and World Wide Web How to program, P.J. Deitel& H.M. Deitel Pearson.

Suggested reference books:

1. Paul Deitel , Harvey Deitel, Abbey Deitel ,"Internet and world wide web – How to Program", Prentice Hall

Course outcomes

- For a given conceptual problem student will able to understand the basic process of Web Technologies and their application domains
- For a given problem the student will able to analyze the problem and select which technique is most suitable for developing a website.
- The knowledge of various techniques will enable student to implement in these dynamic techniques using various tools to make interactive web pages.
- Student will able to write a program using these technologies to implement the basic concepts of web.

Operating System Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-212G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Operating System Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 4</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Contents:

1 Introduction to UNIX File System.

2. File and Directory Related Commands in UNIX.

3. Essential UNIX Commands for working in UNIX environment.

4. I/O Redirection and Piping

5. Introduction to VI Editors.

6. Introduction of Processes in UNIX

7. Communication in UNIX and AWK.

8. Introduction of the concept of Shell Scripting.

9. Decision and Iterative Statements in Shell Scripting.

10. Writing the Shall Scripts for unknown problems.

Suggested Books:

1. UNIX Shell Programming by YashavantKanetkar.
2. UNIX Concepts and Applications by Sumitabha Das

Course Outcomes.

Co1: Understand the structure and architectural components of UNIX Operating System to analyze and design the problem. Moreover, students would be able to know the Basic Introduction of UNIX Operating System.

Co2: Basic Introduction of UNIX Commands that are used for operating the UNIX.

Co3: Introduction of Shell Scripting and VI Editor.so that the students get familiar with writing the UNIX scripts in UNIX editor.

Co4: Students will establish themselves as effective professionals by solving real problems with UNIX Shell Scripting knowledge and with attention to teamwork, critical thinking and problem solving skills by Writing Shell Scrips of unknown problems

Object Oriented Programming Lab Using C++

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-214G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Object Oriented Programming Lab Using C++</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 4</td></tr>
<tr><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Contents:

1. [Classes and Objects] Write a program that uses a class where the member functions are defined inside a class.
2. [Classes and Objects] Write a program that uses a class where the member functions are defined outside a class.
3. [Classes and Objects] Write a program to demonstrate the use of static data members.
4. [Classes and Objects] Write a program to demonstrate the use of const data members.
5. [Constructors and Destructors] Write a program to demonstrate the use of zero argument and parameterized constructors.
6. [Constructors and Destructors] Write a program to demonstrate the use of dynamic constructor.
7. [Constructors and Destructors] Write a program to demonstrate the use of explicit constructor.
8. [Initializer Lists] Write a program to demonstrate the use of initializer list.
9. [Operator Overloading] Write a program to demonstrate the overloading of increment and decrement operators.
10. [Operator Overloading] Write a program to demonstrate the overloading of binary arithmetic operators.
11. [Operator Overloading] Write a program to demonstrate the overloading of memory management operators.
12. [Inheritance] Write a program to demonstrate the multilevel inheritance.
13. [Inheritance] Write a program to demonstrate the multiple inheritance.
14. [Inheritance] Write a program to demonstrate the virtual derivation of a class.
15. [Polymorphism] Write a program to demonstrate the runtime polymorphism.

16. [Exception Handling] Write a program to demonstrate the exception handling.
17. [Templates and Generic Programming] Write a program to demonstrate the use of function template.
18. [Templates and Generic Programming] Write a program to demonstrate the use of class template.

Web Technologies Lab

<table>
<tr><td>Course code</td><td colspan="5">LC-CSE-216G</td></tr>
<tr><td>Category</td><td colspan="5">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="5">Web Technologies Lab</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester 4</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Branches (B. Tech.)</td><td colspan="5">Computer Science and Engineering</td></tr>
<tr><td>Class work</td><td colspan="5">25 Marks</td></tr>
<tr><td>Exam</td><td colspan="5">25 Marks</td></tr>
<tr><td>Total</td><td colspan="5">50 Marks</td></tr>
<tr><td>Duration of Exam</td><td colspan="5">03 Hours</td></tr>
</table>

Contents:

HTML :

1. Simple HTML using
   a. Heading elements
   b. Text Elements
   c. Logical Styles
   d. Physical Styles
   e. Ordered , Unordered and Definition list
2. Hyper Links
   a. Image Link → Link to page containing Images and Videos
   b. File Link
   c. Single Page Link
3. Using Frames
   a. Navigation Frame
   b. Floating Frame
   c. Inline Frame
4. Registration Form with Table

CSS:

Inline Style , Internal Style ,and External Style Sheets

XML :

1. Create a any catalog
2. Display the catalog created using CSS or XSL

PHP:

1. File operation
2. Regular Expression, Array, Math, String, Date functions

MC-106G : (ENVIRONMENT SCIENCE)

Course code	MC-106G				
Category	Mandatory Course				
Course title	Environmental Sciences				
Scheme and Credits	L	T	P	Credits	Semester 4
	3	0	1	0	
Branches (B. Tech.)	Common For All Branches				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Theory 75 Marks Field Work 25 Marks (Practical/Field visit)

Unit-1 The Multidisciplinary nature of environment studies. Definition, scope and importance. (2 lecture)

Unit-2 Natural Resources :

Renewable and non-renewable resources :

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non-renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

* Role of an individual in conservation of natural resources.

* Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit-3 Ecosystems :

* Producers, consumers and decomposers.
* Energy flow in the ecosystem.
* Ecological succession.
* Food chains, food webs and ecological pyramids.
* Introduction, types, characteristic features, structure and function of the following eco-system :

a. Forest ecosystem.

b. Grassland ecosystem.

c. Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit-4 Biodiversity and its conservation

* Introduction - Definition : Genetic, Species and ecosystem diversity.
* Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
* Biodiversity at global, National and local levels.
* India as a mega-diversity nation.
* Hot-spots of biodiversity.
* Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
* Endangered and endemic species of India.
* Conservation of biodiversity : In-situ and ex-situ conservation of biodiversity.

(8 lectures)

Unit-5 Environmental pollution :

Definition, causes, effects and control measures of :

a) Air pollution.

b) Water pollution

c) Soil pollution

d) Marine pollution

e) Noise pollution

f) Thermal pollution

g) Nuclear hazards

* Solids waste management: causes, effects and control measures of urban and industrial wastes.
* Role of an individual in prevention of pollution.
* Pollution case studies.
* Disaster management : floods, earthquake, cyclone and landslides.

(8 lectures)

Unit-6 Social issues and the Environment:

* From unsustainable to sustainable development.
* Urban problems related to energy.
* Water conservation, rain water harvesting, watershed management.
* Resettlement and rehabilitation of people : its problems and concerns case studies.
* Environmental ethics : Issues and possible solutions.
* Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
* Wasteland reclamation.
* Consumerism and waste products.
* Environment Protection Act.
* Air (Prevention and Control of pollution) Act.
* Water (Prevention and Control of pollution) Act.
* Wildlife Protection Act.
* Forest Conservation Act.
* Issues involved in enforcement of environmental legislation.
* Public awareness. (7 lectures)

Unit-7 Human population and the Environment.

Population growth, variation among nations.

Population explosion- Family Welfare Programme.

Environment and human health.

Human Rights.

Value Education.

HIV/AIDS.

Woman and Child Welfare

Role of Information Technology in Environment and human health.

Case Studies. (6 lectures)

Unit-8 Field Work :

* Visit to a local area to document environmental assets - river/forest/grassland/hill/mountain.
* Visit to a local polluted site-urban/Rural/ Industrial/ Agricultural.
* Study of common plants, insects, birds.
* Study of simple ecosystems- pond, river, hill slopes, etc. (Field work equal to 10 lecture hours).

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Pub. Ltd. Bikaner.
2. Bharucha, Frach, The Biodiversity of India, MApin Publishing Pvt. Ltd. Ahmedabad-380013, India, E-mail : mapin@icenet.net (R).
3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw Hill Inc. 480p.
4. Clark R.S., Marine pollution, Slanderson Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai 1196 p.
6. De A.K., Environmental Chemistry, WileyEastern Ltd.
7. Down to Earth, Centre for Science and Environment (R).
8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute, Oxford Univ. Press, 473p.
9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural HistorySociety, Bombay(R).
10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge Uni. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.
12. Mackinney, M.L. & Schoch, RM 1996, Environmental Science systems & solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Mayyer Hazardous, Tekchno-Science Publications (TB).
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB).
15. Odum, E.P. 1971, Fundamentals of Ecology. W.B. Saunders Co. USA, 574p.
16. Rao M.N. & Datta, A.K. 1987 Waste Water Treatment. Oxford & TBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma, B.K. 2001, Environmental Chemistry, Goal Publ. House, Meerut.
18. Survey of the Environment, The Hindu (M).
19. Townsend C., Harper J. and Michael Begon. Essentials of Ecology, Blackwell Science (TB).
20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Comliances and Standards, Vol. I and II Enviro Media (R).
21. Tridevi R.K. and P.K. Goal, Introduction to air pollution, Techno Science Publications (TR).
22. Wagner K.D., 1998, Environmental Management, W.B. Saunders co. Philadelphia, USA 499p.
23. Atext book environmental education G.V.S. Publishers byDr. J.P. Yadav.

(M) Magazine

(R) Reference

(TB) Textbook

The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory: 75 marks, Practical/ Field visit : 25 marks. The structure of the question paper will be :

Part- A: Short Answer Pattern	:	15marks
Part- B : EssayType with inbuilt choice	:	60marks
Part-C : Field Work (Practical)	:	25marks

Instructions for Examiners :

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.