Branch: Civil Engineering. **Year: Fourth.** **Semester: Seventh**

SL. NO.	COURSE NO.	SUBJECT	PERIOD			EVALUATION SCHEME					
Theory			L	T	P	Sessional Examination			ESE	Subject Total	Credit
						TA	CT	Total			
1.	CE 711	Theory of Structures-III.	3	1		50	25	75	100	175	4
2.	CE 712	Design of Structures-III.	3	1		50	25	75	100	175	4
3.	CE 713	Civil Engineering Planning.	3	1		50	25	75	100	175	4
4.	CE 714	Irrigation Engineering.	3	1		50	25	75	100	175	4
5.	CE 715	Elective-I.	3	1		50	25	75	100	175	4
6.	CE 716	Elective-II.	3	1		50	25	75	100	175	4
7.	CE 717	Training.			2					*	2
8.	CE 718	Project-I.			8					**	4

Total			18	6	10	

Total marks: 1200 Total Periods: 34 Total Credits: 30

TA: Teachers assessment. *CT: Class Test.* *ESE: End Semester Examination.*

Electives: -

Civil Engineering: Elective-I: Open channel Flow/ Advanced Engineering Geosciences/ Environmental Geotechnics.

Elective-II: Elements of Remote Sensing/ Earthquake Engineering.

* Training Report : 20 Marks.
Seminar+Viva : 30 Marks.

** Project-I : TA : 40 Marks.
Report : 30 Marks.
Seminar+Viva : 30 Marks.

THEORY OF STRUCTURES – III

SUB CODE: CE 711

Theory- 100.

Sessional – 75.
Time- 3 hrs.

1. Unsymmetrical bending:
Principal moment of inertia, Stress in beams due to unsymmertic bending, Location of Neutral axis.

2. Moving Loads and Influence lines:
Application to determinate structures-Beam, Truss, 3-hinged arch, Suspension Bridges.

3. Muller-Breslau's Principles:
Influence lines for support reactions, bending moment, shear force in propped cantilever, two span continuous beams and for two hinged arch.

4. Analysis of frames:
Moment Distribution Method, Slope Deflection method, Kani's Method with and without lateral sway.

5. Introduction to Stiffness Method.

6. Analysis of Curved Beam on horizontal plan.

7. Dynamic Analysis:
Introduction, Degrees of freedom, Damping, Free Vibration, Natural frequency, Forced vibration, Simple Structures with single and two degrees of freedom.

8. Plastic Method of Analysis:
Introduction, plastic moment of inertia, plastic section modulus, characteristic of plastic hinge, concept of Moment Redistribution, Static and kinematic method, combined mechanism for plastic collapse loads of beams, single bay two storey and two bay two storey portal frames, simple pitch roof frame, deflection at point of collapse.

SEVENTH SEMESTERS

DESIGN OF STRUCTURES–III

Theory- 100.
Sessional- 75.
Time- 4 hrs.

FIRST HALF

1. **Prestressed concrete:**
   Concept of Prestressing materials for Prestressed concrete, I.S. specifications; Analysis of Prestress-resultant stress at section, Thrust line, load balancing concept, stress in tendons. Design of simple section.
2. **Buildings:**
   I.S. specifications for loadings, stair cases, Multi-bay multi storey frame, Flat slab.

3. **Water Tank:**

   Circular and rectangular tanks, Intze type tank, column-brace type staging.

4. Beams curved in plan, circular raft foundation.

SECOND HALF

5. **Elevated steel water tank:**

   Rectangular pressed steel tank, staging and footing.

6. **Plate girder and Gantry girder.**

7. **Industrial Building:**

   Elements of an industrial building, structural framing, Bracing.

8. **Tubular structures:**

   Behaviour of tubular sections, combined stresses, connections.

SENENTH SEMESTER
CIVIL ENGINEERING PLANNING
SUB CODE: CE 713

Theory-100.
Sessional-75.
Time-3 hrs.

Introduction- Planning need, history and dynamics in Development planning.

National Development in context of five year Plan, Planning Commission.

Social, economic and Physical Planning, Regional Planning, Planning for Rural Development.

Urbanization- Historical,

Need for Services, Bye-laws.

Zoning Regulations.

Building Bye-laws: Bye laws for Residential, Commercial other buildings (as per GMDA)

Regarding area, height, Set back, ventilation, lighting, drainage Water Supply etc.

Procedure for receiving permission for construction.

Basic Principles of Buildings Planning, Aspect, Prospect, Orientation, ventilation, Lighting, Circulation, Horizontal & Vertical transportation.

Planning of Building and Colony. Site Selection, Sizes of parts of building, Practical considerations. Introduction and Application of Vastu principles in Planning.

Planning & Drawing Practical (6 hrs. Practical)-

Conceptual planning and planning details of Residential, Commercial Office, Institutional, Industrial buildings, Colony Planning.

SEVENTH SEMESTER

IRRIGATION ENGINEERING

SUB CODE: CE 714

Theory - 100.
Sessional - 75.
Time- 3 hrs.

Introduction:
Definition, aim, necessity, benefits and ill effects of irrigation; irrigation development in India – its status in North East, types of irrigation – advantages and disadvantages, irrigation schemes.

Soil – water plant relationship:
Soil water classifications, field capacity, wilting point, available moisture; soil fertility manure and fertilizer; crop rotation, functions of soil water.

Water requirement of crops:
Crop seasons, consumptive use – evapotranspiration, measurements, command area, delta, duty, base period kor depth, kor period, irrigation requirements, depth and frequency of irrigation, factors effecting water requirements, principal crops of India.

Water application methods:
Surface irrigation – various methods, sub surface irrigation – drip irrigation, sprinkler irrigation, advantages and disadvantages of different methods.

Flow irrigation:
Sources and systems of flow irrigation, irrigation canals – classification, alignment, networks. Inundation canal, canal losses, canal lining – functions, advantages, types, lining materials, maintenance of irrigation canal.

Lift irrigation:
Types, sources, advantages and disadvantages, well irrigation – comparison with canal irrigation, types and construction of wells; lift canal irrigation, Lifting devices – pumps their selection.

Canal Design:
Canal section and bed slope, design of lined and rigid boundary canal – Manning's equation; design of alluvial canals – Kennedy's and Lacey's Silt theories, their limitations and draw backs, design procedures,

Canal Headworks:
Layout and components of storage and diversion head works, descriptive studies of dams, weirs, barrage, spillways and head regulator, sill excluder.

Regulation works :
Canal falls – necessity, location, various types; regulators, silt control devices, canal outlet and escapes.

Cross drainage works:
Necessity, types – aqueducts, superpassages, level crossing, selection of suitable types.

Water Logging and land reclamation:
Water logging – causes, ill effects and preventive measures; reclamation of water logged land – surface and sub surface drains.

SEVENTH SEMESTER

A. OPEN CHANNEL FLOW

SUB CODE: CE 715 (ELECTIVE – I)

Theory – 100.
Sessional- 75.

Time -3 hrs.

Basic Principles:
Open channel, types and section elements. Classification of flow, basic equations, velocity co – efficient, pressure distribution, specific force.

Uniform flow in rigid – boundary channels:
Boundary shear, flow over scattered roughness elements, chezy's equation, Mannig's equation, other resistance formulae, equivalent roughness, channel conveyance, section factor – curves for rectangular and trapezoida channels, flow in a circular channel, relation between conveyance and depth.

Uniform flow in mobile – boundary channels:
Incipient motion condition, regimes of flow, resistance to flow in alluvial streams.

Design of channels:
Rigid – boundary channels, non scouring erodible boundary channels, alluvial channels, free board in channels.

Energy Depth Relationship:
Specific energy, critical depth, specific energy curve, critical depth computation, control section, application of specific energy and critical depth concepts. Channel transitions.

Gradually Varied flow:
Governing equation and its limitations, water surface profiles – classification and characteristics; flow profiles on mild, steep, critical, horizontal and adverse slopes, computation of G.V.F. in prismatic and non prismatic channels, by Direct step method and by numerical method, delivery of channels.

Rapidly Varied Flow Hydraulic jump:
Types of jump, hydraulic jump in horizontal and sloping rectangular channels, location and length of jump on horizontal floor, forced hydraulic jump, jump in expanding rectangular channels. Energy loss and application of hydraulic jump.

Channel control and transitions :
Free overfall, sharp crested weirs, flow over spillways, broad – crested weirs, side weirs, sluice gate, standing wave flume, subcritical flow transitions, supercritical flow transitions, flow in bends.

Unsteady flow :

Waves and their classification, celerity of a wave, surges, equations of motion, Introduction to Dam Break Flood, method of characteristics and finite difference.

SEVENTH SEMESTER

B. ADVANCED ENGINEERING GEOSCIENCES

SUB CODE: CE 715 (ELECTIVE – I)

Theory – 100.

Sessional – 75.

Time - 3 hrs.

GROUP – A
(GENERAL GEOSCIENCES)

Definition and role of geosciences in the field of civil engineering.

Rock:
Engineering properties of rocks, Defects in rock masses, Engineering classification of Rocks.

Soil:
Process of soil formation, soil profile, mineralogy of soils, types of bonds, engineering properties of clay minerals, typical soil deposits with special reference to North – East India.

Quarrying and Mining: Definition, methods of quarrying and mining and some related problems.

Basic concept of land from evaluation.

GROUP – B

(ENVIRONMENTAL GEOSCIENCES)

Definition and scope of environmental geosciences in of civil engineering.

Seismicity: Definition and causes of earthquakes, seismic waves and their mode of propagation, Intensity and magnitude of earthquake, seismic belt, seismic risk, prediction and mitigation of Earthquake, recent concept and scope of paleoseismicity in earthquake prediction.

Land – Slide: Types, causes and prevention of land – slides.

Flood: Definition, causes of floods, flood plain development, Role of flood in the development of landform.
Simple idea of environmental pollution, Environmental impact of quarrying and mining.

LABORATORY WORKS:

Study of advanced geological maps, bore hole problems, earthquake fault – plane solutions.

Structural models.

SEVENTH SEMESTER
C. ENVIRONMENTAL GEOTECHNICS
SUB CODE: CE 715 (ELECTIVE – I)

Theory – 100.

Sessional – 75.

Time - 3 hrs.

Introduction to Environmental Geotechnics; Contaminated Land; Source, Production and classification of waster, Environmental Effects on Geotechnical problems, Soil – Pollutant Interactions; Waste Disposal Facilities – site selection and Design, Waste Devices, Geotechnical Application of Fly Ash and other Industrial Wastes.
Geotechnical aspects of Geo – environmental hazards: Earthquake, types of wave generated and their effects, meaning of response spectra and seismic coefficient, liquefaction phenomena and remedial measures.

Books :

Daniel, D.E. (1993) Geotechnical practice for waste Disposal, Chapman and Hall, London.

Dutta, S. (2002) Environmental Treatment Technologies for Hazardous and Medical Wastes. Remedial scope and efficiency, tata McGraw Hill.

Raju, V.S., Datta, M., Seshadri, V., Agarwal, V.K. and Kumar, V. (1996) : Ash Ponds and Ash disposal systems, Norosa publishing House.
Soil Dynamics : Shamsher prakask, McGraw – Hill Book company

SEVENTH SEMESTER

ELEMENTS OF REMOTE SENSING
SUB CODE: CE 716 (ELECTIVE – II)

Theory –100.
Sessional – 75.
Time- 3 hrs.

Introduction to remote sensing: Principles, Electromagnetic Radiation. Interaction mechanisms. Ideal and practical remote sensing system. Advantage and Disadvantage of remote sensing over conventional methods. Reference Data Spectral signature.

Platform and sensors for remote sensing. Terrestrial and Aerial platforms, space platforms – Landsat, spot. IRS. Characteristics of various sensor photo theodolite, aerial camera, MSS, RBV, TM, HRV and LISS system Radiometers.

Characteristics and use of various data product – B& W, coloured and Infrared photographs, photomosaic, orthophotograph, B&W satellite imageries, F.C.C., high-density tapes, CCT

Interpretation and analysis of R.S. data: Visual interpretation – interpretation element and key. Interpretation equipments Digital image processing – advantage over visual techniques. Components of image processing system D.I.P. techniques. supervised and unsupervised classification .

Application of Remote sensing to Water Resource Development: Fundamental analysis of Landforms, Geomorphology, drainage characteristics, soil type erosional features, Land use, Vegetal cover, pollution studies, Ground water studies, flood plain Mapping, Application to highway planning and engineering.

Geophysical information system: Basic concept, components usefulness and application area.

SENENTH SEMESTER
EARTHQUAKE ENGINEERING
SUB CODE: CE 716 (ELECTIVE-II)

Theory-100.
Sessional-75.
Time-3 hrs.

Introduction

Earthquake- Magnitude and Intensity; Ground Motions.
Wave Propagation: Parameter- Peak Ground Acceleration, velocity and Displacement, Epicentre & Hypocentre, Focus of Earthquake.
Recording of Ground Motions sensors.

Industry Structural dynamics SDOF systems; Equation of Motions; Free and Forced Vibrations; Damping; Response Spectrum; MDOF systems; Dynamics Properties; Modal Superposition Method; Practical Considerations. Equation of Motions; Free and Forced Vibrations; Numerical Methods, Approximate Methods Rayleigh's Method, Dunkerley's Method, Stodola Method.
Earthquake Analysis: Idealization of Structures: Equivalent Force Concepts; Equivalent seismic lateral loads using seismic coefficient method; Response Spectrum Analysis; Use of IS 1893-2002 for analysis and design of building structures.
Introduction to Design of Bridges, Dams, Industrial Structures and Retaining Walls.

Earthquake Resistant Construction

Earthquake Resistant Design Philosophy; Concept of ductility in structures; ductile detailing requirements; Codal Provisions for ductile detailing (specific reference to IS: 13920-1993).
Specific reference to IS: 4326 for earthquake resistant construction of buildings.
Earthquake-resistant features in non-engineered constructions and masonry structures; specific reference to IS: 13927 and IS: 13928-1993 may be made.

Earthquake geotechnical engineering

Site effects, Soil-structure interaction, Dynamics Properties of Soil, Dynamic Earth Pressure, Soil Liquifaction. Ground Improvement Techniques.
Earthquake Policy & Disaster Mitigation
Review of Damage during Past Earthquake Natural disaster mitigation,
Lessons from past disasters, social and economic aspects, preparedness,
Public policies and role of engineers.
Strategies for Quality Control
Vulnerability assessment of structures
Retrofitting and Strengthening of Buildings and Bridges
Seismic microzonation.

SEVENTH SEMESTER
PRACTICAL TRAINING

SUB CODE: CE 717

A Six Weeks Practical Training programs is compulsory. Each student has to undergo a training programme in a relevant field of Civil Engineering in a reputed organization. The student has to prepare a report on the work for which 20 marks are assigned. There shall be one presentation and viva on the work for which 30 marks are assigned.

SEVENTH SEMESTER
PROJECT-I

SUB CODE: CE 718

Under this Course, students of the class will be divided into groups of 2/3/4 students. Each group will be assigned a topic related to Civil Engineering field. The topic may be either experimental or theoretical. The group will work under one or more supervisor(s) from the Department and submit a report on the work. Each student will give a presentation on the project work before a panel of examiners.

7th semester BE(ME)

SL.No	Course No	SUBJECT	PERIOD			EVALUATION SCHEME					
Theory			L	T	P	Sessional/Exam. TA	CT	Total	ESE	Subject Total	Credit
1	ME 721	Mechanical Vibration	3	1	1	50	25	75	100	175	4
2	ME 722	Applied Thermodynamics – II	3	1	0	50	25	75	100	175	4
3	ME 723	Hydraulic Machines	3	1	0	50	25	75	100	175	4
4	ME 724	Heat Transfer – II	3	1	1	50	25	75	100	175	4
5	ME 725	Elective – I	3	1	0	50	25	75	100	175	4
6	ME 726	Elective – II (Open)	3	1	0	50	25	75	100	175	4
Practical/ Drawing/Design											
7	ME 727L	Practical Training	0	0	2			50		50*	2
8	ME 728L	Project – I	0	0	8					100**	4
Total			18	6	12					1200	

Total marks : 1200 **Total Periods: 36** **Total Credits : 30**

TA : Teachers Assessment *CT: Class test* *ESE : End Semester examination*

Electives : Mechanical Engineering

Elective – I : Refrigeration/Machine Tools

Elective – II : Computational Fluid dynamics and Heat Transfer/ Non Conventional Energy Systems

* Practical Training : Report = 20 marks ; Seminar + Viva = 30 marks

** Project – I : TA = 40 marks ; Report = 30 marks ; Seminar + Viva = 30 marks

ME 721 MECHANICAL VIBRATION(3-1-1)

Theory 100 Sessional 75 Time 3 Hrs

Chapter: 1 BASIC CONCEPTS (4 classes)

Introduction, importance, main causes of vibration, characteristics of vibration Harmonic Analysis, Beats, Periodic and non-harmonic excitation, mathematical models, Elements of a Vibratory System, lumped or Discrete parameter system, Continuous or Distributed parameter systems, Equivalent springs and dashpots.

Chapter: II UNDAMPED FREE VIBRATION; 5 classes, 2 tutorials

Introduction, Derivation of differential equation motion-energy method, Newton's 2nd law method, Rayleigh's method. Solution of differential equations of motion, Angular Oscillation- compound pendulum.

Chapter: III DAMPED FREE VIBRATION; 5 classes, 2 tutorials

Introduction, Viscous damping, free vibration with viscous damping – overdamped, critically damped and under damped system, critically damping co-efficient , Logarithmic Decrement, Coulomb damping, Structural damping, interface damping-comparisons

Chapter:IV FORCED VIBRATION (SINGLE DEGREE FREEDOM SYSTEM); 6 classes, 2 tutorials

Introduction , Forced harmonic vibration , magnification factor , resonance, Excitation due to unbalance – rotating reciprocating, vibration isolation force transmissibility , motion transmissibility.

Chapter:V SESMEIC INSTRUMENTS : 3 Classes, 1 tutorials

Introduction, vibrometer, accelerometer, phase distortion.

Chapter :VI SYSTEMS WITH TWO DEGREES OF FREEDOM -6 classes 2 tutorials

Introduction, Principal modes of vibration, modes shapes, Torsional Vibration, coordinate coupling- static and dynamic, Dynamic Vibration Absorber, Torsional Vibration Absorber, Pendulum type vibration Absorber, Generalized Co-ordinates

Chapter :VII MULTI DEGREE FREEDOM SYSTEMS -6 classes 2 tutorials

Introduction, equation of motion, matrix methods, orthogonality and principal mode of vibration, Approximate method of determining fundamental frequencies- Dunkerley's method, Rayleigh's method, Holzer's methods, method of matrix iteration.

Chapter :VIII WHIRLING MOTION AND CRITICAL SPEED 2 classes, 1 tutorial

Introduction, critical speed of a single rotors, multiple rotors.

Chapter : IX NOISE ENGINEERING 3 classes, 1 tutorials

Introduction, Subjective response to sound, sound spectra, types of sound fields, loudness of composite sound, Equivalent sound level, auditory effects of noise. Noise standards and limits, Major source-industries, Survey and measurement technique Industries noise control strategies.

Text Books

1. A.G. Ambekar, Mechanical Vibration & Noise Engineering. Prentice–Hall of India Pvt. Ltd.
2. Thomson W.T. Vibration Theory & Application, 2nd Ed. Prentice–Hall
3. Tse Morse Hankle- Mechanical Vibration Theory and Application. Prentice–Hall of India Pvt. Ltd, New Delhi
4. Church A H Mechanical Vibration John Wiley & Sons, Newyork

ME722: APPLIED THERMODYNAMICS – II(3-1-0)

Theory100 Sessional75 Time3Hours

Chapter 1 : Air Compressors Introduction; Reciprocating type – Single stage and multi-stage, Compression ratio and volumetric efficiency, effect of clearance, compressor efficiencies. Methods for improving thermal efficiencies. Compressor work and power. Intercooler and after-cooler. Rotary compressors – Classification, Centrifugal compressors – theory of operations, impeller and diffuser, impeller work; efficiency. Rotary Vs Reciprocating compressor. Introduction to axial flow compressors, charging and choking of compressors.

Chapter 2: Gas Turbine Introduction – gas turbine cycles – open and closed, Ideal and Actual cycles. Isentropic efficiencies and thermal efficiencies. Power output. Methods to improve thermal eficiencies; Gas turbine Vs I C Engines.

Chapter 3: Jet and Rocket propulsion *Introduction. Types of jet engines – turbojet, turboprop, ramjet, pulsejet. Analysis of turbojet engine cycle, thrust, jet thrust, propeller thrust, effective speed ratio, specific fuel consumption, thrust, impulse, performance. Types of rocket engines – solid propellants rockets, liquid propellants rockets, hybrid rockets, analysis of rocket propulsion, performance, comparison between jet and rocket propulsion.*

Chapter 4: Refrigeration Inroduction – Reversed Carnot cycle and air refrigeration cycles; COP; Capacity of a refrigerating unit. Vapour compression and vapour absorption cycles. Properties of refrigerants. Heat pump.

Chapter 5: Psychrometry Introduction; Psychrometric terms; Delton's law of partial pressures. Psychrometric processes. Psychrometric chart. Psychrometr.

Reference books:

1. *Applied thermodynamics --- T. D. Eastor and A McConkey, ELBS (Longman)*
2. *Thermal Engineering --- P. L. Ballaney.*

ME 723: HYDRAULIC MACHINES (3-1-0)

Theory-100 marks Sessional -75marks Time3 hours

Review of Euler equations of Turbo –machinery: Radial, axial and mixed flow machines. Impulse and Reaction machines. Specific speed, specific diameter, efficiency.

Turbines Pelton wheel, wheel diameter, jet diameter, bucket shape, size and number, speed control of Pelton wheel. Use of Pelton wheel and efficiency, specific speed and specific diameter range.

Francis –runner, flow and speed ratio, casing guide, vanes, flow control, speed control, runner shape variation with the change of specific speed. Draft tube, surge tank, penstock, cavitation.

Axial flow turbine and Kaplan turbine. Blade profile, specific speed, diameter change of blade, pitch, guide vane, flow control, cavitation characteristics, draft tube, speed control of Kaplan turbines.

Centrifugal pumps-single and multistage, radial and mixed flow pumps, vane pump, volute casing pump. Pump efficiencies-hydraulic efficiency, overall efficiency, loss in pump, speed ratio, efficiency. Pump characteristics- surging, cavitaion on pump. Priming of centrifugal pumps, self priming of pumps, multi stage pumps, runner, casing and stationary vanes.

Axial pump-specific speed, flow ratio, speed ratio characteristics, applications. Propeller pump, blade-shape and aerofoil analysis-lift and drag estimate of pressure rise and power requirements.

Fluid couplings, Hydraulic dynamometer, reciprocating pumps, Gear pumps

ME724: HEAT TRANSFER - II (3-1-1)

Theory: 100 Sessional: 75 Time: 3hours

A. Fundamentals of Convective Heat Transfer:

Introduction; The basic equations, the convective heat transfer co-efficient;

B. Forced convective systems:

Forced convection over a flat-plate (External flow), Heat transfer and temperature distribution for flow between parallel plates, Forced convection in circular tubes (Internal flow).

C. Free Convection:

Laminar boundary layer equations of free convection on a vertical flat-plate, concept of Grashoff number, Empirical correlations for vertical plates, horizontal plates, inclined surface, vertical and horizontal cylinders, spheres.

D. Heat exchanger analysis & design

Types; Overall heat transfer co-efficient. Fouling factor, LMTD methods of analysis, Effectiveness – NTU method. Pressure drop and pumping power, Aspects of design, double pipe heat exchanger; Shell and tube heat exchanger; Condensers, Optimization of heat exchangers.

F. Boiling and Condensation:

Boiling heat transfer phenomena, Boiling correlations, Laminar film-wise condensation on a vertical plate.

G. Convective mass transfer:

Convective mass transfer co-efficient; the concentration boundary layer. Analogy between momentum, heat and mass transfer, Convective mass transfer correlation, evaporation of water into air.

H. Dimensional analysis:

Application to free and forced convection; application to convective mass transfer.

Recommended books:

1. A basic approach to heat transfer – by M N Ožišik
2. Fundamentals for heat transfer – by Sachdeva
3. Heat transfer, by P.S. Ghoshdastidar, Oxford University Press

ME725 (Elective I): REFRIGERATION (3-1-0)

Theory: 100 Sessional: 75 Time: 3Hours

Refrigeration: Introduction, history, methods of refrigeration, Ice, Evaporation expansion of air, throttling of gas, vapour compression and absorption, steam jet, liquid gas, dry ice, units of refr. Difference between engine, refrigerator and heat pump.

Gas cycle refrigeration: Simple cycles – Carnot and Bell-Coleman; Regenerative & reduced ambient system;Air-craft refrigearting system - simple boot-strap, reduced ambient; Actual cycles, ramming; Advantages and disadvantages of DART.

Vapour Compression Systems: Analysis of simple cycles, representation of TS, pH plans; methods of improving COP; Deviations of actual cycles from theoretical cycles. Compound compression with liquid flash cooler, flash inter-cooler multiple systems – COP, power required, Ewing diagram.

Vapor Absorber Ref. System: Thermodynamical analysis of systems, Advantages and disadvantages, Components, Practical systems NHe Watt. Water LiBr, Electrolux systems, Calculations based on concentration; Properties of binary mixtures.

Non – Conventional Ref. System: Steam jet ref. Thermoelectric, Vortex tube refr. – merits and demerits and applications.

Refrigerants: Nomenclature, classification, desirable properties. Important refrigerants and their comparisons, selection of refrigerants.

Ref. Equipment: Brief introduction to compressors, condensers, expansion devices, evaporators; Piping , line valves, solenoid valves, oil separators, driers, filters, moisture indicators, purging and controls.

Application of Refrigeration: Production of dry ice, cascading, multi-staging domestic, commercial, industrial and medical, preservator of food-spoilage, methods of preservation, cold storage, preparing of insulating materials using in ref. Systems.

Recommended books:

1.Refrigeration and Air-Conditioning by Ahmedul Ameen, PHI

2. Refrigeration and Air-Conditioning by C.P.Arora, Tata McGraw Hill Publication.
3. Refrigeration and Air-Conditioning by M.Prasad

ME 726(Elective II): Computational Fluid Dynamics and Heat Transfer(3-1-0)

Theory100marks Sessional75marks Time3hours

FLUID DYNAMICS

Unit 1: The Basic Equations of Fluid Dynamics:

General form of a Conservation law: equation of mass conservation, conservation law of momentum, conservation equation of energy.

The dynamic levels of approximation:

The Navier-Stokes(NS) equation: The Reynold's averaged NS equation, The thin layer NS approximation, The parabolaised NS approximation, The boundary layer approximation The distributed loss model, The inviscid flow model, Euler equations, steady inviscid rotational flow, The potential flow model, small disturbance approximation of the potential equation, Linearised potential flow, singularity methods, mathematical nature of flow equations.

Basic discretization techniques:

(a)The finite difference method, (b)The finite volume method and conservative discretization.

Analysis and application of Numerical schemes:

Consistency, stability, convergence, Fourier and Von Neumann stability analysis, modified equation ,application of finite difference methods, to wave, heat. Laplace and Burger's equation.

Integration methods for systems of ODE:

Linear multi step methods, predictor-corrector schemes, ADI methods, The Runge-Kutta schemes.

Numerical solution of Euler Equations:

Mathematical formulation of the system of Euler equations, space-centered schemes, upwind shemes for the Euler's equation-Steger and warming flux vector splitting, Van Leer's flux splitting.

HEAT TRANSFER

Basics of finite difference and finite element methods: Numerical methods for conduction heat transfer, Numerical methods for convection heat transfer, Numerical methods for radiative heat transfer.

Reference Books:

1. Computational Fluid Mechanics and Heat Transfer—Hemisphere-Anderson, Tannehill, Pletcher.
2. Computational Heat Transfer-Hemisphere and Springer-Verlag-Jaluria and Torrance
3. Computational techniques for Fluid Dynamics-Verlag-Fletcher and Springer
4. Numerical Computation of Internal and External flows-John-Wiley-Charlse and Hirch

ME 727L: PRACTICAL TRAINING(0-0-2)

Sessional: 50 marks

Factory training for a period of 6 (six) weeks is compulsory for all the Mechanical Engineering Students and 20 marks are allotted for the Technical report submitted after completion of the training. There will be a seminar cum viva on the report submitted by the student and 30 marks are assigned for this. The report should be submitted to the HOD, by a date announced by the HOD. Students are to obtain a certificate from the Factory Authority regarding their attendance and performance during the training period which is to be submitted along with the report.

ME 728L: PROJECT – I(0-0-8)

Sessional marks: 100 Pass marks: 50

Under this course each student will be assigned a topic related to Mechanical Engineering. The project may be extended to Eight semester depending upon the quantum of works required for the project. The students will work under a faculty member and submit a report on the assigned project in a standard FORMAT prescribed by the department.

Branch: Electrical Engineering Year: Fourth Semester: Seventh

Sl No.	Course No.	Subject	Period			Evaluation Scheme					
	Theory		L	T	P	Sessional Examination			ESE	Subject Total	Credit
						TA	CT	Total			
1.	EE 741	Computer Aided Power System Analysis	3	1		50	25	75	100	175	4
2.	EE 742	Communication Engineering	3	1		50	25	75	100	175	4
3.	EE 743	Operations Research	3	1		50	25	75	100	175	4
4.	EE 744	Instrumentation Engineering	3	1		50	25	75	100	175	4
5.	EE 745	Elective -I	3	1		50	25	75	100	175	4
6.	EE 746	Elective-II	3	1		50	25	75	100	175	4
8.	EE 747	Training								50	2
9.	EE 748	Project -I		6						100	4
TOTAL			18	12		300	150	450	600	1200	30

Total Marks: 1200 **Total Periods: 30** **Total Credits: 30**

TA: Teachers' Assessment *CT: Class Test* *ESE: End Semester Examination*

Electives: Elective-I: Non-conventional Energy Sources/Digital System Design/Computer Networking
Elective –II: Microprocessor-based Instrumentation/Modeling and Simulation/ Illumination Engineering.

L T P

(3 1 0)

EE 741: COMPUTER AIDED POWER SYSTEM ANALYSIS

Full Marks: Theory =100
Sessional=75

Time=3 Hrs.

1. Network matrix :

Primitive network, bus incidence matrix, formation of Y-bus by singular transformation , networks with mutually coupled elements ,formation of Z-bus by matrix inversion , formation of Z-bus using the building algorithm – addition of a tree branch p to reference bus , addition of a link between buses p and q , addition of a link between bus p and reference bus .

2. Symmetrical components and unsymmetrical fault calculations:

Fortesque's theorem. Symmetrical components of an unbalanced 3- phase system: average power in terms of symmetrical components, sequence impedances, fault calculations, graphical method of determining swquence components, network equations. LG, LL, LLG faults. Effect of fault impedance on fault current. Sequence networks.

3. Fault and Contingency calculation:

Fault calculation using Z-bus and Ybus. Contingency analysis using Z-bus in superposition method, alternative method using Z-bus, use of Y-bus Table Factors for contingencies.

4. Load flow analysis :

Introduction , classification of buses , representation of transformers , Gauss Seidel iterative method using Ybus , N-R iterative method using Y-bus , approximation to the Jacobian in the NR method , Fast Decoupled L-F method , solution using Z-bus in the bus frame of reference . Calculation of power flows.

5. Power system stability:

Introduction. Dynamics of synchronous machine, swing equation. Power- angle curve. Steady- state and transient Stabilities. Equal area criterion. Calculation of power – angle curves for fault and post – fault conditions for various types of Fault; effect of reclosing. Numerical solution of swing equation.

Dynamic stability, automatic regulation, effect of excitation systems. Factors affecting stability.

L T P
(3 1 0)

EE 742: Communication Engineering

Full marks: Theory=100
Sessional=75
Time=3 Hrs.

1. **Properties of Fourier transform:**

Response of LTI systems – transfer functions and frequency responses. Correlation and spectral density – correlation of power signals, correlation of energy signals.

2. **Random signal theory :**

Random variable – cumulative distribution function, probability distribution function, statistical averages, standard deviation, Gaussian and Rayleigh PDF. Random processes – ensemble averages and correlation, stationary and ergodic process.

3. **Noise:**

Sources and characteristics of different noise, thermal and shot noise, concept of white Gaussian noise. Noise temperature, noise bandwidth and noise figure.

4. **Analog communication :**

Linear CW modulation –AM-DSB, AM –DSB /SC,AM-SSB/SC signals and spectra , generation and detection of AM , Exponential CW modulation –PM and FM signals , generation and detection of AM , and FM , Super heterodyne receivers .Frequency division multiplexing.

5. **Signal to noise ratio for different analog communication schemes:**

6. **Pulse Coded Modulation:**

PCM generation and reconstruction, quantization noise, non uniform quantization and compounding, signal to quantizing noise power ratio, Time Division Multiplexing.

7. **Digital Communication:**

ASK, PSK, FSK

EE744: INSTRUMENTATION

L T P
(3 1 0)

Full marks: Theory =100
Sessional =75
Time=3 hours

1 .**Introduction:**

Generalized approach to measuring systems. Function descriptions. Transducers- Active and passive, primary and secondary transducers. Input- output configuration of measuring instruments and Instrument systems.

2**. Generalized performance characteristics of instruments:**

Static characteristics- Accuracy, Precision, Errors, Uncertainty and Bias. Static sensitivity. Linearity.

3. **Sensors :**

Resistive pots, Strain gauges, LVDTs, capacitive transducers, piezoelectric transducers, Hall Effect transducers. Digital shaft position encoder, Ultrasonic transducers, Seismic sensors.

4. **Process Instrument**:

Measurement of temperature (RTD, thermistors, thermocouples, pyrometers). Measurement of Force and Pressure (Bellows, Bourdon tubes, Load cells, Diaphragm etc). Level measurement.

5**. Servo Components:**

Synchros, DC and AC servomotors, Tachogenerators, Stepper Motor.

6**. Signal conditioning**:

D.C. And a. c. signal conditioning circuits. Operational amplifiers. Instrumentation amplifier. Amplitude Modulation and Demodulation. Bridge circuits. Analog to digital (A/D) and Digital to Analog (D/A) converters.

7. **Data transmission and Telemetry**:

Methods of data transmission. D.C. Telemetry systems. A.C. telemetry systems. Modulation- Amplitude modulation (A.M), Frequency modulation (F.M), Phase modulation, pulse amplitude modulation (PAM), Pulse duration modulation (PDM).

8. **Introduction to the optical, Ultrasonic, radio isotopes and laser based Instrumentation systems.**

Books/References:

1) Measurement System Application And Design: Doeblin.E.O. (Tata McGraw)

2) Electrical measurements and measuring instruments: swahney.A.K (Dhanpat Rai)

3) Instrumentation, Measurement and Analysis

EE 743: Operations Research

L T P
3 1 0

Max. Marks = 100
Sessional Marks= 75

1. **Introduction and history of OR**:

Definition, Characteristics and limitations of OR, phases of OR.

2. **Concepts in probability and statistics:**

Continuous and discrete variables. Arithmetic mean, median, mode, Concepts of different types of probability distributions & their applications.

3. **Fields of application of linear programming**:

Mathematical formulation of LP. Graphical and Simplex method of solution of LP problems. Duality in LP. Sensitivity analysis.

4. **Transportation problem**:

Initial solution, optimal solution, degeneracy, alternate solution; North-West corner method. Vogel's approximation method.

5. **Assignment problem-**:

6. Integer programming problem:

7. **Waiting line models:**

Introduction & history. Basic structure & classification of waiting line problems, Queuing models. Assembly line balancing problem.

8. **Dynamic programming:**

Structure and characteristics of dynamic programming; principles of optimality, dynamic programming models- probabilistic and deterministic.

9. **PERT/CPM:**

Books:

1. Introduction to Operations Research- Hiller & Liberman.
2. Operations Research- Askhedkar % Gupta.
3. -----Do----------Hira & Gupta.
4. Introduction to OR- Gillett.
5. Operations Research- H.A. Taha

EE 748: Project-I (0-6-0)

Max Marks: 100, pass Marks: 40

In this subject, a project work has to be taken up on a relevant topic to be decided by the student in consultation with the supervisor. The project is to be done in a group, which may consist of two, three or four students. The project may be software, hardware or a study type one.

The students have to submit a project proposal and/or justify the relevance of the topic in a project proposal seminar at the beginning of the semester, after approval of which only a student can take up that project. The students also have to give a presentation of their progress in a seminar. At the end, the students have to submit a report and present their works in a seminar. A viva-voce examination will also be held at the end of the semester.

The distribution of marks for the project is as follows:

Seminar: 25 Viva: 25 Report: 50

EE 747: Training (0-2-2)
Max Marks: 50

In this, every student has to undergo industrial training during summer vacation just after sixth semester) for a period of 4 weeks. For this, the student has to get prior approval from the department. At the end of the training, a student has to submit a report to the department, which will be evaluated by the faculty members of the department.

EE 745/IE753: Computer Networking (Elective)

4-1-0

Max Marks: 100
Sessional: 75
Time: 3 hours

Introduction to computer networks and layered architecture overview, Packet switching and fast packet switching.

Point to point protocols and Links: ARQ retransmission strategies. Selective repeat ARQ. Framing and standard data link control protocol-HDLC, SDLC, LAPD. Queuing models in communication networks.

Multi-access communication & multiple access protocols: ALOHA, slotted ALOHA, CSMA, CSMD/CD. Performance modeling & analysis.

Local area networks: Ethernet, Token ring, and FDDI. Design & analysis.

Internetworking issues: Bridges, Routers and Switched networks. Routing & Flow Control Algorithms in data networks.

Broadband Networks: ATM, Frame relay & gigabit Ethernet, Traffic management in ATM networks.

Security & reliability of Networks.

Books:

1) Data Networks, R G Gallager, PHI
2) Data & Computer Communication, W stallings, PHI.
3) Multiple Access Protocols, R Rom & M Sidi, Springer verlag.

EE 745/IE 753: Digital System Design (Elective) (4-1-0)

Max Marks: 100
Sessional: 75
Time: 3 hours

1. Counter Design: Changing the counter modulus; Decade counters; Pre-settable counters; Counter design as a synthesis problem.

2. Design of Sequential circuits: State machine design using Moore and Mealy model; State transition diagram and preparation of state synthesis table. Derivation of design equation from state synthesis table using Karnaugh map.
   Circuit implementation: flip-flop based approach and ROM based approach.
   State reduction techniques,Analysis of asynchronous Sequential circuits, Problems specific to asynchronous sequential circuits, Design issues related to asynchronous Sequential circuits.

3. D/A conversion and A/D conversion, Variable, Resistor Networks.
   Binary ladders. D/A converters, D/A accuracy and resolution.
   A/D converter – simultaneous Conversion.
   A/D converter – Counter method.
   Continuous A/D conversion.
   Dual- slope A/D conversion.
   A/D Accuracy and Resolution.

4. A simple Computer Design
   Building blocks, Register Transfer language, Macro and micro operations, Design of control unit, programming computer.

Books:

1) Digital Logic & Computer Design, M.Morris Mano. (PHI)
2) Digital Principles and Applications – Malvino, Leach and saha (Tata McGrow Hill)

EE 745: Non-Conventional Energy Sources (Elective)

4-1-0

Max Marks: 100
Sessional: 75
Time: 3 hours

1) Introduction to Non conventional energy sources:-

Importance, primary & secondary energy sources, limitations to primary sources, various sources of non-conventional energy, renewable energy.

2) Solar Energy:-

Solar radiation, solar radiation angles, local solar time, solar collector-flat plate collector & solar concentrator, solar heater-water heater & air heater, solar cooker, solar distillation, solar energy storage- sensible heat storage & latent heat storage.

3) Photovoltaic Energy Conversion:-

Photovoltaic effect, equivalent circuit & V-I characteristics of PV cell, types of solar cell & their characteristics, effect of temperature, light intensity, cell-area & series resistance on PV cell, solar cell array & module and their configurations, specifications of PV module, PV system & their components, isolated & grid connected PV systems.

4) Wind Energy:-

Wind energy conversion, wind turbine rotor -classification, characteristics & analysis of ideal wind turbine rotor, power co-efficient, air foils, lift & drag forces, blade shape for ideal rotor, generalized rotor design procedure , wind turbine_ subsystems, components, design, power curve prediction, electrical aspects of wind turbine, grid connected wind turbine, wind farms, site selection.

5) Fuel Cell:-

Introduction, energy conversion principles, types of fuel cell, components of a fuel cell, polarization.

6) Energy from bio-mass:-
Introduction, Bio-mass conversion technologies, bio-gas generations, classifications of bio-gas plants, selection of site for bio-gas plant, utilization of bio-gas, thermal gasification of bio-mass.

7) Geo thermal Energy:-
Sources and use of geo-thermal energy, geo-thermal power plants, applications.

8) Energy from the ocean:-
Tidal power, components of tidal power plants, generation of tidal power, estimation of energy & power, ocean thermal energy conversion (OTEC)_ introduction, types, plants & their specifications.

9) Magneto Hydro Dynamic Generation:-
Principles of MHD generation, MHD generator, equivalent circuits, MHD system.

10) Combined Operation utilizing more than one source, composite systems.

Books:

1) G.D. Rai, Non conventional energy sources, Khanna publishers.
2) Thomas Markvart, Solar Electricity, John Willy & Sons.
3) A.C.Baker, Tidal Power, Peter Peargrenus Ltd.
4) G.N.Tiwari, Solar Energy_Fundamentals, design, modeling & application, Narosa Publishing House.

EE 746: Illumination Engineering (Elective)

4-1-0

Max Marks: 100
Sessional: 75
Time: 3 hours

1) **Radiation:-** Wavelength, frequency & velocity. The radiation spectrum. Radiations from black bodies & other sources.

2) **Entities in the illumination system and their units:-** Luminous sources, illumination, intensity, brightness, other terms and units. The inverse square law. The cosine law. Solid angle relation ship. Luminosity, relationship between brightness & luminosity for a perfectly diffusing source, illumination standards.

3) **The eye & vision:-** The structure of the eye, accommodation, aberration of the eye, the rods & cones, visual acuity, glare, color & color response of the eye.

4) **Light Sources & Their Characteristics:-** Day light incandescent, electric discharge(low & high pressure), fluorescent, are amps and laser beams, color rendering, wiring, switching & control circuits. Starters & ballast.

5) **Light Control:-** Reflection & reflection factor, absorption, transmission & transmission factor. Control of light by luminaries.

6) **Illumination & measurement:-** Illumination from point sources, light units in a row, area illumination, polar curves. Linear & surface sources, flat linear source, flat-strip of short length. Illumination of a vertical source. Radiant energy detectors, PV cell, Photo-tubes, Photometry, Electro-photometry, Photo cells, Spectro-photometer, Colorimeters.

7) **General Illumination & Design calculation:-** Interior lighting of industrial, residential & commercial buildings. Effective utilizations of daylight. Daylight factor, Outdoor lighting, Street, rail/shipyards, airports, sports area. Lighting design for signaling, advertising & security.

Books:

1) Cotton.H, Principles of Illumination, Chapman & Hall.
2) Boast. W.S., Illumination Engineering, McGraw-Hill.
3) IES Lighting Handbook, Illumination Engineering Society, New York.

EE 746/IE 754: Modeling & Simulation (Elective)

Max Marks: 100
Sessional: 75
Time: 3 hours

System models-entities, attributes, states, activities. Types of models. Static & Dynamic Models.

Deterministic & stochastic activities. Principles used in modeling. System simulation-continuous & discrete event simulation languages_GPSS, GIMULA, CSMP, DYNAMO. Probability concepts in simulation-random number & random variate generation stochastic processes, Birth – Death process, parameter estimation & input-output validation, Queuing systems_M/M/1 and M/M/C queues. Bulk arrival & Bulk service system. Inventory control & forecasting. Evaluation & Validation of simulation experiments.

Books:

1) Payer, T.A. : Introduction to Simulation, McgrawHill.
2) Gordon, G : System Simulation, PHI.
3) Law, A.M & W.D. Kelton : Simulation Modelling & Analysis, McgrawHill.

IE 754: Microprocessor Based Instrumentation (Elective)
(4-0-2)

Max. Marks=100
Lab/Sessional=75

Microprocessor interfacing, methods of data transfer, DMA, synchronization, polling and interrupt, LSI support chips for micro-processor, IEEE-488 interface, RS-232 interface, dedicated I/O controllers, programmable peripheral controllers, transducer interfacing, actuator interfacing, micro-processor based measurement of pulse width, frequency, voltage, rpm, pH, pressure, temperature etc., obtaining device characteristics(semiconductor devices) with micro-processor, micro-processor based scanner, data-logger, alarm enunciators, PID controller, programmable controller, analytical instruments such as gas chromatograph, Sequential control and interlock control, micro-processor based diagnostic systems.

Branch: Chemical **Year**: Fourth **Semester**: Seventh

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
Theory			L	T	P	Sessional Exam			ESE	Subject Total	Credit
						TA	CT	Total			
1	CH 781	Mass Transfer Operations-II	3	1		50	25	75	100	175	4
2	CH 782	Biochemical engineering	3	1		50	25	75	100	175	4
3	CH 783	Process Equipment Design	3	1		50	25	75	100	175	4
4	CH 784	Environmental Pollution Control Engineering	3	1		50	25	75	100	175	4
5	CH 785	Elective-I*	3	1		50	25	75	100	175	4
6	CH 786	Elective-II**	3	1		50	25	75	100	175	4
Practicals/Project											
7	CH 787	Factory Training			2					50^{+}	2
8	CH 788	Project-I			8					100^{++}	4
Total			18	6	10						

Total Marks: 1200 **Total Periods: 34** **Total Credits: 30**

TA: teachers assessment ***CT: Class Test*** ***ESE: End Sem Exam***

***Elective-I: CH 785** **(a) Food Processing and Preservation**
(b) Polymer science & engineering
****Elective –II: CH 786** **(a) Fluidization Engineering**
(b) Bio Separation
© Risk analysis & HAZOP

+ Factory Training:
Report: 20; Seminar cum viva: 30
++ Project-I:
Teachers assessment: 40; Report : 30; Seminar cum viva: 30

CH 781 Mass Transfer Operations-II

Theory : 100 marks
Sessional : 75 marks
Time : 3 hours

L – T – P
3 – 1 – 0

Extractions: Solid-liquid extraction (leaching): locus of underflow, choice and nature of solvents, single and multistage extraction, nature and composition of solids in solid-liquid extractions, graphical solutions
Liquid-liquid extractions: Ternary liq-liq equilibrium (right triangular and equilateral triangular diagram), choice of solvents, selectivity, single and multistage extraction, co-current and counter-current continuous extraction with and without reflux, cross-current extraction, multi-feed extraction, graphical calculations.

Distillation: Binary systems: Introduction, vapor-liquid equilibria, P-X-Y and T-X-Y diagrams, concept of volatility and effect of pressure and temperature on equilibrium data, ideal solutions, Raoult's Law as applied to distillation operations, deviation from ideality, minimum and maximum boiling azeotropic mixtures, enthalpy-concentration diagram and their characteristics.

Flash distillation, steam distillation, simple distillation, batch fractionation, continuous rectification, determination and number of stages, Ponchon-Savorit method and McCabe-Thiele method, multi-tray tower, concept of minimum, total and optimum reflux ration, reboilers, use of open steam, multiple feed, side product, partial condensers, cold. hot, circulating reflux.

Rectification of azeotropic mixtures, concept of azeotropic distillation and extractive distillation.

Continuous contact equipments like packed towers, sieve, bubble cap towers etc. Determination of number of transfer units and height of transfer units.

Multi-component systems: Vapor-liquid equilibrium data, definition ok K etc, ideal systems, limitations, key components, reflux, Lewis and Matheson calculation, liquid-vapor ratio, method of Thiele and Geoddes, enthalpy balances of conventional columns, determination of minimum reflux ratio for conventional columns.

Use of efficiencies: Modified Murphree and vaporization efficiency, determination of plate efficiency, concept of ASTM, TBP and molecular distillation.

Books:

1. R E Treybal: Mass transfer Operations, 3rd Ed, McGraw Hill Book Co.
2. C J Geankopolis, Transport Processes in chemical Operations, 4th ef. Prentice Hall India.
3. G G Brown: Unit Operations, CBS Publishers and Distributors
4. J M Coulson and J F Richardson, Chemical Engineering, Vol-II, 3rd Ed, Pergamom Press.
5. Badger and Banchero: Introduction to chemical engineering

6. McCabe and Smith: Unit operation of Chemical Engineering

CH 782 BIOCHEMICAL ENGINEERING

L – P – T
3 – 0 – 1
Theory : 100 marks
Sessional : 75 marks
Time : 3 hrs.

Application of bioprocess in different field.
Structure of cells.
Types of cell.
Chemicals of life :

- Lipids.
- Sugar & Polysaccarides.
- Nucleotides & RNA & DNA.
- Aminoacid & Proteins
- Hybrid bio-chemicals.

Simple enzyme kinetics with one and 2 substrates

- Michaclis – Menten kinetics.
- Kinetics for reversible reactions.
- Substrate activation & inhibition.
- Multiple substrate on single enzyme.
- Influence on enzyme activity.

- Enzyme deactivation.

Application of enzyme catalyst.

- Hydrolysis of starch & cellulose by hydrolytic enzyme.
- Medical application.
- Non hydrolytic enzyme.
- Immobilized enzyme technical & kinetic – brief overview.

Basic fermentation engineering.

- Media preparation, culture , sterilization
- Fundamental of molecular Genetics.

Transport Phenomena in bio process.

- Gas liquid transfer in cellular system.
- Heat transfer.

Kinetics in cell culture.

- Reaction.
- Kinetics of balance growth.
- Death kinetics.

Product recovery operation –
Recovery of particulate, product isolation, preparation, membrane separation, electrophoresis, ……. Operations.

Books:

1. Biochemical Engineering by Bailey, Mcgraw Hills.
2. Bioprocess Engineering-Basic Concepts by M L shuler and F Kargi, Prentice Hall India

CH7 83 PROCESS EQUIPMENT DESIGN

Theory : 100 marks
Sessional : 75 marks
Time : 3 hours

L – T – P
3 – 1 – 0

1. DESIGN OF PIPE FITTINGS AND JOINTS: Design and schematic of simple bolts and screws. Riveted joints. Design & Draw of shafts and couplings.

2. DESIGN OF REACTION VESSEL AND STORAGE TANK: Design and schematic of storage tank, (vertical and horizontal) supports, agitated vessel.

3. DESIGN OF HIGH PRESSURE SYSTEMS: Design of high pressure vessels and reactors.

4. DESIGN OF PHASE SEPARATION EQUIPMENT: Design of physical separation equipment such as cyclones, centrifuges, thickens filtration equipment KO drum.

5. **DESIGN OF HEAT TRANSFER EQUIPMENTS:** Design and Drawing of Heat Transfer Equipments such as heat exchangers with and without phase change, evaporators, crystalizers.

5. DRAWING OF PHASE SEPARATION EQUIPMENT: Drawing of physical separation equipments such as hydro-cyclones, packed towers, plate columns, electro static precipitators.

TEXTBOOKS:

1.L. E. Brownell and E.H. Young, "Process Equipment Design - Ves Design", Wiley Eastern Edn. New York, 1968.
2. R. H. Perry, "Chemical Engineers' Handbook", 7th Edn., McGraw Hill , N York, 1998.
3.M. V. Joshi, "Process Equipment Design", 2nd Edn. .Mac Millan Press, N Delhi, 1996.

4. Process Equipment Design-mechanical aspects; B C Bhattachrjee

REFERENCES:-

1. J. M. Coulson and J. F. Richardson, "Chemical Engineering.", Vol-VI, Pergam Press, New York, 1987.

CH784: ENVIRONMENTAL POLLUTION CONTROL ENGINEERING

L - T - P
3 - 1 - 0
Theory : 100 marks
Sessional : 75 marks
Time : 3 hours

- Man and Environment, Environmental Legislations.
- Water Pollution :

A. (i) Regulations on the discharge of industrial pollutants in water, threshold limits.
(ii) Types of waste water, sources of pollutants, classification of pollutants.
(iii) Site selection, sampling, preservation, water quality parameters and significance, monitoring, determination of BOD and COD.
(iv) Dissolved oxygen balance in water, self purification of a water system (Critical deficit of a runoff).

B. Some fundamental aspects of microbiology as applied to pollution control.

C. Control of Water Pollution :
(i) Basic approach to solve the problem.
(ii) Primary, secondary and tertiary treatment of waste water, clariflocculation, sludge disposal.
(iii) Treatment of phenolic waste water and also water containing N and P.
(iv) Control of heavy metal ions, As, Hg, Cr.

- Air Pollution :
(i) Concept of atmosphere, sources of air pollutants, classification and effects, air quality criteria and standard, methods of estimation of air pollutants, monitoring.
(ii) Meteorology and air pollution – lapse rate, plume types, stability, stack design, basic concept of dispersion.
(iii) Fundamental approach to air pollution control.
(iv) Control of particulates.
(v) Control of gaseous pollutants.

- Solid Waste Management : Types of solid wastes, sources and composition, methods of waste management – sanitary landfill, composting, incineration, pyrolysis, anaerobic digestion, concepts of recycling.
- Design of lagoons, oxidation pond, activated sludge process units, gravity settler, Rotating Biological Cyclone (RBC) separators, anaerobic digester, and stack for emission control.

- Noise Pollution : Sources of noise, levels permissible, impact of noise pollution, Noise Exposure Index (NEI), control methods of noise pollution.
- Case Studies (Sessional only) : Petroleum Refinery. Petrochemical Complex. Paper Mill. Automobile Pollution.

PRACTICALS :

- Determination of water quality parameters : pH, conductivity, Dissolved Oxygen, BOD and COD.
- Spectrophotometric and Gas Chromatographic analysis of air and water pollutants.
- Analysis of particulates and gaseous pollutants.

BOOKS :

1. G M Masters, Introduction to Environmental Engineering and Science, Prentice Hall India
2. Peavy, Rowe & Tchobanoglous, Environmental Engineering, McGraw-Hill.
3. Mahajan, S.P., Industrial Pollution Control, Tata McGraw-Hill.

CH 785 (b) Polymer Science and Engineering (elective-I)

Theory : 100 marks
Sessional : 75 marks
Time : 3 hours

L – T – P
3 – 1 – 0

1. Basics:
   - History
   - Formation
   - Classification
   - Methods of Polymer formation
2. Chemistry of Polymerization:
   - Step Growth
   - Chain Growth
   - Co-ordination
   - Zerigler-Natta catalyst
3. Kinetics of Polymerization
   - Free radical
   - Cationic and anionic polymerization
   - Poly Condensation

4.Molecular weight and molecular weight distribution

5. Structure of Polymer molecules:
   - Based on chemical composition- homo and co-polymer
   - Based on geometrical structure of chain
   - Structural Model- Random Coil, fringed mecellar model, spherulites
6. Physical States and transitions:
   - Amorphous and Crystalline
   - Conformation of single chains
   - Spherulites
   - Liquid Crystals
   - Transition temperature- glass transition temperature, melting temperature
7. General properties
8. Polymer Processing/ Fabrication:
   - Injection molding (plunger and screw type)
   - Compression molding
   - Extrusion – flat, sheet and tubing
   - Pultrusion
   - Blow molding
   - Foams, thermoforming, vacuum forming
   - Spinning – wet and dry
9. Rheology:
   - Viscous flow, models of Newtonian and Non-Newtonian
   - Visco-elasticity – Maxwell Model
10. Introduction to Rubber elasticity

Books:

1. Fried; Polymer Scince and Technology, 2nd Ed, Prentice Hall India
2. Sinha; Oulines of Polymer Technology: Manufacture of Polymers, Prentice Hall India

CH 786 (a) FLUIDIZATION ENGINEERING (Electrive-II)

Theory : 100 marks
Sessional : 75 marks
Time : 3 hours

L – T – P
3 – 1 – 0

1 INTRODUCTION AND APPLICATIONS:

Introduction to Fluidized bed systems. Fundamentals of fluidization. Industrial applications of fluidized beds - Physical operations. Synthesis reaction, cracking and reforming of hydrocarbons. Gasification, Carbonization, Gas - solid reactions ,calcining and clinkering.

2. GROSS BEHAVIOR OF FLUIDIZED BED:

Gross behavior of fluidized bed. Minimum and terminal velocities in fluidized beds .Types of fluidization. Design of distributors. Voidage in fluidized beds. TDH, variation in size distribution with height, viscosity and fluidity of fluidized beds. Power consumption.

3. ANALYSIS OF BUBBLE AND EMULSION PHASE:

Davidson's model. Frequency measurements, bubbles in ordinary bubbling bed model for bubble phase . emulsion phase: Experimental findings. Turn over rate of solids. Bubbling bed model for emulsion phase Interchange co-efficient.

4. FLOW PATTERN OF GAS AND HEAT & MASS TRANSFER IN FLUIDIZED BEDS:

Flow pattern of gas through fluidized beds. Experimental findings. The bubbling bed model for Gas inter change Interpretation of Gas mixing data. Heat and Mass Transfer between fluid and solid: Experiment findings on Heat and Mass Transfer. Heat and Mass Transfer rates from bubbling bed model.

5. HEAT TRANSFER BETWEEN FLUIDIZED BEDS AND SURFACE:

Heat transfer between fluidized beds and surfaces: Experiment finding theories of bed heat transfer comparison of theories. Entrainment of or above TDH, model for Entrainment and application of the entrainment model to elutriation.

TEXTBOOK:

1. D.Kunii and O.Levenspiel ,'Fluidisation Engineering " 2nd. Edn.,]ohn Wiley& sons, 1992.

CH 786 (b) RISK ANALYSIS & HAZOPS (Elective-II)

Theory : 100 marks
Sessional : 75 marks
Time : 3 hours

L – T – P
3 – 1 – 0

1. INTRODUCTION TO CONSEQUENCE ANALYSIS - DISPERSION AND TOXIC MODELS: Risk analysis introduction - Rapid risk : Analysis - Comprehensive risk analysis -Failure types and release rate calculation - Emission and dispersion - Dispersion models for dense gas - Plume dispersion - Jet dispersion - Toxic dispersion model Evaluation of risk contours.

2. CONSEQUENCE ANALYSIS - FIRE AND EXPLOSION MODELS; Radiation - Tank on fire - Flame length - Radiation intensity calculation and its effect to plant, people & properly, UCVCE - Explosion due to - Deflatration -Detonation - TNT, TNO & DSM model - Over pressure - Effects of explosion -Risk contour - Flash fire - Jet fire - Pool fire - BLEVE - Fire ball.

3. RISK MANAGEMENT: Overall risk analysis - Generation of Meteorological data - Ignition data -Population data - Overall risk contours for different failure scenarios - Disaster management plan - Emergency Planning - on site & offsite emergency planning - Risk management &IS014000- EMS models- Case studies-Marketing terminal, gas processing complex, refinery.

4. PAST ACCIDENT ANALYSIS: Hazard identification -Safety Audits-Checklists- What if Analysis-Vulnerability models - Event tree and Fault tree Analysis - Past accident analysis Flixborough -Mexico - Bhopal - Vizak 3 miles - island chernoobyl, feyzih disasters, seveso accident analysis.

5. HAZOPS : HAZOPS- Principles - Risk ranking - Guide word - Parameter - Deviation - • Consequences - Recommendation - Coarse HAZOP study - Case studies Pumping system - Reactor System - Mass transfer system.

TEXTBOOKS:

1. K. V. Raghavan and A. A Khan, "Methodologis in Hazard Identification and Risk Assessment", Manual by CLRI, 1990.
2. V. C. Marshal, "Major Chemical Hazards", Ellis Hawood Ltd., Chichester,United Kingdom.1987.
3. Kletz, "Risk Analysis Hazops " Institute of Engineers, U.K.. 1990.

REFERENCES:

1. Frank P. Less, "Loss Prevention in Process Industries", Vol. I, II & III Butterworth, London,1980.
2. " A Guide to Hazard Operability Studies", Chemical Industry Safety and Council, 1977.

CH 788 Project-I

Sessional 100, Pass Mark :50

Under this course each student will be assigned a topic related to Chemical engineering field. The topic shall either be experimental or theoretical (feasibility report/literature survey with some mathematical calculations). The student will work under the supervision of a staff member and submit a report on the assigned project. The student will give a presentation on the project work before a panel of examiners.

CH 787 Factory Training

Sessional: 75

Factory training for a period of 6 (six) weeks is compulsory for all chemical engineering students and 20 marks are allotted for the technical report submitted after completion of the training. There will be a seminar cum viva on the report submitted by the student and 30 marks are assigned for this. The report should be submitted to the HOD, by a date announced by the HOD. Students are to obtain a certificate from the Factory authority regarding their attendance and performance during the training period which is to be submitted along with the report.

7th Semester

Project : 100

Theory : 6X100 = 600
Sessional : 6 X 75 = 450
Training : 50
Total :1200

Branch: ETE **Year**: Fourth year

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
			L	T	P	Sessional Marks			ESE	Total Marks	Credit
						TA	CT	Total			
1	ET 761	Analogue System Design	3	1		50	25	75	100	175	4
2	ET 762	Computer Architecture and Organization	3	1		50	25	75	100	175	4
3	ET 763	Digital Signal Processing	3	1		50	25	75	100	175	4
4	ET 764	Mobile Communication	3	1		50	25	75	100	175	4
5	ET 765	Elective-I	3	1		50	25	75	100	175	4
6	ET 766	Elective-II (Open)	3	1		50	25	75	100	175	4
7	ET 767	Training			2					50 *	2
8	ET 768	Project I			8					100 **	4
Total			18	6	10						

Total Marks: 1200 **Total Periods: 34** **Total Credits: 30**

TA: teachers assessment ***CT: Class Test*** ***ESE: End Semester Exam***

Electives:

Elective I: IC Technology/Communication System engg./ Optimization techniques/ Micro Electro Mechanical Systems
ElectiveII: Acoustics & Sound Engineering /Telecommunication switching and transmission System/Multimedia Theory and Applications

* Training Report: 20 Marks Seminar cum Viva: 30 Marks

** TA: 40 Marks Report: 30 Marks Seminar cum Viva: 30 Marks

ET 761 Analog System Design
Theory : 100 marks
Sessional: 75 marks
Time: 3 hours

Operational Amplifier Fundamentals

Introduction. Op-amp configurations, ideal Op-amp circuit analysis, negative feedback Non-ideal closed loop charactcristics. Powering the Op-amp.

Linear Op-amp Circuit

DC sources, current to voltage converters, V-I converters (floating load and grounded load). Current amplifiers.

Non-linear Circuit Applications

Comparators. Applications. level detectors. window detectors. Schmitt trigger. Precision half wave and full wave rectifiers Peak detectors. Sample and hold circuits.

Signal Generators

Sine wave generators. mono-stable. bi-stable and astable multivibrators and their Applications. Triangular wave generator triangular to sine- wave converter sawtooth generator. Voltage to frequency and frequency to voltatge converters.

Limitations of Practical Op-amps

DC performance - Bias. offset and drifts-input bias and offset current, effects of offset current on output voltage; input offset voltage Offset error compensation AC performance- frequency response, frequency compensation, bandwidth limitation, slew rate and slew rate limitation. Noise considerations.

Voltage Reference

Performance parameters. Zener and Avalanche diode voltage references. Drift due to temperature change. Compensation methods. Applications.

Voltage Regulators

Series regulators. Building blocks IC Voltage Regulators-applications. Thermal considerations. Power supply design.

D/A and A/D converters

Converter definitions and specifications. Basic DAC techniques. Bipolar DACs. DAC based AD converters. Flash/Parallel converters. Integrating type ADCs Data acquisition and distribution.

Active Filters

First order active filters. Audio filter application. Second order low-pass, high-pass, band pass and notch filters. Butterworth filters. Cascadcd design. RLC simulation design. Filter sensitivity.

Logarithmic Amplifiers and Analog Multipliers

Log/Antilog Amplifier. Practical Log/Antilog circuits. Non-linear function circuits. Analog multipliers.

Text Books/references:

1. Nergio Franco - Design with Operational Amplifiers and Analog Integrated Circuits, McGraw Hill Book Company.

2. R.F.Coughlin, F.F.Driscoll - Operational AmpIifier and Linear Integrated Circuits, Prentice Hall of India

ET 762 Computer Architecture Organization
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Evolution of Computer

Introduction, different generations till the present time. Basic structure of a computer.

Design Methodology

Components and design techniques at gate level, resistor level and processor level. Processing Unit of a Computer.

Processor organization

Number formats. Instruction formats, instruction types. Fixed point arithmetic, addition, subtraction, division and multiplication.

ALU

Organization floating point arithmetic, arithmetic processor.

Control Unit

Instruction sequencing and interpretation. Control unit design.

Memory Organization

Types of memories. Memory device characteristics. RAM organization. Memory hierarchies. Cost and performance Virtual memories. High speed memories like caches.

Parallel Processing

Introduction and types of parallel processors with performance considerations. Pipe-line processors and multiple processors.

Text Books / references:

1. John P Hayes - Computer Architecture & Organization, Mc Graw Hill Book Company.

2. M. Mano - Computer System Architecture, Prentice-Hall of lndia.

ET 763 Digital Signal Processing
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Discrete time signals and systems

Signal and system classification, time and frequency domain representation.

Discrete time signal analysis and linear systems

Linear time invariant system. Linear time invariance. Unit impulse system response. Causality, stability, IIR and FIR systems. Difference calculations and its solutions. Fourier transforms, frequency response, linear phase system. Sampling of analog signals.

Z-transforms and its properties

Analysis of LTI systems in Z-transform.

Realization of digital systems

Recursive and non-recursive structures. Block diagram and signal flow graphs Direct cascade, parallel, ladder and lattice realization.

Design of IIR digital filters

Approximation theory impulse invariance and bilinear transformations. Frequency transformations. Computer aided design techniques.

Design of IIR digital filters

Windowing and frequency sampling techniques. Computer aided design methods.

Discrete Fourier transforms

Discrete time Fourier series. Discrete time Fourier transforms. Properties, circular convolution and computation of DFT.

FFT algorithm

Basic D-I-T and D-I-F algorithms Computational efficiency considerations.

Finite word length effects

Quantization errors and their effects on performance of digital signal processor.

Digital signal processing applications

Introduction to image processing, speech and audio processing.

Text Books / references:

1. A.V. Oppenheim and R.W. Schafer - Discrete Time Signal Processing, Prentice-Hall of India.
2. J. G. Proakis and D.G. Manolakis - Digital Signal Processing: principles, Algorithms and Applications, Prentice-Hall of India.
3. Alkin - Digital Signal Processing : A Laboratory Approach using PC-DSP, Prentice-Hall of India.
4. MATLAB User's Guide, Math Works Inc.

ET 764 Mobile Communications
Theory: 100 marks
Sessional: 75 marks
Titme: 3 hours

Introduction to Wireless Communications
The wireless vision. Applications and requirements. The obstacles and challenges. A brief historical tour. Standards. Spectrum regulation and de-regulation. Classification of wireless systems. The cellular concept and its guiding principles. Frequency reuse. Handoff. Some essentials on traffic theory.

Antennas & Propagation
Antenna fundamentals. Radiation patterns, gain and effective area. Reciprocity. Friis formula. Free-space propagation. Ray tracing. Empirical models. Large-scale path loss. Shadow fading. Cell coverage and outages.

The Mobile Radio Channel
Multipath propagation and fading. Doppler spectrum and coherence time. Slow and fast fading. Narrowband signals. Stationarity. Power angular spectrum and correlation. Fading distributions: Rayleigh, Ricean and Nakagami. Level crossing rates and average fade durations.

Wideband Radio Channels
Frequency-selective fading. Coherence bandwidth. Delay spread and intersymbol interference. Equalization. OFDM.

Channel Capacity
Basic information theory notions. Shannon's coding theorem. Capacity. Side information. Capacity of AWGN and faded channels. Rate adaptation. Capacity of frequency-selective channels.

Diversity
Concept of diversity. Macroscopic and microscopic diversity. Diversity mechanisms: frequency, time, space, polarization and pattern. Diversity combining: selection, equal-ratio combining and maximal-ratio combining. Performance. Transmit diversity.

Spread Spectrum
Spread spectrum principles. Directe-sequence spread spectrum. RAKE receivers. Frequency-hopping spread spectrum.

Multiple Access
Multiuser channels: uplink and downlink. Multiple access schemes: orthogonal (FDMA, TDMA and OFDMA) and non-orthogonal (CDMA and SDMA).

Text books / references:

1. Andrea Goldsmith – Wireless Communications, Cambridge University Press, 2005.
2. David Tse and Pramod Viswanath – Fundamentals of Wireless Communication, Cambridge University Press, 2005.
3. John Proakis – Digital Communication, McGraw-Hill.
4. W. C. Y. Lee - Mobile Communication Design Fundamentals, John Wiley and Sons, 1993, 2/e.
5. T. S. Rappaport - Wireless Communication, Prentice Hall, 1996.
6. W. C. Y. Lee - Mobile Cellular Telecummunications, McGraw - Hill, 1995, 2/e.
7. G. H. Stubber - Principles of Mobile Communications, Kluwer, 1996.

ET 765 Integrated Circuit Technology
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Basic Outline of fabrication techniques; Silicon bipolar transistor as an example. Cost benefits of mass produced circuit blocks, reliability and performance considerations. Disadvantages. Exploiting the inherent component matching capabilities of I.C.s - example from linear and digital circuits.

Introductory ideas about crystal growth and wafer preparation. Short description of the Czochralski process.

The diffusion process. Simple diffusion theory and the evaluation of impurity diffused in silicon - determination of junction depth and sheet resistance. Oxidation and epitaxial growth of silicon. Pre-deposition and drive-in diffusions in junction devices. Fick's law, distribution of impurities and the calculation of emitter and base depths. Lateral diffusion. Diffusion related parameters for boron and phosphorous. Preparation of a simple process schedule.

Lithography. Optical lithography, minimum line-width consideration, layout fundamentals and mask making. Brief references to X-ray, electron beam and deep UV lithography.

Interconnection. Aluminium metallization -- resistance heated evapovated and CVD methods. Brief mention about metallization failures -- step covering and electromigration. Other method of interconnection.

Passive components. MOS capacitors and resistors. Calculation of area and the layout of capacitors and resistors.

NMOS and CMOS fabrication techniques. Polysilicon self aligned gate devices. Layout of simple Circuits. Introduction to VLSI processing and layout Stick diagrams and layout and simulation tools.

Other related processes. Ion implantation, dry etching, sputtering, assembly and reliability related evaluation. Future trends.

Text Books / references:

1. Douglas J. Hamilton and William G. Howard - Basic Integrated Circuit Engineering, McGraw-Hill Book Company.
2. S M. Sze - Basic VLSI Technology. McGraw-Hill Book Company
3. Douglas A. Pucknell and Karman Eshraghain - Basic VLSI Design, Prentice Hall of India.
4. Andrew S. Grove - Physics and Technology of Semiconductor Devices, John Wiley and Sons.
5. R Jacob Baker, Harry W. Li and David E. Boyce - CMOS circuit design layout and simulation,PHI.

ET 765 Communication System Engineering
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Review of AM and FM broadcasting systems.
Transmitter and receiver circuits and structures.

Television (Black and White)
Signal structure of composite \ video signal. Sound subcarrier. VSB broadcasting and reception. Sound demodulation. Camera and imaging devices. Scanning and deflection circuits.

Colour Television
Colour video signal. Colour modulation svstems PAL, SECAM and NTSC. Transmission and reception. Colour signal recovery. Colour representation in vector space.

Digital Audio and DAB
Principles and formats Important considerations such as encoding and compression. Framing and multiplexing issues and standards.

Telephony
Analogue and Digital. Principles and standards. Principles of facsimile and paging.
Introduction to advanced communication systems

Channel coding and transmission over terrestrial, satellite and networks.

Text Books / references:

1. R. R Gulati - Colour Television Principles and Practice, Wiley Eastern Pvt. Ltd.
2. A. M. Dhake - Television and Video Engineering, Tata McGraw Hill.
3. R. L Freeman - Telecommunication Systems Engineering, John Wiley and Sons.
4. R. G. Winch - Telecommunication Transmission Systems, McGraw-Hill Book Company.
5. W. C. Y. Lee - Mobile cellular Communications, McGraw-Hill Book Company.

6. Wayne Tomasi - Electronic Communications Systems, Pearson Education Asia.
7. Harold Kolimbiris - Digital Communication Systems, Pearson Education Asia.
8. H. L. Rohde - Communication Receivers, McGraw-Hill Book Company.

ET 765 Optimization Techniques
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction to optimization

Introduction and scope of optimization. Definitions: design vector, design constraint and objective function. Classification of optimization problems.

Classical optimization techniques

Local and global minima and maxima. Single and multi-variable optimization without constraints. Multivariable optimization with inequality constraints. Method of direct substitution and method of Lagrange's multipliers. Multivariable optimization with inequality constraints. Kuho-Tucker conditions.

Linear programming

Formulation of linear programming problems (LPP). Standard form of LPP. Geometry of LPP (graphical solution). Solution by the simplex method. Computer program. Duality in linear programming. Sensitivity or post-optimality analysis.

Non-linear programming

Uninodal functions. One dimensional minimization methods. A brief idea about elimination (search) method. Fibonacci and golden section methods. Quadratic interpolation method. Gradient methods. Method of steepest descent, conjugate gradient (Fletcher-Reeve) method.

A brief introduction to dynamic programmiry and solution to simple problems.

Text Books / references:

1. N. S Rao - Optimization: Theory and Application Wiley Eastern ltd.
2. H. Taw - Operations Research - An Introduction, Prentice Hall
3. K. V. Mittal and C. Mohan - Optimization Methods in Operations Research and System Analysis, New Age International.

ET 765 Micro Electro Mechanical Systems
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction: Historical background, development of microelectronics, evolution of micro sensors, MEMS, emergence of micro machines. Electronic materials and processing: Introduction, electronic materials and their deposition, pattern transfer, etching electronic materials, doping semiconductors.

MEMS Materials and Processing: Overview, metals, semiconductors, ceramic, polymeric and composite materials. Silicon micro machining – bulk: Introduction, etch-stop techniques, dry etching, buried oxide process, silicon fusion bonding, anodic bonding.

Silicon Micro Machining–Surface: Introduction, sacrificial layer technology, material systems in sacrificial layer technology, plasma etching, combined IC technology and anisotropic wet etching.

Micro Sensors: Introduction, thermal sensors, radiation sensors, mechanical sensors, magnetic sensors, biochemical sensors and flow sensors. SAW Devices: Introduction, saw devices development and history, transducers in SAW devices, acoustic waves.

Micro Sensors: LIGA – Introduction, Application of LIGA, Technology barrier and competing technologies, Microsterolithography – Introduction, Scanning method, two photon MSL, Projection MSL, Polymeric MEMS Architecture with silicon, Metal and ceramics, Applications of MSL.

Text Books/ References:

1. S.M.Sze - Semiconductor Sensors, John Wiley & Sons, Inc., 1994.
2. M.Elwenspoek, R.Wiegerink - Mechanical Microsensors, Springer-Verlag Berlin Heidelberg, 2001.
3. Julian W. Gardner, Vijay K. Varadan - Microsensors, MEMS, and Smart Devices, John Wiley & Sons Ltd, 2001.
4. Massood Tabib-Azar - Microactuators - Electrical, Magnetic, Thermal, Optical, Mechanical, Chemical and Smart structures, Kluwer Academic Publishers, New York, 1997.
5. Eric Udd - Fiber Optic Smart Structures, John Wiley & Sons, New York, 1995.

6. Kevin Chau - Analog Devices, Inc., Introduction to MEMS Technology and Devices (SC266), SPIE education services, Bellingham WA.
7. Vasundara Varadan, Vijay Varadan - Microsensors and MEMS for Smart Structures

ET 766 Telecommunications Switching and Transmission Systems
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction

Review of circuit and packet networks. Switching systems. Telecommunication transmission networking and media selection (fiber optics, cable, wireless) theory and practices. Network configuration and network technologies.

Network services and architecture

Top down, application-driven view of networks, including a layered approach.

Networks

Packet networks, OSI model, packet switching, Internet. Circuit networks, core and access technologies, circuit switching and intelligent networks. ATM networks. Network control and operations, quality of service.

Wireless systems

Cellular system. Wireless LANs.

Optical systems

Components of optical system. WDM, optical routing and all-optical networks

Text Books / references:

1. L. W. Couch II, "Digital and Analog Communications Systems", 6th edition, Prentice Hall, 2001.

2. M. Schwartz, "Telecommunications Networks: Protocols, Modeling and Analysis", Addison Wesley.

3. W. Stallings, "Data and Computer Communications", 6th edition, Prentice Hall, 2000.

4. A. S. Tanenbaum, “Computer Networks”, 2nd edition, Prentice Hall, 1989.

5. T. S. Rappaport, “Wireless Communications: Principles and Practice”, Second Edition, Prentice Hall, 2002.

6. K. Pahlavan and P. Krishnamurthy, “Principles of Wireless Networks”, Prentice Hall, 2002.

7. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”, 2nd edition, Morgan Kaufmann, 2002.
8. Thomas E. Stern and Krishna Bala, “Multiwavelength Optical Networks: A Layered Approach”, Addison Wesley, 2000.

ET 766 Multimedia
Theory: 100
Sessional: 75
Time: 3 hours

Introduction

History of Multimedia Systems, Hypermedia/Multimedia, HyperText/HyperMedia, Overview of Multimedia Software Tools, Music Sequencing and Notation, Graphics Image and Video Editing, Multimedia Authoring.

Issues in Multimedia authoring

Multimedia Authoring Metaphors, Content Design, Scripting(Writing), Graphics(Illustrating), Animation(Wiggling), Audio(Hearing), Interactivity (Interacting)

Multimedia Data Representations

Basics of Digital audio, Introduction to MIDI(Musical Instrument Digital Interface), Graphics/ Image File Formats, Standard System Independent Formats, System Dependent Formats, Color in Image and Video, Basics of Video, Types of Color Video Signals, Digital Video.

Video and Audio Compression

Basics of Information Theory, Lossless Compression Algorithms, Huffman Coding, Lempel-Ziv-Welch Algorithm, Image Compression-JPEG, 4 JPEG modes, JPEG 2000, Video Compression, H.261, H.263, MPEG, New MPEG Standards, Audio Compression, Simple Audio Compression Methods, Psychoacoustics.

Text Books/ References

1. Multimedia System Design by Adeleigh and Thakrar.
2. Multimedia at Work by T. Vaughan
3. Introduction to Data Compression by Khalid Sayood

ET 766 Acoustics and Sound Engineering
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Fundamentals of Acoustics: Nature of sound and the physics of vibrations. Wave equations and wave propagation. Plane and spherical sound waves. Sound pressure and intensity. Propagation effects – attenuation and dispersion. Acoustic impedances. Noise absorption and insulation. Measurement of sound level. Perception of sound level and direction. Frequency response of the ear. Standard weighting curves and reference levels for sound measurement. Techniques for measuring sound level. Laws and standards for environmental noise. Health and safety aspects.

Sound Production - Vibrations and Resonators: Vibration of mechanical systems. Wave propagation through various media and boundaries. Resonance. Sound waves in pipes. Helmholtz resonators. Musical instruments. Analogies between acoustic, electrical and mechanical systems.

Loudspeakers, Microphones, Psychoacoustics and Sound Reproduction: Pressure and velocity microphones. Directional and frequency response of microphones. Operational details and properties of various types of microphones: moving coil, ribbon, capacitor, electrostatic. Operation of moving coil loudspeakers. Design of different types of loudspeaker enclosures (infinite baffle, tuned port, acoustic suspension, horn). Psychoacoustic effects and their applications in sound perception. Sound reproduction, Dolby noise reduction, mini-disk, surround sound. Compare and contrast Dolby A, SR and DBX noise reduction. Identify when and how to use noise gates. Near/field and far/field monitoring. Principles of loud speaker system's proper selection and placement in the control room. Loudspeaker phase linearity.

Acoustics in Enclosed Spaces: Sound in rectangular enclosures: time and frequency analysis. Direct and reflected sound. Diffuse sound fields. Normal modes of vibration in regular enclosures. Transient responses. Reverberation. Statistical characterization of sound in irregular enclosures. Calculation and measurement of reverberation. Reverberation time and other design criteria. Architectural acoustics. Speech and communication in enclosed spaces. Sound transmission through walls.

Principles of Audio Recording: Physical properties of analog tape. Analog tape recording process. Analog tape formats and equipment from visuals. Cleaning and demagnetization of different analog tape machines. Principles of the digital recording process. Digital audio editing. Digital recording machines of differing formats and storage types from visuals. Compare/Contrast the difference between preamplifiers and power amplifiers. Identify and place preamplifiers in the audio signal chain. Identify and place power amplifiers in the audio signal chain, define equalizers, summing amplifiers, distribution amplifiers, isolation amplifiers, impedance amplifiers, power amplifiers, voltage controlled amplifiers.

MIDI: Applications of MIDI controllers, voice modules, and sequencers. Principles of synchronization and equipments used for synchronization. Procedures for implementing synchronization principles and
equipment.

Fundamentals of Signal Processing: Amplitude and wave shape processing. Audio equipment used to manipulate the amplitude and wave shape of audio signals. Compression, limiting, expansion, keying, and ducking. Compressor and dynamics processing equipment. Fundamental controls of dynamics processors.
Application of delays, artificial reverberation and the other types of enhancers that are used in contemporary audio production.

Skills to Plan a Recording Session: Pprocedures of Recording, Overdubbing, Mixdown, Editing. Identify the needs of the client given a simulated recording project. Planning and tracking a recording session. Studio and setup equipment for a recording session.

Books / references :

1. Kinsler, Frey, Coppens and Saunders: Fundamentals of Acoustics, Wiley. 2000.

2. D E Hall: Basic Acoustics, Wiley. 1987.

3. T. D. Rossing, F. R. Moore, and P. A. Wheeler: The Science of Sound, Pearson Addison- Wesley, 2001.

4. Bruce and Jenny Bartlett: Practical Recording Techniques. Focal Press, 3rd edition. 2001.

Branch: Instrumentation Engineering Year: Fourth Semester: Seventh

Sl No.	Course No.	Subject	Period			Evaluation Scheme					
	Theory		L	T	P	Sessional Examination			ESE	Subject Total	Credit
						TA	CT	Total			
1.	IE 757	Principles of Process Control	3	1		50	25	75	100	175	4
2.	IE 751	Instrumentation System Components -II	3	1		50	25	75	100	175	4
3.	EE 743	Operations Research	3	1		50	25	75	100	175	4
4.	IE 752	Analytical Instrumentation	3	1		50	25	75	100	175	4
5.	IE 753	Elective -I	3	1		50	25	75	100	175	4
6.	IE 754	Elective-II	3	1		50	25	75	100	175	4
8.	IE 755	Training								50	2
9.	IE 756	Project -I		6						100	4
TOTAL			18	12		300	150	450	600	1200	30

Total Marks: 1200 **Total Periods: 30** **Total Credits: 30**

TA: Teachers' Assessment *CT: Class Test* *ESE: End Semester Examination*

Electives: Elective-I: Acoustics Engg. /Computer Networking
Elective –II: Microprocessor & Micro controller based Instrumentation/Modeling and Simulation

L T P

IE 752: Analytical Instruments (3 1 0)

Theory Marks=100
Sessional Marks=75

Sampling techniques- Sampling system for liquids & gases, Gas analysis- Gas chromatography, Sampling system, fractionating column, thermal conductivity gas analyzer, heat of reaction method, estimation of O_2, H_2, CH_4, CO etc. in binary or complex gas mixtures, electro- chemical reaction method, Bailey oxygen analyzers, paramagnetic oxygen analysis, gas analysis by chemical absorption, Orsat apparatus, CO_2 and Hydrogen measurement, Gravitimetric method of gas analysis, methanometers.

Measurement of humidity- Dry & wet bulb psychrometers, hair hygrometer, dew point meter.

Measurement of moisture- laboratory method and on-line measurement techniques: Electrical methods, radio isotopes method, IR techniques, moisture in gases.
Chemical composition analysis- measurement of viscosity, laboratory and on-line methods, capillary tube viscometer, Efflux type, rotating cylinder type viscometer, vibrating reed, ultrasonic and plastometer type industrial viscometer, applications in paper & petrochemical industries, temperature effect on viscosity.

Acidity/ alkalinity- definition of pH, methods of measurement, pH electrodes, optical-fiber pH sensors.

Measurement with Radio-Isotopes- Nuclear radiation transducer, Geiger Muller Counter, Scintillation counters, Radioactive Vaccum, Thickness & Level gauges.

Spectro-chemical analysis- mass spectrometry & its application to analysis of solids, liquids and gases, absorption spectrometry, emission spectrometry. Electromagnetic radiation spectrum, UV, IR analysis.

Books:

1. Basic Instrumentation in Industrial Measurement: O' Higgins, PJ.
2. The Measurement Instrumentation and Sensors Handbook: Webster, John G.

3. Principles of Industrial Instrumentation: Patranabis.

IE 751: Instrumentation Systems Components - II

L T P
(3 1 0)
Theory Marks =100
Sessional. Marks= 75

Synchros – transmitter- transformer – receiver, construction, working principle, application as error detector and angular displacement transducer.

DC and AC servomotors- construction, theory of operation, applications.

PD, PI and PID controllers – principles, transfer functions, physical realization, applications.

Tachogenerators – AC and DC: construction, principle of operation, position and speed regulator, and transducer.

Stepper motors- construction, method of operation, torque equation, driver circuit, logic translator, applications

Feedback transducers- negative feedback principle, advantages and typical schemes.

Hydraulic systems – different types of valves, construction and principles of operation, pitot valve, flapper valve, slide valve, two-stage valve.

Pneumatic control system – equivalent circuit of pneumatic valve and transfer function, pneumatic servo in jet engine application.

BOOKS:

1. Transducers and Instrumentation : Murthy, DVS, PHI
2. Principles of Industrial Instrumentation: Patranabis, TMH
3. Control System Components: Gibson and Tutor,
4. Electromechanical Devices for Energy Conversion and Control System : Vincent Del Toro
5. Electromechanical Components for Servo-mechanism : Davies, SA and Ledgerwood, BK
6. .Automatic Control Systems : Raven

IE 756: Project-I (0-6-0)

Max Marks: 100, pass Marks: 40

In this subject, a project work has to be taken up on a relevant topic to be decided by the student in consultation with the supervisor. The project is to be done in a group, which may consist of two, three or four students. The project may be a software, a hardware or a study type one.

The students have to submit a project proposal and/or justify the relevance of the topic in a project proposal seminar at the beginning of the semester, after approval of which only a student can take up that project. The students also have to give a presentation of their progress in a seminar. At the end, the students have to submit a report and present their works in a seminar. A viva-voce examination will also be held at the end of the semester.

The distribution of marks for the project is as follows:

Seminar: 25 Viva: 25 Report: 50

E 755: Training (0-2-2)
Max Marks: 50

In this, every student has to undergo industrial training during summer vacation just after sixth semester) for a period of 4 weeks. For this, the student has to get prior approval from the department. At the end of the training, a student has to submit a report to the department, which will be evaluated by the faculty members of the department.

IE753: Acoustic Engineering (Elective)

Theory Marks: 100 **L- T- P**
Sessional: 75 **4 – 0 - 0**

Basic Acoustics Theory, Sound Generation & Propagation, Impedance, Absorbing Materials, Industrial Noise Sources, Isolation Methods of Noise Control, Enclosures, Instrumentation & Measurement, Frequency Analysis, Noise Regulations, Computational Methods of Acoustics.

Books:

1) Bies and Hansen , Engineering Noise Contro, Allen & Unwin, 1988
2) Hassall and Zaveri, Acoustic Noise Measurement, Bruel & Kjaer, 1988

EE 745/IE 753: Computer Networking (Elective)

Theory Marks: 100 **L- T- P**

Sessional/Lab: 75 **4 – 0 - 1**

Introduction to computer networks and layered architecture overview, Packet switching and fast packet switching.

Point to point protocols and Links: ARQ retransmission strategies. Selective repeat ARQ. Framing and standard data link control protocol-HDLC, SDLC, LAPD. Queuing models in communication networks.

Multi-access communication & multiple access protocols: ALOHA, slotted ALOHA, CSMA, CSMD/CD, Performance modeling & analysis.

Local area networks: Ethernet, Token ring, and FDDI. Design & analysis.

Internetworking issues: Bridges, Routers and Switched networks. Routing & Flow Control Algorithms in data networks.

Broadband Networks: ATM, Frame relay & gigabit Ethernet, Traffic management in ATM networks.

Security & reliability of Networks.

Books:

4) Data Networks, R G Gallager, PHI
5) Data & Computer Communication, W stallings, PHI.
6) Multiple Access Protocols, R Rom & M Sidi, Springer verlag.

EE 746/IE 754: Modeling & Simulation (Elective)

Max Marks: 100

Sessional: 75
Time: 3 hours

System models-entities, attributes, states, activities. Types of models. Static & Dynamic Models.

Deterministic & stochastic activities. Principles used in modeling. System simulation-continuous & discrete event simulation languages_GPSS, GIMULA, CSMP, DYNAMO. Probability concepts in simulation-random number & random variate generation stochastic processes, Birth – Death process, parameter estimation & input-output validation, Queuing systems_M/M/1 and M/M/C queues. Bulk arrival & Bulk service system. Inventory control & forecasting. Evaluation & Validation of simulation experiments.

Books:

4) Payer, T.A. : Introduction to Simulation, McgrawHill.
5) Gordon, G : System Simulation, PHI.
6) Law, A.M & W.D. Kelton : Simulation Modelling & Analysis, McgrawHill.

IE 746/IE 754: Microprocessor Based Instrumentation (Elective)

(4-0-2)

Max. Marks=100
SessionalLab = 75

Microprocessor interfacing, methods of data transfer, DMA, synchronization, polling and interrupt, LSI support chips for micro-processor, IEEE-488 interface, RS-232 interface, dedicated I/O controllers, programmable peripheral controllers, transducer interfacing, actuator interfacing, micro-processor based measurement of pulse width, frequency, voltage, rpm, pH, pressure, temperature etc., obtaining device characteristics(semiconductor devices) with micro-processor, micro-processor based scanner, data-

logger, alarm enunciators, PID controller, programmable controller, analytical instruments such as gas chromatograph, Sequential control and interlock control, micro-processor based diagnostic systems.

Project : 100
Theory : 6X100=600
Sessional : 6 X 75 = 450
Training : 50
Total :1200

Branch: CSE **Year**: Fourth year

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
			L	T	P	Sessional Marks			ESE	Total marks	Credit
						TA	CT	Total			
1	CS 771	Artificial Intelligence	3	1		50	25	75	100	175	4
2	CS 772	Design & Analysis of Algorithms	3	1		50	25	75	100	175	4
3	CS 773	Cryptology & Security Systems	3	1		50	25	75	100	175	4
4	CS 774	Network Programming	3	1		50	25	75	100	175	4
5	CS 775	Elective-I	3	1		50	25	75	100	175	4
6	CS 776	Elective-II (Open)	3	1		50	25	75	100	175	4
7	CS 777	Training			2					50 *	2
8	CS 778	Project			8					100 **	4
Total			18	6	10						

Total Marks: 1200 **Total Periods: 36** **Total Credits: 34**

TA: teachers assessment ***CT: Class Test*** ***ESE: End Sem Exam***

Electives:

Elective I: IC Technology/ Optimization Techniques/Fault Tolerant Systems/ Pervasive Computing.
Elective II: Multimedia Theory and Applications/Graph theory/ Microprocessor Based System Design.
* Training Report: 20 Marks Seminar cum Viva: 30 Marks
** TA: 40 Marks Report: 30 Marks Seminar cum Viva: 30 Marks

CS771 Artificial Intelligence
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Fundamental issues in intelligent systems: History of artificial intelligence; philosophical questions; fundamental definitions; philosophical questions; modeling the world; the role of heuristics.

Search and constraint satisfaction: Problem spaces; brute-force search; best-first search; two-player games; constraint satisfaction.

Knowledge representation and reasoning: Review of propositional and predicate logic; resolution and theorem proving; non-monotonic inference; probabilistic reasoning; Bayes theorem.

Advanced search: Genetic algorithms; simulated annealing; local search.

Advanced knowledge representation and reasoning: Structured representation; non-monotonic reasoning; reasoning on action and change; temporal and spatial reasoning; uncertainty; knowledge representation for diagnosis, qualitative representation .

Agents: Definition of agents; successful applications and state-of-the-art agent-based systems; software agents, personal assistants, and information access; multi-agent systems.

Machine learning and neural networks: Definition and examples of machine learning; supervised learning; unsupervised learning; reinforcement learning; introduction to neural networks.

AI planning systems: Definition and examples of planning systems; planning as search; operator-based planning; propositional planning.

Books:

1. Nilsson, N. J, Principle of AI, Narosa Publ. House.
2. Pitterson, D.N, Introduction to AI & Expert Sys.
3. Jacson, P., Intro. To Ex. Sys., Addision Werley Publ. Co.
4. Clocksm & Mellish, Programming in PROLONG, Narosa Publ. House.
5. Norvig, Peter, Paradigms of AI Programming, Morgan Kauffman, 1992.
6. Rusell, Stuart & Norvig, Peter, Artificial Intelligence, Prentice Hall, 1995.

7. Rich & Knight, Artificial Intelligence, 2nd edition, TMH, 1991.

CS772 Design and Analysis of Algorithms
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Review of basic data structures such as stacks, queues, linked lists, trees and graphs.

Concepts in algorithm analysis, asymptotic complexity. Domain independent algorithm design techniques such as divide and conquer, greedy method, dynamic programming, backtracking, branch and bound.

Examples of above techniques from sets, graphs, text processing, internal and external sorting, height balanced trees, B-trees, hashing algorithms, dynamic storage allocation and garbage collection.

Lower Bound theory and NP-hard problems.

Books / references:

1. Introduction to Algorithms - T. H. Comer, C. E. Leiserson and R. L. Rivest.

2. The Design and Analysis of Computer Algorithms - A. V. Aho, J.E. Hopcroft and J. D. Ulman, Adison Wesley Publication Company

3. Fundamentals of Computer Algorithms - E. Horowitz and S. Sahni, Galgotia Publications.

CS 773 Cryptology and Security Systems
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction
Introduction to OSI Network Security Architectures, Services, Mechanisms and Attacks, Classical Encryption Techniques, Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor Machines, Steganography.

Block Cipher and Data Encryption standards
Classical Encryption Techniques, Introduction to DES, differential and Linear Cryptanalysis, Block Cipher Cryptography, Triple DES Algorithm, International Data Encryption Algorithm (IDEA), Blowfish Algorithm, RC-x Algorithms, CAST-x Algorithms, Symmetric Block Cipher Schemes, Encryption Function Placement and Confidentiality problems.

Public-Key Cryptography and Message Authentication
The Key Distribution Problem, Random Number Generation, The Public-Key Cryptosystems, The RSA Algorithm, The Key Management riddle, The Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. Introduction to Message Authentication, requirements and functions, Message Authentication Codes, Hash Functions, their Security and other considerations

Authentication Applications
The Message Digest (MD5) Algorithm, The Secure Hash Algorithm (SHA-1), RIPEMD-x and HMAC fundamentals, Digital Signature basics, Authentication Protocols, The Digital Signature Standard, Introduction to the Kerberos Authentication scheme, The X.319 Directory Authentication scheme.

Electronic Mail and IP Security
Fundamentals of the E-mail security, PGP, The S/MIME Standard, The IP Security Framework, The Authentication Header scheme, The ESP scheme, Hybrid schemes and Key Management problems

Web Security and network management

Web-based Security frameworks, requirements, The SSL and TLS frameworks**,** A review of Web-security solutions, Introduction to Intrusion Detection, On the Virus, Worm and similar security threats, Introduction to Firewall Systems, On the Trusted Systems, A Case-study / Design of an Internet Security System.

Text Books/ References:

1. William Stallings, Cryptography and Network Security: Principles and Practice, Third Edition, Pearson Education, New Delhi, 2001.
2. C. Kaufman, R.Perlman and M. Spenser, Network Security, Second Edition, Prentice-Hall, Englewood Cliffs, 2002.
3. 3. S. Bellovin and W.Chesvick, Internet Security and Firewalls, Second Edition, Addison-Wesley, Reading, 1998

CS 774 Network Programming
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

The client server model; an introduction to TCP socket function calls: socket(), connect(),bind(),listen() and accept().

Constructing messages for computer communication; byte manipulation functions; an example of a client-server program.

Introduction to multiple access in wireless networks; CDMA; 802.11 Wireless LANs; the 802.11 MAC protocol; the use of RTS/CTS frames.

The 802.11 frame format; addressing in 802.11; handling mobility within the same IP subnet; Bluetooth.

Using the Domain Name Service in programs; A review of SMTP and an example SMTP dialogue.

Writing a concurrent server program; using fork(), pipe() and wait() functions in C; using signals (asynchronous software interrupts); zombie processes.

Managing mobility in networks; addressing and routing under mobility; mobile IP; implications of wireless to higher layers.

Introduction to multimedia networking; the network service requirements of multimedia applications; RTSP; QoS on top of a best-effort service network; understanding jitter and playout delay; forward error correction and interleaving.

I/O multiplexing; using the select() and poll() functions; blocking and non-blocking sockets; socket options.

Review of HTTP; software architecture of web servers; event-driven, process-driven and hybrid servers; the Apache server as a case study;

Protocols for multimedia transmissions: RTP and RTCP; Session Initiation Protocol (SIP); communicating between circuit-switched telephone network and the Internet; H.323.

Scheduling and policing mechanisms for quality-of-service; fair queueing; leaky bucket.

Issues in buffering and TCP; understanding the TCP socket life cycle.

Content distribution networks; Integrated Services and Differentiated services for quality of service in the Internet; Resource reservation protocol.

Cellular Internet access and managing mobility in cellular networks.

Books / references:

J. F. Kurose and K. W. Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, Addison-Wesley Publishing, 2nd edition, 2002

W. R. Stevens, *UNIX Network Programming*, Prentice Hall PTR, 2nd edition, January 1998

CS 775 Integrated Circuit Technology
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Basic Outline of fabrication techniques; Silicon bipolar transistor as an example. Cost benefits of mass produced circuit blocks, reliability and performance considerations. Disadvantages. Exploiting the inherent component matching capabilities of I.C.s – example from linear and digital circuits.

Introductory ideas about crystal growth and wafer preparation. Short description of the Czochralski process.

The diffusion process. Simple diffusion theory and the evaluation of impurity diffused in silicon – determination of junction depth and sheet resistance. Oxidation and epitaxial growth of silicon. Pre-deposition and drive-in diffusions in junction devices. Fick's law, distribution of impurities and the calculation of emitter and base depths. Lateral diffusion. Diffusion related parameters for boron and phosphorous. Preparation of a simple process schedule.

Lithography. Optical lithography, minimum line-width consideration, layout fundamentals and mask making. Brief references to X-ray, electron beam and deep UV lithography.

Interconnection. Aluminum metallization – resistance heated evapovated and CVD methods. Brief mention about metallization failures – step covering and electromigration. Other method of interconnection.

Passive components. MOS capacitors and resistors. Calculation of area and the layout of capacitors and resistors.

MOSFET: NMOS and CMOS fabrication techniques. Polysilicon self aligned gate devices. Layout of simple Circuits. Introduction to VLSI processing and layout Stick diagrams and layout and simulation tools.

Other related processes. Ion implantation, dry etching, sputtering, assembly and reliability related evaluation. Future trends.

Books / references:

1. Douglas J. Hamilton and William G. Howard - Basic Integrated Circuit Engineering, McGraw-Hill Book Company.
2. S M. Sze - Basic VLSI Technology. McGraw-Hill Book Company
3. Douglas A. Pucknell and Karman Eshraghain - Basic VLSI Design, Prentice Hall of India.
4. Andrew S. Grove - Physics and Technology of Semiconductor Devices, John Wiley and Sons.
5. R Jacob Baker, Harry W. Li and David E. Boyce - CMOS circuit design layout and simulation. Prentice Hall of India.

CS775 Fault Tolerant Systems
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Test generation for digital systems. Fault models & Different types of test generation. Design for testability, Scan paths.. Built-in self test etc. Fault simulation, circuit modeling and logic values. Delays and Timing. General algorithm. Deductive and concurrent fault simulation. Fault injection and comparison of fault simulation methods. Coding theory & techniques in fault tolerant, self checking fail-safe circuits. An overview of architecture of fault tolerant computers. System diagnosis. a brief idea of fault tolerant software.

Books / references:

1. D. K. Pradhan - Fault Tolerant Computing, Prentice Hall of India.

CS 775 Optimization Techniques
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction to optimization

Introduction and scope of optimization. Definitions: design vector, design constraint and objective function. Classification of optimization problems.

Classical optimization techniques

Local and global minima and maxima. Single and multi-variable optimization without constraints. Multivariable optimization with inequality constraints. Method of direct substitution and method of Lagrange's multipliers. Multivariable optimization with inequality constraints. Kuho-Tucker conditions.

Linear programming

Formulation of linear programming problems (LPP). Standard form of LPP. Geometry of LPP (graphical solution). Solution by the simplex method. Computer program. Duality in linear programming. Sensitivity or post-optimality analysis.

Non-linear programming

Uninodal functions. One dimensional minimization methods. A brief idea about elimination (search) method. Fibonacci and golden section methods. Quadratic interpolation method. Gradient methods. Method of steepest descent, conjugate gradient (Fletcher-Reeve) method.

A brief introduction to dynamic programmiry and solution to simple problems.

Text Books / references:

1. N. S Rao - Optimization: Theory and Application Wiley Eastern ltd.
2. H. Taw - Operations Research - An Introduction, Prentice Hall
3. K. V. Mittal and C. Mohan - Optimization Methods in Operations Research and System Analysis, New Age International.

CS775 Perasive Computing
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introductory concepts, Brief History and Emerging Trends

Pervasive Computing Application Architectures, Pervasive Computing Devices.
Interfaces and Biometrics.

Operating System issues in Pervasive Computing. Java in Pervasive Computing

Device Technology Trends in Pervasive Computing. Device Connectivity Issues and Protocols . Device Connectivity Security Issues. Device Management and Mechanisms

Web-based Applications. Protocols, Transcoding, Authentication of Clients over Web. Wireless Application Protocol (WAP). WAP Architecture, Infrastructure, Security. WAP Push Technology, I-Mode and Emerging Trends. Scalability and Availability Issues

Wireless Markup Language: Introduction.

Voice-enabling Pervasive Computing Systems: Introduction. Voice Standards. Speech applications and security issues.

Personal Digital Assistants: Introduction. PDA Operating Systems. PDA Device Characteristics. PDA Software Components, Standards. Applications.

User Interface Architectures. Implementation of User Interface Architectures. Smart Card-based Authentication Mechanisms over the Internet.

Books and References:

1. Jochen Burkhardt, Horst Henn, Stefan Hepper, Thomas Schaec & Klaus Rindtorff: Pervasive Computing: Technology and Architecture of Mobile Internet Applications, Pearson Education, 2004

2. Uwe Hansman, Lothar Merk, Martin S. Nicklous & Thomas Stober: Principles of Mobile Computing, Second Edition, Springer-Verlag, New Delhi, 2003.

3. Rahul Banerjee: Internetworking Technologies: An Engineering Perspective, Prentice-Hall of India, New Delhi, 2003.

5. Yi-Bing Lin & Imrich Chlamtac: Wireless and Mobile Network Architectures, John Wiley & Sons, New Delhi, 2004.

6. P. Nicopolitidis, M. S. Obaidat, G. I. Papadimitriou & A. S. Pompportsis: Wireless Networks, John Wiley & Sons, New Delhi, 2003.

CS776 Multimedia Theory And Applications
Theory: 100 marks
Sessional: 75 marks
Time: 3 Hours

Introduction
History of Multimedia Systems, Hypermedia/Multimedia, HyperText/HyperMedia, Overview of Multimedia Software Tools, Music Sequencing and Notation, Graphics Image and Video Editing, Multimedia Authoring.

Issues in Multimedia authoring
Multimedia Authoring Metaphors, Content Design, Scripting(Writing), Graphics(Illustrating), Animation(Wiggling), Audio(Hearing), Interactivity (Interacting)

Multimedia Data Representations
Basics of Digital audio, Introduction to MIDI(Musical Instrument Digital Interface), Graphics/ Image File Formats, Standard System Independent Formats, System Dependent Formats, Color in Image and Video, Basics of Video, Types of Color Video Signals, Digital Video.

Video and Audio Compression
Basics of Information Theory, Lossless Compression Algorithms, Huffman Coding, Lempel-Ziv-Welch Algorithm, Image Compression-JPEG, 4 JPEG modes, JPEG 2000, Video Compression, H.261, H.263, MPEG, New MPEG Standards, Audio Compression, Simple Audio Compression Methods, Psychoacoustics.

Books/ References

4. Multimedia System Design by Adeleigh and Thakrar.
5. Multimedia at Work by T. Vaughan
6. Introduction to Data Compression by Khalid Sayood

CS776 Microprocessor Based System Design
Theory: 100 Marks
Sessional: 75 Marks
Time: 3hrs

Small Systems Organization

Bus Architecture

Building blocks around a microprocessor

Memory Techniques, RAM discs

PAGED memory modules

Communication and data transfers

Monitors and Operating Systems

Engineering Applications of Microprocessors as device controllers

Concept of local and Central Control.

CS776 Graph Theory
Theory: 100 Marks
Sessional: 75 Marks
Time: 3 Hours

Graph : Incidence and degree; Handshaking Lemma; Isomorphism; Subgraphs and Union of graphs; Connectedness; Walks, Paths and Circuits; Components and Connectedness; Walks, Walks, Paths and Circuits; Components and Connectedness algorithms; Shortest Path Algorithms, Eulerian graph, Fleury's algorithm and Chinese postman problem; Hamiltonian graph - necessary and sufficient conditions; Traveling salesman; Bipartite graph.

Tree : Properties of trees; Pedant vertices in a tree; Center of a tree; Rooted binary trees; Spanning trees - Spanning tree algorithms; Fundamental circuits; Spanning trees of a weighted graph; cut-sets and cut-vertices; Fundamental cut-sets; Connectivity and separativity; network flow; max-flow min-cut theorem.

Planner graph: Combinatorial and geometric dual; Kuratowski's graph; detection of planarity; Thickness and crossings.

Matrix representations of graph: Incidence; Adjacency; matrices and their properties.

Colourings: Chromatic number : Chromatic polynomial; The six and five colour theorems; The four colour problem.

Directed graphs : Binary relations; Directed graphs and connectedness; directed trees; Aborecence; Polish method; Tournaments.

Counting of labeled trees : Cayley's theorem; Counting methods; Polya theory.

Books :

1. Deo, N.: Graph Theory with Applications to Engineering and Computer Science.
2. Harary : Graph Theory, PHI (EEE)

BRANCH: INDUSTRIAL & PRODUCTION ENGG. (7TH Semester)

SL.No	Course No	SUBJECT	PERIOD			EVALUATION SCHEME					
	Theory					Sessional/Exam.			ESE	Subject Total	Credit
			L	T	P	TA	CT	Total			
1	IP 731	Production Planning & Control	3	1	0	50	25	75	100	175	4
2	IP 732	Ergonomics & Work Design	3	1	0	50	25	75	100	175	4
3	IP 733	Non-Traditional Production Process	3	1	2	50	25	75	100	175	4
4	IP 734	Organisational Behaviour and Industrial Relation	3	1	0	50	25	75	100	175	4
5	IP 735	Elective – I	3	1	0	50	25	75	100	175	4
6	IP 736	Elective – II (Open)	3	1	0	50	25	75	100	175	4
		Practical/ Drawing/Design									
7	IP 737L	Practical Training	0	0	2					50*	2
8	IP 738L	Project – I	0	0	8					100**	4
Total			18	6	12					1200	

Total marks : 1200 **Total Periods: 36** **Total Credits : 30**

TA : Teachers Assessment *CT: Class test* *ESE : End Semester examination*

Electives : Industrial and Production Engg.

Elective – I : Ecology and Environment/Tool Design

Elective – II : Total Quality Managemant

* Practical Training : Report = 20 marks ; Seminar + Viva = 30 marks

** Project – I : TA = 40 marks ; Report = 30 marks ; Seminar + Viva = 30 marks

IP 731 : PRODUCTION PLANNING AND CONTROL [3-1-0]

Theory100 marks Sessional75marks Time 3 Hrs

Unit I : The need for production planning and control (PPC) – Functions – Production planning versus Production planning versus Production Control.

Factors influencing PPC : Project and Jobbing production, Batch, Mass and Flow production, Continuous production – Planning for meeting seasonal or occasional increase in demand. Centralised and decentralised PPC.

Unit II : Pre-requisites of PPC : product design and analysis – marketing, functional and operational analysis ; Data for raw materials, Equipment and Tooling.

Economic Analysis : Profit and competitiveness – standardisation and Simplification – Economic lot size.

Unit III : Process Design : Product planning or buy decision, value analysis. Process planning steps and process sheets – Routing – Tool control. Cost benefit and Break-even analysis.

Process planning in different situations.

Unit IV : Scheduling : Concepts – Factors influencing scheduling : Master Schedule.

Job Schedules – Schedule techniques – Gantt Chart. Mathematical loading and scheduling – Index method – Sequencing.

Project Scheduling – Network logic and Steps in the use of critical Path Analysis.

Unit V : Dispatching : Introduction and Functions – How functions are performed – Dispatching under different situations – Documents in Dispatching.

Unit VI : Sales Forecasting : Need and meaning – Forecasting techniques – market survey ; Experimental smoothing ; Regression analysis, sessional variations.

Extrapolating Future Demand.

Reference books

1. Production Planning and Control (Everest Publisher) ------ L. C. Jhamb.
2. Elements of PPC (Universal Book) ------ S. Elton.
3. Production Systems, Planning analysis and Control ------ J. L. Riggs.

IP 732 : ERGONOMICS AND WORK DESIGN [3-1-0]

Theory100 marks Sessional75 marks Time 3 Hrs

Unit I : Introduction and definition : Main constituent areas of study – Approach to Ergonomic problem solving and Guide to Ergonomic study – Motto and responsibilities of Ergonomists.

Defining human factors in a production systems ; Characteristic features of man-machine system.

Unit II : Anthropometry : meaning – Body dimensions and posture – Structural and Functional Body dimensions : Design of seating – work surface height – Design for extreme individuals and average : Design for adjustable range.

Work space Design.

Unit III : Human performance and performance reliability : Human performance under heat, cold, illumination, vibration, noise, pollution, static and dynamic conditions.

Unit IV : Bio-mechanics and Bio-engineering : Movements of body members – anatomical levers – Energy expenditure in body movements – Rest period.
Unit V : Design of Controls : Types and Examples ; Choice of control – control dynamics ; general principle.
Unit VI : Application of results from human factors data and analysis in work study : Work design ; Method study and work measurement techniques.

Reference books

1. Ergonomics [AICTE, code no. 264] ---------- Dr. S. Raja.
2. Work Study and Ergonomics [Dhan Pat Rai & sons] ------ H. S. Shan.
3. Industrial Engineering and Production Management ------ M. Telsang.
[S. Chand & Co.]
4. Ergonomics and work Design [New Age] ------ Nag.

IP 733 : NON -TRADITIONAL PRODUCTION PROCESS [3 -1-2]

Theory100 of marks Sessional/Lab75 marks Time 3 Hrs

Unit I : Introduction to the new methods of Production, Need and capability analysis of the various processes ; classification and selection.
Unit II : Abrasive processes of machining : Abrasive Jet Machining (AJM), Water Jet Maching (WJM) and ultrasonic Machining (USM). Equipments and the processes ; advantages and Application.
Unit III : Chemical Machining (CHM) and Electro-chemical, Machining (ECM) : Principle and steps in the process ; merits, demerits and application. Electro-chemical deburring and Honing. Electro-Chemical Grinding (ECG).
Electrical Discharge Mechnining (EDM). Principle of the process ; the EDM machine and tools. Field of application. Comparison with ECM.
Unit IV : The principle and process of Electron Beam Machining (EBM), Plasma Arc Machining (PAM) and Laser Beam Machining (LBM). Comparative study of the processes and applications.
Unit V : High Energy Role Forming (HERF) or High Velocity Forming (HVF) -- Explosive Forming, Electrohydraulic Forming, Magnetic Forming and Pneumatic Mechanical Forming. Principle, steps and application.
Unit VI : **S**election of the most suitable process for a products. Economic analysis of the non-traditional machining processes.

Reference books

1.

2.

IP 734 : ORGANISATIONAL BEHAVIOUR AND INDUSTRIAL RELATIONSHIP [3-1-0]

Theory-100marks Sessional-75marks Time 3 Hrs

Unit I : Introduction : Concept and features of organisation. Types and signature – concept of organisational behaviour (OB) : Nature and role of O.B. – value of Theory and experience – Applying OB knowledge to management practices ; Hawthorne experiments.

Unit II : Motivation and behaviour – Human needs and classification : Maslow's Need Priority Model and Need Hierarcht.
Theory X and Theory Y : Expectancy Theory of approach. Financial and non-fianacial incentives. Job enrichment.
Concept and nature of Attitudes – attitudes formation, measurement and change.

Unit III : Group Dynamics and behaviour : Concept – Nature and types of group : Group behaviour, norms, cohesion and decision making. Positive and negative aspect of group decision making.
Conflict management : meaning and definition – stages of conflict situation. Conflict resolutions and implication.

Unit IV : Leadership Qualities : meaning and definition – importance and functions of leadership ; leadership styles ; Theories of leadership. Factors affecting managers as leaders.
Power and Authority : Need for control ; control and organisational factors ; Means of Control. Power distribution in organisation ; Authority and its sources, Limits of authority. Power and authority comparison.

Unit V : Organisational Developments (O.D.) : Objectives and values O.D. ; characteristics of O.D. ; process involved in O.D. and the variance training methods used.
Human Resources developments.

Unit VI : Participative Management : Idea, advantages and Limitations of participation ; Theories of participation. Participative management : Morale and productivity. Determinants and degree of participation.

Unit VII : Industrial Relations : Indian Trade Union act, Industrial Dispute act and Indian Factories act.
Industrial disputes Settlement machinery in India – Works committee, Conciliation officers, Board of Conciliation, Court of inquiry, Industrial Tribunal, Adjudication.

Payment of Wages act : Workmen's compensation act.

Reference books

1. Organisational Behaviour : Concepts, Controversions and application (PHI) ------ Stephen P. Rabins.
2. Organisational Behaviour (S. Chand & Co.) ------ L.M. Prasad.
3. Organisational Behaviour (King Books) ------ M.M. Varma anf R. K. Agarwal.
4. The Industrial Law (Eastern Book Co) ------ P. L. Malik
5. Personal Management and Industrial Relations in India. (Vikash) ------ R. S. Davar.
6. Labour and Industrial Laws. (Pioneer Printers) -- R. K. Agarwal and A.K. Gayal.

IP 735 (Elective I) : ECOLOGY AND ENVIRONMENT [3-1-0]

Theory -100 marks Sessional -75 marks Time 3 Hrs

Unit I : Basic concept of Ecology and Environment : Subdivision of Ecology – Basic components of Environment – impact of major technological developments.

Ecosystems – Components and functioning – concept of Homeostatis – Natural , man made and agroecosystems.

Impact of Biosphere on the Environment.

Unit II : Earth's Natural Resources – Soil, Water, Forest, Wildlife etc.: Renewable and non-renewable resources – Finite nature of the natural resources – basic human requirements – overexploitation of the resources ; towards sustainable developments.

Unit III : Environmental pollution – Effects of Pollutants on living systems : Air, Water, Agricultural Noise and Radiation pollution – Solid waste and Hazardous substances.

Monitoring and Control.

Unit IV : Environment and Future : Global warming causes and Effects.

Pollution growth – regulation ; Modern Technology and Population explosion ; World Food Production – population growth in India – Green revolution.

Growth and Urbanisation : factors contributing to urbanisation – urban environment – health housing, Education etc. – management of urbanisation.

Unit V : Environmental Imapact Assessment process – Goals, Objectives, Survey, Prediction and analysis ; alternative plans – implementation and monitoring. Cost benefit analysis.

Environment and sustainable developments with regard to population growth, Global warming, Urbanisation and Industrial growth – Threat to sustainable development – development project and nature management.

Reference books

1. Environmental Problems and solution (S. Chand & Co.) ----- D. K. Asthana and Meera Asthana.
2. Fundamentals of Environmental Science (Kalyani Publ.) ----- G. S. Dhaliwal, G.S. Sinha and P. K. Rathen.
3. Environmental Engineering (Tata Mc Graw Hills)---- G. N. Pandey & G. C. Carney.

IP 736 (Elective II) : TOTAL QUALITY MANAGEMENT [3-1-0]

Theory-100 marks Sessional-75 marks Time 3 Hrs

Unit I : Introduction : Concept of quality : Quality of design Conformance and Performance – Inspection and Quality Control (Q.C.) cost and value of Q.C. – Statistical Quality Control (S.Q.C.) – Benefits.

Total Quality Control (T.Q.C.) -- meaning and evolution.

Unit II : Concept and definition of Total Quality Management (TQM) : Characteristics feature – stages in TQM ; Pre-requisites and Lavels of TQM – Methodology for implementation.

TQM concept and practice in India.

Unit III : The Structure of TQM – Quality checkpoints – stages of Product's life and associated quality control – structural Elements of TQM..

Unit IV : The operational Dimensions of TQM. Creating a co-ordinating structure for TQM activities – Quality improvement and Quality policy – Training for TQM activities.

Quality Control Circles (QC^2) : Variations and characteristics – Establishing QC^2.

Objectives, standards and measures for TQM.

Unit V : Implementation of TQM : Scope and pre-conditions – Planning for implementation – guidelines and steps – Juran's Methodology for Quality Planning.

Unit VI : Problems in TQM implementation – Impending factors and supportive measure -- Integration for TQM ; Proactive and Reactive approach.

ISO : 9000 -- A way to TQM.

Reference books

1. Total Quality Management : Theory practice [AICTE]------ Dr. P.N.Rastogi.
2. T.Q.M. & ISO : 9000 [AICTE publication] ------ Dr. P.L. Bali.
3. Statistical Quality Control [Dhan Pat rai & Sons] ------ M. Mahajan.

IP 737L: PRACTICAL TRAINING(0-0-2)

Sessional: 50marks

Factory training for a period of 6 (six) weeks is compulsory for all the Industrial and Production Engineering Students and 20 marks are allotted for the Technical report submitted after completion of the training. There will be a seminar cum viva on the report submitted by the student and 30 marks are assigned for this. The report should be submitted to the HOD, by a date announced by the HOD. Students are to obtain a certificate from the Factory Authority regarding their attendance and performance during the training period which is to be submitted along with the report.

IP 738L: PROJECT – I(0-0-8)

Sessional marks: 100 Pass marks: 50

Under this course each student will be assigned a topic related to Industrial and Production Engineering. The project may be extended to Eight semester depending upon the quantum of works required for the project. The students will work under a faculty member and submit a report on the assigned project in a standard FORMAT prescribed by the department.