Branch: Civil Engineering. **Year: Third.** **Semester: Sixth**

SL. NO.	COURSE NO.	SUBJECT	PERIOD			EVALUATION SCHEME					
Theory			L	T	P	Sessional Examination			ESE	Subject Total	Credit
						TA	CT	Total			
1.	CE 611	Design of Structures-II.	3	1		30	20	50	100	150	4
2.	CE 612	Foundation Engineering.	3	1		30	20	50	100	150	4
3.	CE 613	Transportation Engineering-II.	3	1		30	20	50	100	150	4
4.	CE 614	Environmental Engineering-II.	3	1		30	20	50	100	150	4
5.	CE 615	Estimation and Valuation.	3	1		30	20	50	100	150	4
6.	CE 616	Hydrology.	3	1		30	20	50	100	150	4
7.	CE 617	General Proficiency.							50	50	2
Practical/Drawing/Design											
8.	CE 617	Survey Camp.			4				50	50	2
9.	CE 611 L	Design of Structures-II.			3	30	20	50		50	2
10.	CE 613 L	Transportation Engineering-II.			3	30	20	50		50	2
11.	CE 614	Environmental Engineering-II.			3	30	20	50		50	2
Total			18	6	13						

Total marks: 1150 Total Periods: 37 Total Credits: 34

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

DESIGN OF STRUCTURES- II
SUB CODE: CE 611

Theory – 100.
Sessional – 50.
Time - 4 hrs.

1. **General principles of design:** Types of loads, structural arrangement, structural metals and their properties, I.S. specification.

2. **Riveted joints:**Dimension, pitch, edge distance, types of failure, strength and efficiency of lap and butt joints, splices for angles, flanges and web plates.

3. **Riveted connections in frames:**Centrally and eccentrically loaded connection, riveted connection, rivet in combined shear and tension.

4. **Welded joints:**Types of welded joints, various types of butt and fillet joints, strength and efficiency of welded joints.

5. **Welded connection in frames:**Welded brackets, moment resistant welded connections. Design of tension members, splicing of tension members.

6. **Design of compression numbers:**Simple struts, concentrically and eccentrically loaded simple and built up columns, column splice, secondary design consideration, column splicing.

7. **Design of beams:**Simple and built up beams, laterally restrained and un-restrained beams.

8. **Column bases:**Centrally and eccentrically loaded, base plate design and grillage foundation.

9. **Design of roof truss:**Types of truss for different spans, dead, live and wind loads, rise, camber and spacing, end supports and bearings, joints and connections, design of purlin. Industrial buildings-truss, columns, bracings.

DESIGN OF STRUCTURES- II (PRACTICAL)
SUB CODE: CE 611L

Marks- 50.

Practical Class on Design of Structures

Concrete:

Preparation of detailed structural drawings various reinforced concrete members viz. beam, slab, column, foundation (shallow and deep), pile cap etc.

Steel:

Preparation of detailed drawing for riveted and welded connections, splicing, lacing, column base, grillage foundation, beam-column connections.

Working Drawing to be prepared in tracing paper and blue print copies to be submitted.

FOUNDATION ENGINEERING
SUB COD: CE 612

Theory – 100 marks.
Sessional – 50 marks.
Time – 3 hrs.

Introduction: Classification of foundation types and principles of selection.

Lateral earth pressure: Earth pressure at rest, Rankine and Columb's theories for active and passive states, influence of surcharge, water table, wall friction and deformation on earth pressure, Culman's graphical method, point of application.

Bearing capacity of shallow footings: Requirements for satisfactory action of footings, Terzaghis theory, factors affecting bearing capacity, influence of eccentric and inclined loads. Determination of allowable bearing pressure and proportioning of footing on clay and sand.

Stress distribution computation for immediate and consolidation settlements, limits of settlement, correction for rigidity and three dimensional consolidation effects, settlement of foundation in sand and clay, Boussinesque and Westegaard formula and Newmark's chart.

Deep foundation: Uses and types of piles, bearing capacity of single pile in clay and sand, Engineering News and Hiley's formula, Indian standard pile load test, group action, negative skin friction, settlement of pile groups.
Piers and caisson foundations, elements of well foundation, depth of well foundation, list of forces acting on well, remedial measures for shifts and tilts of well, permissible values.
Introduction to ground improvement techniques including use of geosynthetics.

Soil exploration: Purpose, methods of soil exploration, methods of boring, soil samples and samplers, penetration and sounding tests, plate load test, geophysical methods, planning of exploration programme.

Types of machine foundations, modes of vibration of a block foundation, degrees of freedom of a block foundation, design criteria of a reciprocating machine foundation.

TRANSPORTATION ENGINEERING–II
SUB CODE: CE 613

Theory - 100.
Sessional - 50.
Time- 3 hrs.

Railway Engineering:

Permanent way: Rail, sleeper, ballast – their ideal requirements, dimensions, classification and behaviours, wearing of rails, coning of wheels, creep – causes, effects & remedies, Railway surveys – traffic, reconnaissance, preliminary and final location surveys.
Geometric Design: Gauges, alignment, horizontal curves, super elevation, Gradients and grade compensation, Length of transition curve, cross – sections of permanent way, Geometric requirements for high speeds.
Construction of railway track: Stages in construction, methods of plate laying, various fittings and fixtures, points and crossings, Turn – outs and track junctions.
Signalling and interlocking: Control of train movements types of signals in stations and yards, principles of interlocking.
Resistances to traction: Various resistances, Hauling capacity and Tractive effort, various stresses in Railway Track.

Airport Engineering :

Aircraft characteristics : Aeroplane component parts.
Airport Planning : Regional planning, Airport selection, Zoning laws, Imaginary surfaces.
Airport Layout: Geometric components of an airport and their functions, Typical Airport layouts.
Runway Design : Runway orientation, Basic Runway Length, corrections for Elevation, Temperature and Gradient, Runway Geometrics.
Taxiway Design : Geometric Design Standards, Turning radius, Exit Taxiways.
Structural Design of Airport Pavements: Design factors, Design methods for Flexible and Rigid Pavement, Design of an overlay, special characteristics and Requirements of Airport Drainage.

Tunnel Engineering :

Advantages and Disadvantages of Tunnels, Classification, Shapes of Tunnels, Sizes of Tunnels.
Shafts: Classification, Shape, Size and location. Introduction to various methods of tunneling, Methods of ventilation and Dust Control.

TRANSPORTATION ENGINEERING – II
SUB CODE: CE 613 L

Marks-50.
Time – 4 Hrs.

LABORATORY WORK: -

1. Ductility determination.
2. Viscosity determination.
3. Softening Point determination.
4. Flash and fire point determination.
5. Striping Value determination.
6. Marshal Stability test.
7. Penetration test,
8. Skid Resistance test.

ENVIRONMENTAL ENGINEERING–II
SUB CODE: CE 614
Theory – 100 marks.
Sessional – 50 marks.
Time - 3 hrs.

Introduction: Sanitation, sewage, sewer, sewerage, method of water collection conservancy and water carriage system, sewerage system types, selection of a system.

Waste water flow : Quantity of sanitary sewage, infiltration of water, variation in flow and its impact on waste water system, quantity of storm water, rational method, time of concentration, rainfall intensity duration relationship, Empirical formula.

Sewage characteristics: Important parameters and their significance SOD COD solids, DO nitrogen, test physical, chemical, biological: Standards of disposal in natural water course and on land.

Waste water collection: Sewerage system, principle of lay out and planning shapes of sewers design of sewers, self clansing velocity and slopes, construction and testing of sewers line, sewers materials, joints and appurtenances, maintenance of sewerage system. Sewage pumping and its necessity, sewage pumps.

Waste water treatment: Objectives, methods and their sequance and afficiencies, preliminary treatment screening, grit removal, scum removal, primary treatment, sedimentation, secondary biological treatment, trickling filter, cirlculation, activated sludge process: sludge digestion and disposal.

Waste water disposal: Disposal by dilution, disposal by irrigation, sewage farming, sewage sickness, sewage disposal for independent houses and small communities septic tank and its general features, working principle and design consideration : imhoff tank, oxidation pond, aerated lagoon etc.

Plumbing for drainage of building: various system of plumbing, traps, layout of house, drainage, ventilation.

Environmental Pollution: Introduction to air, sound, ground pollution. Causes, effects, and preventive measures.

Refuse disposal and rural sanitation: Collection storage, recovery and disposal of refuse.

Elements of ecology:
Ecosystem components, energy flow effects of human interference.

ENVIRONMENTAL ENGINEERING–II
SUB CODE: CE 614 L

Marks-50.

Laboratory tests for Water:

DO (Dissolve Oxygen), BOD (Bio-Chemical Oxygen Demand), COD (Chemical Oxygen Demand).

ESTIMATION AND VALUATION
SUB CODE: CE 615

Theory – 100 marks.
Sessional – 50 marks.
Time – 3 hrs.

1st half: Estimation (60 marks)

Introduction: - Principles of Estimating, Purpose and types of Estimates, Standard methods of measurement.
Specifications of work: - Aims of specification, Types, Method of preparation, Detail specification of some important items.
Rate Analysis: -Purpose importance, Factors affecting Rate Analysis, Labour & Material requirement for important items of work.
Schedule of Rates: -Local schedule of Rates, CPWD schedule, Importance of schedule. Schedule of Rates for important item-such as-Earth work, Carriage, Concrete, Brick work, Wood work, Steel work etc.
Building Estimate: -Estimate of Single Storied Building (sloped roof & R.C.C.), Trusses.
Road Estimate: - Earthwork Calculation, Estimate for a New Road, Culvert.

2nd half: Valuation (40 marks)

Basic knowledge of value: -Market value, rent, ground rent secured, unsecured, interest, present value, reversionary value.
Rental method of valuation: -Cross rent, net rent, rack rent, security, year's purchase, annual sinking fund, salary or premium.

Land and Building methods of valuations: -Factors affecting value of lands.
Buster land, land locked land: -Various methods of valuation of buildings, Depreciation, Comparison of land value by belting, value of leasehold interest.

HYDROLOGY
SUB CODE: CE 616

Theory – 100.
Sessional – 50.
Time – 3 hrs.

Introduction: Hydrology- definition & scope, hydrologic cycle and its components.

Precipitation: Forms, type & formation of precipitation, measurement of rainfall, interpretation of rainfall data, estimating missing data, double mass curve, average rainfall over area, DAD analysis, abstraction from precipitation.

Runoff and Hydrograph: Runoff components, factor effecting runoff, hydrograph and its components, base flow separation, unit hydrograph– concept, derivation, limitations and use, S- hydrograph and its uses.

Ground Water hydrology: Occurrence of ground water, soil-water relationship, Aquifers, movement of ground water, Darcy's law, yield from wells for confined and unconfined aquifers, yield of an open well.

Urban hydrology: Introduction, use of rational method, hydrograph method.

Flood routing: Definition, storage equation, reservoir routing and channel routing, Hydrologic methods.

Water resources planning: Role of water in national development, single and multipurpose projects, reservoirs– types, Physical characteristics, determination of reservoir capacity, mass curve, yield from a reservoir.

SURVEY CAMP
SUB CODE: CE 618

Marks: 50.

To set out a composite circular –transition- circular.

Approximate mapping of a small area using stepping for linear distance.

Traversing with theodolite using tacheometric principle for distance measures and its plotting. Using Plane-tables, locate the important details. Also draw the contour lines using any method.

Setting out a route alignment.

Demonstration of all available instruments such ad, Automatic level, Microoptic theodolites, Total station and GPS.

Theoretical introduction to GIS.

6th 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 621	Machine Design – II-KK	3	0	0	30	20	50	100	150	4
2	ME 622	Operation Research-RKD+KKB	4	0	0	30	20	50	100	150	4
3	ME 623	Fluid Mechanics – II-AJB	3	1	0	30	20	50	100	150	4
4	ME 624	Engg. Inspection and Metrology – RKD+PKC	3	1	0	30	20	50	100	150	4
5	ME 625	Workshop Theory – II-AB	3	0	0	30	20	50	100	150	4
6	ME 626	Numerical Methods and Computation-KK+KKD	3	1	2	30	20	50	100	150	4
7	ME 627	General Proficiency							50	50	2
Practical/ Drawing/Design											
8	ME 621L	Machine Design – II	0	0	3	30	20	50		50	2
9	ME 623L	Fluid Mechanics – II	0	0	3	30	20	50		50	2
10	ME 624L	Engg. Inspection and Metrology	0	0	2	30	20	50		50	2
11	ME 625L	Workshop Theory – II	0	0	3	30	20	50		50	2
Total			19	3	13						34

Total marks : 1150 **Total Periods: 35** **Total Credits : 34**

ME 621: MACHINE DESIGN II (3-0-3) (for ME & IPE)

Theory 100 marks Sessional 50marks Laboratory 50marks Time 4 hours

Unit I : Design against static load Different type of load and stress, Mode of failure. Factor of Safety.

Unit II : Design against fluctuating load Stress concentration, fluctuating stresses, Fatigue failure, endurance limit, Notch sensitivity, cumulative damage in fatigue, Soderberg and Goodman Diagrams, Fatigue design under combined stresses.

Unit III : Design Considerations and simple cases of design for

a) Mechanical Spring – helical spring
b) Friction clutches – single and multidisc clutch, cone clutch
c) Brakes – Disc, cone, band, and internal expanding shoes
d) Spur Gear, Helical gear
e) Bearing – radial and Thrust journal bearings, antifriction bearings
f) Cams
g) Gasket for static load, in vessel opening

Reference Books:

1. Machine Design (Tata McGraw Hills) ----- Blach and Adams
2. Design of Machine elements (-do-) ----- B. V. Bhandari
3 Machine Design (….) ------- Bahl & Goel
4. Machine Design ----- Hall
5. Machine design ----- Shigley
6. Design of Machine elements ----- M. F. Spot.

ME 622: Operations Research (4-0-0) (for ME &IPE)

Theory100 Sessional 50 Time: 3hours

1. Introduction to OR, Engineering applications, Statement of an OR problem, Type of problems handled in OR.
2. (a) Linear programming (deterministic) – Problem formulation, Feasibility and Optimality, Basic and Non-Basic solutions
   (b) Graphical method of solving LPP, Simplex Algorithm and problem solutions, Use of Slack, Surplus and Artificial variables and their meanings
   (c) Big-M method and 2-phase method
   (d) Dual Simplex algorithm
   (e) Meaning and examples of Unique, Alternate/Multiple, Unbounded and Infeasible solutions.
   (f) Degeneracy and Cycling
3. Special Linear Programming problems – their formulations and solutions in such cases as Integer Programming Problem (IPP), Transportation Problem (TP) and Assignment Problem (AP). Discussion on method extended to Travelling Salesman Problem (TSP).
4. Classical Optimisation – Introduction, Single and Multi-variate problems, Lagrangean method, Karush-Kuhn-Tucker (KKT) conditions
5. Inventory modelling – Classification of inventory, Deterministic versus Stochastic problem situations, Formulation and Solution of Deterministic inventory problems,
6. Simulation – Meaning, Monte-Carlo simulation, generation of random observations, Use of digital computers in simulation, Discussion on simulation examples such as inventory, queuing etc.

Text and references

1. Operations Research – H A Taha
2. Operations Research – Gupta and Hira
3. Operations Research – Billy E Gillet
4. Operations Research – Panneerselvam
5. Optimisation – S S Rao
6. Operations Research – N G Nair
7. System Simulation by digital computers – N Deo

ME 623: FLUID MECHANICS – II (3-1-3)

Theory100 marks Sessional50marks Laboratory 50marks Time3 hours

Unit I : Compressible Flow: Perfect gas, Propagation of elastic waves, wave pattern under varying Mach number, Prandtl Mayer relation, Maximum mass flow and chocked condition, Isentropic flow, Shock waves-Normal shock, Impossibility of shock in subsonic flow, Moving normal shock waves, Effect of Mach numbers on compressibility, Fanno flow, Rayleigh flow, Isothermal flow in long pipelines, Oblique shock and nature of flow, Compression corner and expansion corner, Supersonic flow over a wedge.

Unit II : Viscous Flow: Characteristics of laminar and turbulent flow, Boundary layer equation, Blasius flow over flat plate, Wall shear and boundary layer thickness, Momentum integral equation for boundary layer, Separation of boundary layer, Entry flow in a duct, Control of boundary layer separation, Mechanics of boundary layer transition, Several events of transition, Form drag and skin friction drag.

Unit III : Turbulent Flow Characteristics, Classification, Theories of Turbulent, Mean Motion and Fluctuations, derivation of Governing equation for turbulent flow, boundary conditions, Prandtl's mixing length, universal velocity distribution Law and Friction factor in Duct flow for very large Reynold Numbers, Karman's similarity hypothesis, velocity distribution, shear velocity, hydraulically smooth and rough boundaries, velocity distribution in rough pipes, Nikuradse's Experiment on artificially roughened pipes, Karman-Prandtl resistance equation.

Reference Books :

1. Fluid Mechanics (Tata McGraw Hill) -------- V. L. Steeter
2. Fluid Mechanics (Prentice Hall India) ------- A. Mohanti
3. Fluid Mechanics (ELBS) ------- Massey
4. Gas Dynamics (PHI) ------ E. Rathakrishnan

ME 624: ENGINEERING INSPECTION AND METROLOGY (3-1-2),(for ME &IPE)

Theory: 100 Sessional: 50 Laboratory: 50 Time: 3hours

1. **Introductory concept**: Meaning of engineering inspection and Meaning of engineering metrology. Controlling quality through inspection, types of inspection, merit/demerit of 100% inspection, Sampling inspection – Representative sample. Different methods and techniques of measurement. Standards of measurement and sub-division of standards.
2. **Statistical Process Control**: Product variations – Chance causes and assignable causes, Control charts and its significance in statistical process control, Computer implementation of control charts.
3. **Limits of size and fits**: Concept of tolerance, allowance and clearance. Natural tolerance limits, process capability and Specification limits. Hole and shaft basis systems of specifying limits of size and tolerances. Indian Standard for fits and tolerances.
   Limit gauges – hole and plug gauge, Taylor's principle of gauging. Tolerances and allowances during design of gauges.
   Interchangeability – its importance in production, techniques of achieving interchangeability during manufacturing.
4. **Measurement of screw threads**: Terminologies of screw threads. Measurement of various parameters of screw thread such as diameter, thread angle, effective diameter and pitch. Use of screw gauge and pitch gauge, Use of diameter and pitch measuring machines. Two and three wire methods.
   Use of Profile projectors and Tool Maker's Microscope (TMM) in the measurement of thread elements
5. **Measurement of gears**: Gear tooth profiles – involute and cycloidal, involute function. Spur gear measurements for run-out, pitch, profile, backlash. Parkinson gear tester. Measurement of tooth thickness – chordal thickness method, constant chord method, base tangent method. Check for pitch circle diameter and tooth spacing.
6. **Surface texture**: Meaning of surface texture, order of geometrical irregularities, elements of surface texture. Meaning of roughness and fineness. Roughness width cut-off. Representation of surface roughness. Estimation of surface roughness. Measurement of surface roughness by stylus equipment.
7. **Interferometry**: – Principle of interference. Use of optical flat. Gauge interferometer – Principle NPL gauge interferometer. Laser interferometer.
8. **Alignment testing:** – Optical methods for alignment testing, Laser alignment testing.

Texts and references:

1. Engineering Metrology – K J Hume
2. Engineering. Metrology – K W B Sharp

3. Engineering Metrology – R K Jain
4. Engineering metrology – M Mahajan
5. Dimensional metrology – M K Khare and S Vajpayee.

ME 625: Workshop Theory- II (3-0-3)

Theory: 100 Sessional: 50 Lab:50 Time: 3hrs.

Unit-I –Mechanics of metal cutting: Mechanism of chip formation – Type of chips. Orthogonal and oblique machining, Chip thickness ratio and velocity relationship, Stress, Strain and Strain rate, Merchant Theory of metal cutting, Measurement of cutting forces, Cutting variables and factors affecting them. Tool wears and Tool life – Basic causes – Progressive tool wears – Tool life – Variables affecting tool life – Specifications and criteria for tool life. Machinability – Factors – Criterion.

Unit-II – Semi-Automatics:

Capstan and Turret lathes – Different parts – Tools —Work and Tool holding devices. Indexing and Bar Feeding Mechanisms. Tool layout and Tool Schedule chart.

Unit-III – Milling: Introduction – Classification – Principal parts of a column and knee type milling machine – Specifications. Spindle drive and feed mechanism, Elements of a milling cutter, Milling processes – Up-milling – Down milling – Face milling – End milling. Cutting Speed, Feed and Depth of Cut – Machining Time. Indexing and Dividing Head – Indexing Methods. Spur and Helical gear milling Operations – Selection of Cutter for gear cutting.

Unit-IV – Grinding: Introduction – Kinds of grinding – Grinding Processes – Centreless Grinders – Surface Grinders – Tool and Cutter Grinder – Specifications. Grinding Wheel – Abrasives – Bonding processes – Grit, Grade and Structure – Marking system of grinding wheel – Selection of Grinding Wheel. Mounting, Dressing, Truing and Balancing of grinding Wheel.

Unit-V – Jigs and Fixtures: Introduction – Elements of Jigs and Fixtures – Principle of Location – Locating Methods and Devices – Design Principle for Location. Clamping – Principles for Clamping – Clamping Devices. Indexing Jigs and Fixtures – Indexing devices. Fool- Proofing.

Unit-VI – Non-conventional Machining: Need for Non-conventional Machining. Principles of operation, Machine setups, Applications, Merits and Demerits of – (a) Abrasive Jet Machining, (b) Ultrasonic Machining, (c) Electrochemical Machining, (d) Electro-discharge Machining, (e) Laser Beam Machining, (f) Electron Beam Machining. Comparative study of the above processes.

Books:

1. Elements of Workshop Technology (Vol. I & II) – S.K. Hajra Coudhury and A.K. Hajra Coudhury.
2. A course in Workshop Technology (Vol. I & II) – B.S. Raghuwanshi
3. Manufacturing Technology – P.N. Rao – Tata McGraw Hill
4. Introduction to Machining Science – G.K. Lal, New Age International Limited
5. Jigs and Fixtures – P.H. Joshi, Tata McGraw Hill
6. Manufacturing Science – Amitabha Ghosh and Asok Kumar Mallick, East West Press

7. Non-Conventional Machining – P.K. Mishra, Narosa Publishing House.

ME 626: NUMERICAL METHODS AND COMPUTATION(3-1-2)

Theory: 100 Sessional: 50 Time: 3hrs

1. Solution of Algebraic and Transcendental Equations: Newton-Raphson, Successive Approximation, Comparison of Iterative methods
2. Solution of Linear Simultaneous Equations :
   Gauss Elimination Method, Gauss-Seidal Methods,
3. Basics of Finite Difference Methods :
   Finite differences, Difference representation of ODE & PDE, Error analysis,
   Convergency
4. Application of Finite Difference Methods
   (i) Heat conduction equation (one and two dimensional)
   (ii) Laplace's Equation

Books:

1. Numerical methods with Computer Programs in C++
   By Pallab Ghosh, Publisher: Prentice Hall of India Pvt. Ltd.
2. Computational Fluid Mechanics and Heat Transfer
   By Anderson, Tannehill & Pletcher. Publisher: Hemishphere Publishing Corporation

Branch: Electrical Engineering Year: Third Semester: Sixth

Sl No.	Course No.	Subject	Period			Evaluation Scheme					
	Theory		L	T	P	Sessional Examination			ESE	Subject Total	Credit
						TA	CT	Total			
1.	EE 641	Electromagnetic Fields	3	1		30	20	50	100	150	4
2.	EE 642	Computer Oriented Numerical Methods	3	1		30	20	50	100	150	4
3.	EE 643	Microprocessors & Applications	3	1		30	20	50	100	150	4
4.	EE 644	Electric Power System-II	3	1		30	20	50	100	150	4
5.	EE 645	Control System -II	3	1		30	20	50	100	150	4
6.	EE 646	Signals and Systems	3	1		30	20	50	100	150	4
7.	EE 647	General Proficiency							50	50	2
Practical/Drawing/Design											
8.	EE 642	Computer Oriented Numerical Methods			3	25	25	50		50	2
9.	EE 643	Microprocessors & Applications			3	25	25	50		50	2
10.	EE 645	Control System -II			3	25	25	50		50	2
11.	EE 648	Electrical Machines-II			3	25	25	50		50	2
TOTAL			18	6	12	280	220	500	650	1150	34

Total Marks: 1150 **Total Periods: 36** **Total Credits: 34**

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

EE 642: Computer Oriented Numerical Methods: L T P (3-1-3)

Full marks: Theory—100
Sessional---------50
Lab--------50
Time---3 hrs

1. Computer Arithmetic: Introduction, Floating point representation of numbers and floating point arithmetic, computational errors, Relative and absolute errors, Error propagation, Iterative processes- convergence and acceleration.

2. Iterative methods: Transcendental equations, Methods of bisection, Method of false position, Newton Raphson method, Complex roots, Synthetic division.

3. Matrices and Linear Systems of Equations: Matrix inversion, LU decomposition, Solution of linear system of equations by direct methods—Gauss elimination method, ill—conditioned system, Pivotal condensation, Gauss-Siedel iteration method, Gauss-Jordan matrix inversion, Eigen values and Eigen vectors, N—R method for non-linear system of equations.

4. Finite Difference and Interpolation: Forward difference, Backward difference and central difference, Symbolic relations, Interpolation with equal intervals, Interpolation using forward difference, Newton's and Gauss's formula for interpolation, Interpolation with unequal intervals, Newton's formula, Lagrange's polynomial interpolation.

5. Numerical Differentiation and Integration: Differentiation by polynomial fit, errors in numerical differentiation, numerical integration—Trapezoidal rule, Simpson's rule, Romberg method.

6. Ordinary Differential Equations: Taylor's series method, Euler's method, Modified Euler's method, Runga-Kutta method, Predictor-Corrector method.

**Note: Stress should be given on developing algorithms for the numerical methods. Sessional and laboratory work should consist of writing computer programs using these algorithms and running them on the computer.

EE 645: CONTROL SYSTEM- II.

L T P
(3 1 3)
Theory marks = 100
Sessional= 100
Time----- 3 hours.

1. **Compensation techniques**: Preliminary design specifications in time and frequency domains, gain compensation; load compensation, lag compensation, leg- load compensation.

2. **Describing function analysis of non linear control systems:** Introduction to nonlinear systems. Describing functions of common non linearities; nonlinear control systems, describing function analysis of nonlinear control systems.

3. **Phase- Plane Analysis:** Introduction, methods of constructing phase- plane trajectories, time information and solutions from phase- plane trajectories, singular points, phase- plane analysis of linear and nonlinear control systems.

4. **Discrete time systems**: Introduction to discrete – time systems; Z- transform, inverse Z- transformation; solving difference equation by the Z-transform method; pulse- transfer function; stability analysis in the Z- plane.

5. **State – Space Analysis of control systems:** Concepts of space, state variables and state models; state – space representation of linear systems; transfer matrix; state- space representation of discrete- time systems. Solution of linear time-invariant and discrete- time state equations.

6. **Stability Analysis by Liapunov's second method**: Definition of stability in the sense of Liapunov; the second method of Liapunov; Stability analysis of linear systems; estimating the transient response behaviour of dynamic systems; stability analysis of nonlinear systems.

7. **Design of Feedback Control systems**: Concept of controllability and observality; state feedback and output feedback; a brief idea of pole placement by state feedback and output feedback; optimal control law; cost function or performance index; quadratic performance index; linear quadratic state feedback regulator problem; a brief introduction to model reference systems; adaptive control systems.

EE 641: Electromagnetic Fields (EE)

L T P
(3 – 1 – 0)
Theory Marks =100
Sessional Marks = 50
Time = 3 hours

1. **Vector Analysis:**

Review of dot and cross products, gradient, divergence and curl. Divergence and Stock's theorem, Cartesian, Cylindrical and Spherical co-ordinates system. Transformation between co-ordinates, General curvilinear co-ordinates. Value of gradient divergence and curl in general co-ordinates and to obtain there from their values in cylindrical and spherical co-ordinates.

2. The Static Electric Field:

Coulomb's Law, Electric Field strength, Field due to point charges, a line charge and a sheet of charge, field due to continuous volume charge, electric flux density, Gauss's law in integral form, Gauss's law in differential form (Maxwell's first equation in electrostatics), applications of the Gauss's law.

Electrostatic potential difference and potential, potential and potential difference expressed as a line integral, potential field of a point charge, potential field of a system of charges, conservative property, potential gradient, the dipole, energy density in the electrostatic field.

3. The static magnetic field:

The Biot-Savart's law (the magnetic field of filamentary currents), the magnetic field of distributed surface and volume currents, ampere's circuital law in integral and differential form (Maxwell's curl equation for steady magnetic field).

The scalar and vector magnetic potentials, Maxwell's Divergence equation for B, steady magnetic field laws, forces in magnetic field, force on a current element, force between two current elements, force and torque in a current loop.

4. The Electromagnetic field:

Faraday's law in integral and differential form (Maxwell's first curl equation for electro- magnetic field). The Lorentz force equation.

The concept of displacement current and modified ampere's law (Maxwell's 2nd curl equation for electro- magnetic field), the continuity equation, power flow in an electromagnetic field, the boynting vector.

Sinusoidally time varying fields, Maxwell's equation for Sinusoidally time varying fields, Power and energy considerations for Sinusoidally time varying fields.

The retarded potentials, polarization of vector fields, review of Maxwell's equations.

5. **Materials and fields (review type only):**
Current and current density, the continuity equation, conductor in fields.
Dielectrics in fields: Polarization, flux density, electric susceptibility, relative permittivity, boundary conditions in perfect dielectrics, magnetic materials, magnetization, permeability, boundary conditions.

6. **Applied Electromagnetic I :**
Poisson's and Laplace's equations, solution of one-dimensional cases, general solution of Laplace's equation, method of images.

7. Applied Electromagnetic II:
Electromagnetic waves, the Helm Holtz Equation, wave motion in free space, wave motion in perfect lossy dielectrics, propagation in good conductors, skin effect
Reflection of uniform plane waves.
Radiation of electromagnetic waves.

8. Transmission line equations and parameters: Some examples of transmission lines.

Books:

1. Hayt: Engineering Electromagnetics.
2. N. N. Rao: Basic Electromagnetics with applications.
3. Corson and Lofrain: Introduction to Electromagnetic Fields and waves.
4. Bradshaw and Byatt: Introductory Engineering Field Theory.
5. Nussbaum: Electromagnetic theory for engineers and scientists.

EE 644: Electric Power System-II.

L T P
(3 1 0)
Max. Marks = 100
Sessional = 50

1. **Static Substation:**

Classification. Interconnection of substations, Necessity. Function & arrangement of substation equipment. Layout diagram-single line diagram with different bus-bar arrangements. Current limiting reactors: Types and construction, substation grounding.

2. **Neutral grounding:**

Effectively grounded system. Under grounded system. Arching ground. Methods of neutral grounding. Resonant grounding (Peterson coil). Earthing transformer. Generator neutral breaker. Grounding practice as per Indian electricity rules. Equipment grounding.

3. **Circuit breakers:**

Fuses: Function: Important terms & classification. HRC fuses: Characteristics & advantages. Time delay fuse.

Switchgears: Functions, principles of circuit breaking. DC & AC circuit breaking. Arc voltage & current waveforms. Restriking & recovery voltages, Current zero pause. Current chopping, capacitive current breaking. AC circuit breaker ratings. Arc in oil, arc irruption theories and processes. Bulk oil CB & MOCB, air circuit breaker, air –blast CBs. Vacuum & SF_6 CBs. Testing of circuit breakers.

4. **Protective relays:**

operating principles; Terminology & functional characteristics of Protective relays. Universal relay torque equation. Over current relays. Differential relays. Feeder, generator & transformer protection. Distance relays. Reverse, Translay relays,

carrier current protection, comparators. Static relays: operating principles, advantages, types. Example with block/ power and overvoltage circuit diagrams and operation.

5. **Over-Voltage Phenomena in Power Systems:**

Lightning phenomena, Switching surges, Travelling Waves, Shape and Specification of Travelling waves, Attenuation and distortion of traveling waves, attenuation due to corona, behaviour of traveling waves at a line transition, Construction of Bewely lattice diagram.

6. **Over voltage protection & Insulation co-ordination:**

Surge protection. Different types of lightening arresters & surge absorbers. Ground & counterpoise wires. Location & rating of lightening arresters. Introduction to Insulation co-ordination. Volt-time curve. Important terms. BIL & factors affecting it. co-ordination of system equipment.

7. **HVDC transmission and Systems of Electric Power Transmission:**

Limitations of HVAC transmission. Advantages & limitations of HVDC transmission. Kinds of DC links. Ground return. Equipment for HVDC transmission. Economic distance. Application of HVDC systems.

Review of Existing Systems, Advantages and Limitations of using high transmission voltages, Comparison of overhead and underground systems, Economic voltage of transmission, Economic size of conductors, Kelvin's law

REFERENCES:

1. Electrical Power—S.L.Uppal.
2. Electrical Power System---C.L.Wadha.
3. Electrical Power System's design—M.V. Despande.
4. Switchgear principles—P.H.J.Crane.
5. Switchgear and Protection—S.S. Rao
6. Switchgear and Protection-- M.V. Despande.

EE643: Microprocessors and Applications (EE/IE)

L T P
(3 1 3)

Full marks: Theory = 100
Sessional =50
Lab=50

1. **Microprocessor Architecture**: Introduction to the microprocessor. The ALU. Up registers. Basic concepts of programmable device – Bus organization, system components etc. The interface section. The timing and control section. State transition sequence. Block diagram.

2. **Programming Microprocessors**: Data representation, instruction formats, addressing modes, Instruction set, software design, assembly language programming, program looping, subroutine linkage, position independency, recursion.

3. **Memory Interfacing**: Main memory types, memory characteristics compatibility between memory and up system bus, address space and its portioning, standard vs. system memories, address decoding, Dynamic RAM interfacing, Quasi- static RAMS, memory mapping and management.

4. **Data transfer**: Programmed data transfer, DMA mode of data transfer, I/O part, device polling in the interrupt mode, DMA controller, serial mode of data transfer, some standard interfaces.

5. **I/O devices:** OPAMPS, Opto-couples, DAC, ADC, sample& hold amplifiers, multiplexers, buffers, Timer counter, Data acquisition systems.

6. **Support LSIS:** 8255, 8155, 8253, 8279 etc

7. **Microprocessor based system design**: A system of practical relevance to be chosen and described,
e.g- speed controller of de motor,
- A traffic light controller,
- Temperature monitoring & controller,
- ECG data acquisition & monitoring.

EE 646: Signals and Systems.

L	T	P
3	1	0

Max. Marks = 100
Sessional = 50

1. **Introduction:** Definitions. Continuous and Discrete-time signals. Systems and their classification.

2. **LTI Systems:** Continuous-time LTI systems: the Convolution integral. Discrete-time LTI systems: the Convolution sum. Properties of LTI systems. Systems described by differential and difference equations.

3. **Fourier analysis for continuous-time case:** Response of LTI systems to complex exponential. Representation of periodic signals: the Fourier series. Representation of a-periodic signals: the Fourier Transform and its properties. System analysis by Fourier Transforms.

4. **Fourier analysis for Discrete-time case :** Response of LTI systems to complex exponential. Discrete-time Fourier series. Discrete-time Fourier Transform and its properties. System analysis.

5. **Sampling :** The sampling theorem. Effect of under-sampling. Reconstruction of a signal from its samples using interpolation. Spectrum of sampled signal.

6. **Z-transform :** Definitions. The region of convergence. Properties of Z-transform. Inversion of Z-transforms. Application to system analysis.

7. **Digital Filters** : Frequency selective filters. FIR and IIR filters.

Books:

1. Oppenheim, Willisky, Nawab: Signals and Systems, PHI (India)
2. Oppenheim, Schafer: Digital Signal Processing, PHI (India)
3. Eugene Xavier: Signals, Systems & Signal Processing, S. Chand & Co.
4. Roberts: Signals and Systems, Tata McGraw Hill.
5. Mastering MATLAB, Pearson Education (for Laboratory use).

Branch: Chemical **Year**: Third **Semester**: Sixth

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
Theory			**L**	**T**	**P**	**Sessional Exam**			**ESE**	**Subject Total**	**Credit**
						TA	**CT**	**Total**			
1	CH 681	Chemical Reaction Engg.-II	3	1		30	20	50	100	150	4
2	CH 682	Process Engg. Eco & Optimisation	3	1		30	20	50	100	150	4
3	CH 683	Mass Transfer Operations-I	3	1		30	20	50	100	150	4
4	CH 684	Heat Transfer Operations	3	1		30	20	50	100	150	4
5	CH 685	Petroleum Refining & Petrochemicals	3	1		30	20	50	100	150	4
6	CH 686	Process Dynamics and Control	3	1		30	20	50	100	150	4
Practicals											
7	CH 683L	Mass Transfer Operations Lab			3	30	20	50		50	2
8	CH 684 L	Heat Transfer Operations Lab			3	30	20	50		50	2
9	CH 685L	Petroleum Refining & Petrochemicals Lab			3	30	20	50		50	2
10	CH 686L	Process Dynamics and Control Lab			3	30	20	50		50	2
11	CH 687	General Proficiency							50	50	2
Total			18	6	12						

Total Marks: 1150 **Total Periods: 36** **Total Credits: 34**

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

CH 681 CHEMICAL REACTION ENGINEERING-II

L-P-T
3-0-1
Theory : 100 marks
Sessional : 50 marks
Time : 3 hrs

1. Design for multiple reactions: Series and parallel reactions, Series-parallel reactions.

2. Temperature and pressure effects: Single reactions, multiple reactions.

3. No Ideal Flow: Residence time distribution of flow in vessels, models for non ideal flow, dispersion model, tanks in series model, multi parameter model, diagnosing ills of Operating equipment, Models for fluidized beds.

4. Mixing of fluids: Self-mixing of a single fluid, mixing of two miscible fluids.

5. Introduction to design for heterogeneous reacting systems: rate equations, contacting patterns.

6. Fluid-particle reactions: Un-reacted core model, shrinking core model, determination of rate-controlling step, application to design.

7. Fluid-Fluid reactions: rate equations, application to design.

8. Solid catalyzed reactions: rate equation, experimental methods for finding rates, Product distribution in multiple reactions, application to design.

9. Deactivating catalysts: Mechanism, rate equation, rate equation from experiment, design.

10. Introduction to reactor stability.

Books :-

1. Chemical Reaction Engineering by Levenspiel, Wiley Eastern.
2. Elements of Chemical Reaction engineering, Fogler, 3rd Ed.,Prentice hall
3. Chemical Engineering Kinetics by D.M. Smith, McGraw Hill Publication.
4. Reaction Kinetics for Chemical Engineers by Wales, McGraw Hill Publication.

CH 682 : PROCESS ENGINEERING ECONOMICS & OPTIMISATION

L – T – P
3 – 1 – 0
Theory : 100 marks

Sessional ; 50 marks
Time : 3 hours

- **Feasibility Analysis** : Technology of project. Market Survey analysis.
- **Interest and Economic Equivalence** – Simple interest, Compound interest, Present Worth and Discount, Nominal & Effective interest rates, Uniform annual end of the year amount, i.e. unacost, Uniform annual beginning of year amount, Applications in cost comparison, Cost comparison by present worth for unequal duration of service lives, Cost comparison by unacost, Cost comparison by Capitalized cost.
- **Depreciation & Taxes :** What is depreciation, Depreciation terms and depreciation relationships, Methods of determining depreciation – Straight Line Method, declining Balance Method, Sum-of-the-year Digits Method, Sinking Fund method.
- **Cost Estimation :** Types of Cost Estimation, Process Equipment Cost Estimation, Cost Index, Equipment Cost Size relationship, Production Cost.
- **Profitability :** Introduction, Methods of profitability evaluation – rate of return on investment, rate of return on average investment, Payout time, Payout time with interest, Discounted Cash Flow (DCF) method, venture worth method, Application of profitability relation in alternative investment analysis, cost factor in profitability evaluation.
- **Break Even Analysis :** Introduction, Relation between costs and production. Economic Production chart, Break even chart, Economic Production cost vs rapidity variation, capacity factor, demand factor, load factor, diversity factor, application of break even analysis for project improvement.
- **Financial Statements,** financial analysis and Financial Institutions.
- **Optimization :** Introduction, optimization techniques, nature of optimization, unvariable systems – analytical methods of solution, multivariable systems, method of Lagrangian Multipliers, Search Method, Time Programming.

BOOKS :

1. Chemical Engineering Economics and Division Analysis, Chemical Engineering Education Development Centre, IIT, Madras.
2. Pradip Kumar, Financial Accountancy.
3. Process Plant and Equipment Cost Estimation, Sevak Publication, Mumbai.
4. Jelen, F.C., Cost and Optimization Engineering, McGraw-Hill.

CH 683 MASS_TRANSFER_OPERATION-I

Theory : 100 marks
Sessional : 50 marks
Practical: 50 Marks
Time : 3 hours

L – T – P
3 – 1 – 2

Molecular Diffusion and Eddy Diffusions: Maxwell Stefan law , Fick's law , steady state diffusion through a stagnant fluid, diffusivity of gaseous and liquid systems, Analogy between momentum, Heat and mass transfer. Eddy Diffusion.

Interphase Masss transfer : Mass transfer coefficients, Two-film theory, Idea about penetration and surface renewal theory , Correlations between transfer coefficients, Equilibrium relationship between gas-liquid and liquid-liquid systems.

Steady state co-current and counter current process in gas absorption, Minimum gas-liquids ratio for absorption. Packed absorption tower, liquid hold up, loading and flooding of packed tower, packing materials, graphical design method of packed column, the H.T.U. and N.T.U. Comparison of packed and plate column.

Simultaneous absorption and chemical reaction, effect of chemical reaction on absorption rate. Theory of the stagnant film of finite thickness (steady state rapid 2^{nd} order irreversible reaction and slow first order reaction)

Humidification and Dehumidfication : Vapor – liquid equilibria , Enthalpy of saturated and unsaturated vapor –liquid mixtures , adiabatic saturation curves . concept of wet bulb and dry bulb temperature , Lewis relationship, water cooling with air , Dehumidification of air water vapor, water cooling towers.

Drying: Equilibrium relationship, drying rate curve , batch and continuous drying , mechanism of drying , calculation on batch and continuous drying , continuous drying equipments – Tunnel dryers. Rotary dryers, Spray dryers etc.

Crystallization: Saturation nucleation, crystallization rate , effect of impurities , effect of temperature on solubility, caking of crystals, Batch crystallizers, continuous crystallizers.

Absorption and Ion Exchange: Types of absorption , nature of absorbents, absorption equilibria absorption of single gas/vapor from gaseous mixture dilute and concentrated liquid solutions , fixed bed , ion-bed absorbers, principles of ion exchange, equilibria and rate of ion exchange.

Less Conventional Operations : Introduction to fractional crystallization , sublimation , foam separation , membrane separation , thermal diffusion , reverse osmosis, electro dialysis.

Principles of Process design of absorption and extraction towers.

BOOKS:

1. R.C. Treybal . Mass Transfer Operation , McGraw –Hill Kogakusha, 3^{rd} Edition
2. G. Astavita "Mass Transfer with Chemical Reaction" Elsevier Co.
3. Foust & Wenzel . "principles of Unit Operations" Wiley International.
4. Unit Operations in chemical Engg Ed2 by McCabe and Smith
5. Chemical Engineering Vol 2 Ed2 Pergamon Press by Coulson and Rechardson.
6. N Anantharaman & K M Sheriffa Begum, Elements of mass Transfer, Part-I, Prentice Hall India

Practical :

1. Study of Flooding and Laoding Characteristics in packed bed
2. Experiment on a Fluidized dryer
3. Determination of mass transfer co-efficient in wetted wall column.
4. Equilibrium flash Distillation
5. Diffusivity in still air
6. Bubble cap distillation column.

CH 684 HEAT_ TRANSFER-OPERATIONS

L – T -P
3- 1- 2

Time : 3 hrs
Theory :100 Marks
Sessional: 50 Marks
Practicals: 50 Marks

1.Heat transfer by conduction: One-dimensional Heat Conduction equation, Boundary conditions; One dimensional steady state heat conduction for slab, cylinder, sphere, composite medium, Thermal conduct resistance, critical thickness of insulation, Fourier law, Finned surfaces, temperature dependent K (T), Transient conduction and use of temperature charts. Lumped system analysis for slabs and long cylinder and spheres.

2. Heat Transfer by convection : Flow over a body, flow inside a duct. Forced Convection: Hydrodynamic and thermal boundary layer, simultaneously developing laminar flow, Turbulent flow inside ducts, Heat transfer to liquid metals. FreeConvection : Dimensionless parameters of Free Convection, Correlations of free convection on a vertical plate, Free Convection on a horizontal plate.

3. Condensation : Nusselt equation for horizontal and vertical condenser, Drop and film type condensation, Effect of non-condensable gases. Boiling: Boiling of liquids. Nucleate and film boiling.

4.Heat Transfer by Radiation: Concept of black body , Kirchoff's Law Emissivity, absorptivity, black body and grey body radiation. View factors, Radiation from non- luminous gases, radiation from flames, radiation errors in pyrometry.

5. Heat Exchanges: Classification, temperature distribution in heat exchangers, Overall heat transfer co-efficient, the LMTO method for heat exchanger analysis, correction for LMTD for use with cross flow and multipass exchanger. 6.Evaporation : Classification and application, operation of single and multiple effect evaporators.

6.Preliminary design aspect of heat transfer equipments: Heat Exchangers: Hair pin (double pipe exchangers) 1-2 shell and tube exchangers, Finned tube exchangers, LMTD, fouling factor, pressure drop considerations.

7.Heat transfer in packed and Fluidized bed: Brief introduction.

8.Furnaces: Classification, Constructional details, combustion, calculations.

Practical_ (sessional)

1. Thermal conductivity of solid materials.
2. Laminar and turbulent flow heat transfer I circular and noncircular ducts.
3. Heat transfer in pool boiling.
4. Condensation Heat transfers.
5. Heat transfer in extended surfaces.
6. Determination of view factor, emissivity.

TEXT BOOKS:

1. Heat transfer- Principles and applications; B K Dutta, Prentice Hall India
2. Heat Transfer – A basic approach by M. Necati Ozisik
3. Heat Transfer by W. H. McAdams , Mcgraw-Hill.
4. Fundamentals of Heat Transfer by M. Mikheyev – Mir publications.
5. Unit operations of chemical Engg. W. L. cabe & J. C. Smith – Mcgraw – Hill Publication

CH 685 PETROLEUM REFINING AND PETROCHEMICALS

L – T -P
4- 1- 2

Time : 3 hrs
Theory :100 Marks
Sessional: 50 Marks
Practicals: 50 Marks

1. PRIMARY PROCESSING OF CRUDE OIL : Classification of crude oil, Atmospheric distillation .Vacuum distillation of residue-products and distillation practice.

2. SECONDARY PROCESSING OF CRUDE OIL : FCCU, Hydro cracking, Visbreaking, Thermal cracking. Coking, Reforming, Alkylation, Polymerization and Isomerisation process.

3. TREATMENT-TECHNIQUES : Treatment techniques for removal of objectionable gases. Odours, to improve performance, .Storage stability. Extraction of aromatics, Olefins and recovery operations from petroleum products.

4. PETROCHEMICALS : Chemicals from methane and synthetic gas: Ammonia, Methanol and Hydrogen Cyanide, Chemicals from olefins; Ethviene derivatives, Propylene derivatives and Butylene derivatives, Aromatics, intermediates for synthetic fibers. Plastics and rubber.

5. ENVIRONMENTAL AND SAFETY ASPECTS IN REFINERY AND PETROCHEMICALS : Waste water and effluent gases treatment from alkylation units and petrochemical units, safely aspects in the above industries.

TEXTBOOKS :

1. W.L. Nelson, "Petroleum Refinery Bn~meering"4"' Edn., McGraw Hill , New York 1985

2. B. K. Bhaskara Rao, "Modem Petroleum Refining Processes", 2nd' Edn., Oxford and IBH Publishing Company, New Delhi, 1990. Khanna Publishers.

REFERENCES :

1. G. D. Hobson and W.Pohl., " Modem Petroleum Technology", Gulf Publishers 2nd. Edn., 1990..

2. R. A. Meyers, "Hand book of Petroleum Refining Processes", McGraw Hill , 1st Edn., 1980.

3. F. Hatch md Sumi Malar, "From Hydrocarbons to Petrochemicals", Gulf Publishing Company, 1st Edn. 1981.

CH 686 **PROCESS DYNAMICS AND CONTROL (3-1-2)**

Time : 3 hrs.
Theory : 100 marks
Sessional : 50 marks
Practicals: 50 Marks

1. The control of a chemical process : Its characteristics and associated problems. Process control, Process variables, Design elements of a control system, Control aspects of a complete Chemical plant, List of digital computer in process control, Laplace transformation and its application.
2. Modeling the dynamic and static behavior of Chemical Processes : Development of a Mathematical model, Modeling considerations for control purposes, the input output models, Transfer functions, Linear open loop systems, Degrees of freedom and its applications.
3. Analysis of the Dynamic behavior of Chemical Processes: Transfer functions and the input-output models, Dynamic behavior of 1^{st} order systems, Dynamic behavior of 2^{nd} order systems, Dynamic behavior of higher order systems, Interacting and non interacting systems, Dynamic systems with dead time.
4. Linear closed loop systems : Analysis and design of feedback control systems, Feed back control, types of feed back controllers, Associated problems, Block diagram of feed back controlled processes and closed loop response, Effect of proportional, integral, derivative and composite control actions.
5. Stability analysis of Feed back Systems : The characteristics equation, Routh-Hurwitz Criterion for stability, Root locus analysis, Controller design and tuning, Frequency response analysis of linear processes, Bode diagrams, Design of feed back control systems using frequency response techniques, Bode stability criterion, Gain and phase margins, Ziegler-Nichols tuning techniques.
6. Controllers and Final control elements: Self operated, Pneumatic, Hydraulic, Electric power employed.
7. Advanced control systems : Large dead time, dead time compensation, Cascade control, Split- range control, feed forward control, Ratio control, Adaptive control, Digital computer control.
8. Process dynamics and applications: Process identification, Dynamics and control of chemical equipments such as heat exchangers, distillation columns, reactors etc.
9. Computer simulation of control systems.

Practicals : Experiments on
1. Temperature control.
2. Flow control.
3. Level control.

with respect to a chemical reactor.

Books :
1. Automatic Process Control by D.P. Eckman.
2. Chemical Process Control by George Stephanopoulos, Prentice – Hall of India.
3. Process System Analysis & Control by Coughanuer & Koppel, Tata-McGraw Hill publication.
4. Process Control by Peter Harriat, McGraw Hill Chemical Engg. Series.
5. Industrial Control and Instrumentation by W. Bolton, Orient Lougman.
6. Process Control by Patranabs.

Theory *: 6 X 100 = 600*

Sessional **: 6 X 50 = 300**
Practicals **: 4 X 50 = 200**
General Proficiency **:50**
Total **:1150**

Branch: ET **Year**: Third year

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
			L	T	P	Sessional Marks			ESE	Total Marks	Credit
						TA	CT	Total			
1	EE 641	Electro Magnetic Field	3	1		30	20	50	100	150	4
2	ET 662	Digital communication	3	1		30	20	50	100	150	4
3	ET 663	Microprocessor And Embedded Ssytems	3	1		30	20	50	100	150	4
4	ET 664	Microwave Engineering	3	1		30	20	50	100	150	4
5	ET 665	Computer Communication Networks	3	1		30	20	50	100	150	4
6	ET 666	Data Structure	3	1		30	20	50	100	150	4
Practicals/Drawing/Design											
7	ET 662L	Digital communication			3	30	20	50		50	2
8	ET 664L	Microwave Engineering			3	30	20	50		50	2
9	ET 663L	Microprocessor And Embedded Systems			3	30	20	50		50	2
10	ET 666	Data Structure			3	30	20	50		50	2
11		General Proficiency							50		2
Total			18	6	12						

Total Marks: 1150 **Total Periods: 36** **Total Credits: 34**

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

EE641 Electromagnetic Field
Theory: 100

Sessional: 50
Time: 3 hours

Vector Analysis
Review of dot and cross products, gradient, divergence and curl. Divergence and Stoke's Theorem, Cartesian, Cylindrical and Spherical Co-ordinate system. Transformation between co-ordinates, General curvilinear co ordinates. Value of gradient, divergence and curl in general co- ordinates and to obtain their values in cylindrical ans spherical co-ordinates.

The Static Electric Field
Coulomb's law, Electric field strength, Field due to pont charges, a line charge and a sheet of charge, Field due to continuous volume charge, Electric flux density, Gauss's law in integral form, Gauss's law in differential form(Maxwell's first equation in electrostatics), Applications of the Gauss's law.

Electrostatic potential difference and potential, potential and potential difference expressed as a line integral potential field of a point charge, potential field of a system of charges, conservative property, potential gradient, the dipole, energy density in the electrostatic field.

The static magnetic field
The Biot-Savart's law(the magnetic field of filamentary currents), the magnetic field of distributed surface and volume currents, Ampere's Circuital law in integral and differential form(Maxwell's curl equation for steady magnetic field)
The scalar and vector magnetic potentials, Maxwell's divergence equation for B, steady magnetic field laws, forces in magnetic field , force on a current element, force between two current elements, force and torque in the current loop.

The Electromagnetic field
Faraday's law in integral and differential form(Maxwell's first curl equation for electromagnetic field). The Lorentz force equation.
The concept of displacement current and modified Ampere's law(Maxwell's 2^{nd} curl equation for electromagnetic field), The continuity equation, power flow in an electromagnetic field, Poynting Vector.
Sinusoidally time varying fields, Maxwell's equations for sinusoidally time varying fields, power and energy considerations for sinusoidally time varying fields.
The retarded potentials, Polarization of vector fields, review of Maxwell's equations.

Materials and fields(review type only)
Current and current density, the continuity equation , conductor in fields.
Dielectric in fields: Polarization, flux density, electric susceptibility, relative permittivity,
Boundary conditions in perfect dielectrics, magnetic materials, magnetization, permeability, boundary conditions.

Applied Electromagnetics I
Poisson's and Laplace equations, solution of one dimensional cases, general solution of Laplace equation, Method of images.

Applied Electromagnetics II
Electromagnetic waves, The Helm Holtz equation, wave motion and free space, wave motion in perfect lossy dielectrics, propagation in good conductors, skin effect.
Reflection of uniform plane waves.
Radiation of electromagnetic waves.

Transmission line equations and parameters, some examples of transmission lines.

Text books and references:

1. Hayt: Engg. Electromagnetics.
2. Corson and Lofrain: Introduction to Electromagnetic fields and waves.

ET 662 Digital Communication

Theory: 100

Sessional: 50
Time: 3 hours

Introduction
Introduction to digital communications, review of signals and systems theory, random variables, and Stochastic Processes. Merits of digital systems.

Waveform Coding Techniques
Mathematical models for information sources. Preview of sampling theorem. Sampling, quantizing and coding for discrete sources. Pulse code modulation (PCM). Quantization noise, companding, DPCM, DELTA modulation (DM), ADM. Noise in PCM and DM svstems. Time Division Multipexing(TDM).

Data Modulation and Demodulation

Vector Representation of waveforms. Modulation and Demodulation Based on Vector-Space Concept. Vector Channel Model. Optimum Detection with the AWGN Channel. Error Probability for the AWGN Channel

Signal Constellations and Modulation Techniques
Cubic and Orthogonal Constellations. Circular Constellations- M-ary Phase Shift Keying (PSK). Pulse Amplitude Modulation (PAM). Quadrature Amplitude Modulation (QAM).

Baseband Digital Transmission
Baseband binary PAM systems. Intersymbol interference (ISI). Nyquists's criterion for distortionless baseband binary transmission. Nyquist and Raised Cosine Pulses. Square-Root Splitting of the Nyquist Pulse. Baseband M-ary, PAM systems. Optimum detection. Matched filters, correlation receivers.

Passband System Analysis
Passband Representation. Equivalent Forms for a Passband Signal. Passband Channels and Their Baseband Equivalent. Baseband Equivalent AWGN Channel. Demodulators for the Generation of the Baseband Equivalent.

Error Control Coding

Error detection and correction. Parity check bit coding, block code. Examples of algebraic codes, convolution coding, combined modulation and coding. Trellis Coded Modulation.

Information Theory: Information measure, average information and entropy. Discrete memory less channels. Channel capacity theorem.

ET 663 Microprocessor And Embedded Systems

Theory: 100

Sessional: 50
Time: 3 hours

Introduction to Computer Architecture and Organization: Architecture of 8-bit microprocessors, bus configurations, CPU module, introduction to assembly language and machine language programming, instruction set of a typical 8-bit microprocessor, subroutines and stacks, programming exercises.

Memory Technology: Timing diagrams, RAM, DRAM and ROM families, memory interfacing, programmable peripheral interface chips, interfacing of input-output ports, programmable interval timer. Memory map, peripheral I/O and memory- mapped I/O.

Data Transfer Schemes: Serial and parallel data transfer schemes, interrupts and interrupt service procedure. 8085 interrupts and vector locations, SIM and RIM instructions, RST instructions.

Introduction to Microcontrollers: Architecture, RISC and CISC processors.

Instruction Set and Programming: Instruction set and programming 8051micro controllers.

Architecture: Instruction set and programming of 8 bit micro controllers PIC 16c74.

Development Tools: Simulators, debuggers, cross compilers, in circuit emulators for the micro controllers.

Interface Issues Related to Embedded Systems: A/D, D/A converters, timers, actuators, power, FPGA, ASIC, diagnostic port.

Techniques for Embedded Systems: State machine and state tables in embedded design, simulation and emulation of embedded systems. High-level language descriptions of S/W for embedded system, Java embedded system design.

Real Time Models, Language and Operating Systems: Event based, process based and graph based models, Petrinet models. Real time languages, real time kernel, OS tasks, task states, task scheduling, interrupt processing, clocking, communication and Synchronization. Control blocks, memory requirements and control, kernel services.

Text Books/ References:

1. Ramesh S.Gaonkar - Microprocessor Architecture, Programming and Applications (3e), Penram Pub., 1997.
2. Mazidi M. A. & J. G. Mazidi - The 8051 Microcontroller and embedded systems, Pearson, 2002.
3. Kenneth J Ayala – the 8051 Microcontroller architecture programming and applications, 2nd Edition Penram International publishing.
4. J.B. Peatman – Design with PIC microcontrollers , PH Engg. 1998.
5. Hintz – Micro controllers, Architecture, implementation and programming McGraw Hill.
6. Evesham - Developing Real - Time Systems - A Practical Introduction , Galgotia Publications, New Delhi, 1996.
7. Ball S.R - Embedded microprocessor systems - Real World Design, Prentice Hall, 1996.
8. Herma K - Real Time Systems – Design for Distributed Embedded Applications, Kluwer Academic, 1997.
9. Gassle J - Art of Programming Embedded Systems, Academic Press, 1992.
10. Gajski D.D, Vahid F, Narayan S - Specification and Design of Embedded Systems, PRT Prentice Hall, 1994.

ET 664 Microwave Engineering

Theory: 100

Sessional: 50
Time: 3 hours

Transmission Lines

Review of transmission line theory. Co-axial cable. MIC lines. Standing waves. VSWR and reflection coefficient. Smith chart. Stub matching calculation.

Waveguides

Rectangular and circular waveguides. Solution of wave equations. TE and TM modes. Dominant mode. Filed Patterns. Cut-off frequencies. Wave impedance. Power transmission. Waveguide resonators.

Network Representation

Scattering matrix parameters.

Components

Directional couplers, isolators, circulators, power splitters, E-. H- and magic Tees. Attenuators, phase shifters. Short circuit and matched terminations. Filters.

Microwave Devices

High frequency limitations. Klystrons, magnetrons, TWTs. Microwave transistors - bjts and GaAs MESFETs. Transferred electron devices, avalanche transit-time devices. Read diode, IMPATT diode. BARITT diode and the tunnel diode. Parametric devices. Quantum electronic devices. MASERS and LASERS. MICs.

Text Books/references:

1. S. Y. Liao - Microwave Devices and Circuits, Prentice Hall of India.

2. M. M. Radmanesh - Radio Frequency and Microwave Electronics, Pearson Education Asia.

3. R. E. Collin - Foundation for Microwave Engineering, McGraw-Hill.

4. K. C. Gupta - Microwaves. John Wiley and Sons.

ET 665 Computer Communication Networks
Theory: 100 marks
Sessional 50 marks
Time: 3 hours

Uses of computer networks

Network goals, application structures, architectures, OSI Model and services. Network examples.

Physical layer

Transmission medium, telephone system. RS-232C, RS-449 standards. α21 switching, ISDN and terminal handling.

Medium access sublayer

ALOHA, CSMA, CSMA/CD, Collision free protocol, BRAP, MLMA etc. IEEE standard 802.3, Ethernet, token ring. FDDI, satellite networks and packet radio networks.

Data link layer

Framing, error detection and correction and data link protocols.

Network layer

Routing algorithm, flow control, queuing theory, analytical treatment of M/M/I and M/M/M.

Security and reliability of networks

Case study of' computer communication networks. TCP/IP.

Text books/references:

1. Dimitri Bertsekas & Robert Gallager – Data Networks. PHI, 1992, 2/e.

2. W. Stallings - Data and Computer Communications, Prentice Hall, 1997.

3. A. S. Tannenbaum - Computer Networks. PHI, 1997, 3/e.

ET 666 Data Structure
Theory: 100 marks
Sessional: 50 marks
Time 3 Hours

Time and Space analysis of Algorithms – Order Notations.

Linear Data Structures : Sequential representations – Arrays and Lists, Stacks, Queues, Strings; Link Representations – Linear linked lists, Circular linked lists, Doubly linked lists; Applications.

Recursion – Design of Recursive Algorithms, Tail Recursion.

Nonlinear Data Structures : Trees – Binary Trees, Traversals and Threads, Binary Search Trees, Insertion and Deletion algorithms, Height Balanced Trees and Weight Balanced Trees, B-trees, B+ trees, Application of trees; Graphs – Representations, Breadth-first and Depth-first Search.

Hashing – Hashing Functions, Collision Resolution Techniques.

Sorting and Searching Algorithms : Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort.

File Structures: Sequential and Direct Access, Relative files, Indexed files, B+ tree aas index, Multi-index files, Hashed files.

Books:

1. Data Structures and Algorithms, A. V. Aho, J. E. Hoppcroft, J. E. Ullman, Addision Wesley.
2. Fundamentals of Data Structures, E. Horowitzz, S. Sahni, Galgotia Publ.
3. Data Structures using C, A. S. Tanenbaum
4. Algorithms, Data Structures, and Problem Solving, Addision Wesley.
5. Data Management and File Structures, Loomis, Marry, PHI

6. M. A. Weiss – Data Structures & Algorithm Analysis in C^{++}, Addison Wesley.

7. Lipshutz – Theory and Problems of Data Structures, McGraw Hill.

8. Neil Graham – Learning with C^{++}, McGraw Hill

Branch: Instrumentation Engineering Year: Third Semester: Sixth

Sl No.	Course No.	Subject	Period			Evaluation Scheme					
	Theory		**L**	**T**	**P**	**Sessional Examination**			**ESE**	**Subject Total**	**Credit**
						TA	CT	Total			
1.	CH 487	Fluid Flow Operations	3	1		30	20	50	100	150	4
2.	EE 642	Computer Oriented Numerical Methods	3	1		30	20	50	100	150	4
3.	EE 643	Microprocessors & Applications	3	1		30	20	50	100	150	4
4.	EE 646	Signals and Systems	3	1		30	20	50	100	150	4
5.	EE 645	Control System -II	3	1		30	20	50	100	150	4
6.	IE 651	Electrical Machines	3	1		30	20	50	100	150	4
7.	IE 652	General Proficiency							50	50	2
Practical/Drawing/Design											
8.	EE 642	Computer Oriented Numerical Methods			3	25	25	50		50	2
9.	EE 643	Microprocessors & Applications			3	25	25	50		50	2
10.	EE 645	Control System -II			3	25	25	50		50	2
11.	IE 651	Electrical Machines			3	25	25	50		50	2
TOTAL			18	6	12	280	220	500	650	1150	34

Total Marks: 1150 **Total Periods: 36** **Total Credits: 34**

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

IE 651: Electrical Machines

L T P
(3 – 1 – 3)
Theory Marks =100
Sessional Marks = 50
Laboratory Marks = 50

1. **D.C. Machine:**

   Constructional features and principles of operation: shunt series and compound generators and meter. Performances characteristics. Starting, speed control and braking of meters. Choice of D.C. meters for different applications.

2. **Transformers:**
   Constructional features and principles of Operation.

3. **Induction Meters:**

   Principles of operation, equivalent circuit and circle diagram. Torque-speed characteristics. Methods of speed control. Starting and braking of induction motors. Single phase induction meters- methods of starting.

4. **Synchronous Generators and motors**:

   Principles of operation and simple equivalent circuit. Synchronous motors- methods of starting. Synchronization. Typical application of A.C. motors in Industries.

Books:

1. Langsdraf : Theory of Alternating Current Machines(McGraw Hill)
2. Kingsley, Fitzereld : Electric Machinery (McGraw Hill)
3. Say: Performance and Design of Alternating Current Machine.

Theory : 6 X 100 = 600
Sessional : 6 X 50 = 300
Practicals : 4 X 50 = 200
General Proficiency :50
Total :1150

Branch: CSE **Year**: Third year

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
			L	T	P	Sessional Marks			ESE	Total marks	Credit
						TA	CT	Total			
1	CS 671	Data Base Management System	3	1		30	20	50	100	150	4
2	CS 672	Computer Communication Network	3	1		30	20	50	100	150	4
3	ET 663	Microprocessor and Embedded Systems	3	1		30	20	50	100	150	4
4	CS 674	Operating System	3	1		30	20	50	100	150	4
5	CS 675	Digital Communication & Information Theory	3	1		30	20	50	100	150	4
6	CS 676	Computer Graphics	3	1		30	20	50	100	150	4
Practicals/Drawing/Design											
7	CS 671L	Data Base Management System			3	30	20	50		50	2
8	ET 663L	Microprocessor and Embedded Systems			3	30	20	50		50	2
9	CS 675L	Digital Communication & Information Theory			3	30	20	50		50	2
10	CS 676L	Computer Graphics			3	30	20	50		50	2
11		General Proficiency							50		
Total			18	6	12						

Total Marks: 1150 **Total Periods: 36** **Total Credits: 34**

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

CS 671 Database Management System
Theory : 100 marks
Sessional: 50 marks
Time: 3 hours

Introduction

Data Models

Relational Model, Relational Algebra & Relational Calculus

SQL and other relational query languages

Relational Database Design

Query Processing & Organization

File and File Management System

Object Oriented Databases.

Concurrency Control and Recovery

Distributed DBMS

Books/references:

1. Silberschatz, Korth and Sudarshan - Database System Concepts, McGraw Hill International Edition.

2. Mazumdar and Bhattacharya - Database Management System, Tata McGraw Hill.

CS 672 Computer Communication Networks
Theory: 100 marks
Sessional 50 marks
Time: 3 hours

Uses of computer networks

Network goals, application structures, architectures, OSI Model and services. Network examples.

Physical layer

Transmission medium, telephone system. RS-232C, RS-449 standards. α21 switching, ISDN and terminal handling.

Medium access sublayer

ALOHA, CSMA, CSMA/CD, Collision free protocol, BRAP, MLMA etc. IEEE standard 802.3, Ethernet, token ring. FDDI, satellite networks and packet radio networks.

Data link layer

Framing, error detection and correction and data link protocols.

Network layer

Routing algorithm, flow control, queuing theory, analytical treatment of M/M/I and M/M/M.

Security and reliability of networks

Case study of' computer communication networks. TCP/IP.

Books/references:

1. Dimitri Bertsekas & Robert Gallager – Data Networks. PHI, 1992, 2/e.

2. W. Stallings - Data and Computer Communications, Prentice Hall, 1997.

3. A. S. Tannenbaum - Computer Networks. PHI, 1997, 3/e.

ET 663 Microprocessor And Embedded Systems

Theory: 100

Sessional: 50
Time: 3 hours

Introduction to Computer Architecture and Organization: Architecture of 8-bit microprocessors, bus configurations, CPU module, introduction to assembly language and machine language programming, instruction set of a typical 8-bit microprocessor, subroutines and stacks, programming exercises.

Memory Technology: Timing diagrams, RAM, DRAM and ROM families, memory interfacing, programmable peripheral interface chips, interfacing of input-output ports, programmable interval timer. Memory map, peripheral I/O and memory- mapped I/O.

Data Transfer Schemes: Serial and parallel data transfer schemes, interrupts and interrupt service procedure. 8085 interrupts and vector locations, SIM and RIM instructions, RST instructions.

Introduction: To Microcontrollers, Architecture, RISC and CISC processors.

Instruction Set and Programming: Instruction set and programming 8051micro controllers.

Architecture: Instruction set and programming of 8 bit micro controllers PIC 16c74.

Development Tools: Simulators, debuggers, cross compilers, in circuit emulators for the micro controllers.

Interface Issues Related to Embedded Systems: A/D, D/A converters, timers, actuators, power, FPGA, ASIC, diagnostic port.

Techniques for Embedded Systems: State machine and state tables in embedded design, simulation and emulation of embedded systems. High-level language descriptions of S/W for embedded system, Java embedded system design.

Real Time Models, Language and Operating Systems: Event based, process based and graph based models, Petrinet models. Real time languages, real time kernel, OS tasks, task states, task scheduling, interrupt processing, clocking, communication and Synchronization. Control blocks, memory requirements and control, kernel services.

Text Books/ References:

1. Ramesh S.Gaonkar - Microprocessor Architecture, Programming and Applications (3e), Penram Pub., 1997.
2. Mazidi M. A. & J. G. Mazidi - The 8051 Microcontroller and embedded systems, Pearson, 2002.
3. Kenneth J Ayala – the 8051 Microcontroller architecture programming and applications, 2nd Edition Penram International publishing.
4. J.B. Peatman – Design with PIC microcontrollers , PH Engg. 1998.
5. Hintz – Micro controllers, Architecture, implementation and programming McGraw Hill.
6. Evesham - Developing Real - Time Systems - A Practical Introduction , Galgotia Publications, New Delhi, 1996.
7. Ball S.R - Embedded microprocessor systems - Real World Design, Prentice Hall, 1996.
8. Herma K - Real Time Systems – Design for Distributed Embedded Applications, Kluwer Academic, 1997.
9. Gassle J - Art of Programming Embedded Systems, Academic Press, 1992.
10. Gajski D.D, Vahid F, Narayan S - Specification and Design of Embedded Systems, PRT Prentice Hall, 1994.

CS 674 Operating Systems
Theory: 100 marks
Sessional: 50 marks
Time: 3 hours

Process Management

Process, thread and scheduling algorithms. Concurrent process. Issues related to concurrent processes like functionality, mutual exclusion, synchronization, deadlock and inter-process communication primitives like semaphores and the implementation using machine primitives. Deadlock detection, prevention and avoidance.

Memory Management

Allocation, protection, hardware support, paging and segmentation. Demand paging and virtual memory.

File management

Naming, file operation and their implementation.

File systems

Allocation, free space management, directory management and mounting. File system protection, security, integrity, reliability, device independence.

I/O management

Device drivers, disk scheduling, block I/O and character I/O.

Examples of operating systems

UNIX, DOS and WINDOWS NT.

Books / References:

1. A Silberschatz and P. B. Galvin - Operating System Concepts, Addison Wesley, 1990.
2. H. M. Deitel - Operating Systems, Addison Wesley, 1990, 2/e.
3. W. Stallings - Operating Systems, Prentice Hall. 1995, 2/e.
4. M. J. Bach - The Design of the UNIX Operating System, Prentice Hall of India, 1994.

CS 675 Digital Communication and Information Theory

Theory: 100 marks
Sessional: 50 marks
Time: 3 hours

Introduction
Introduction to digital communications, review of signals and systems theory, random variables, and Stochastic Processes. Merits of digital systems.

Waveform Coding Techniques
Mathematical models for information sources. Preview of sampling theorem. Sampling, quantizing and coding for discrete sources. Pulse code modulation (PCM). Quantization noise, companding, DPCM, DELTA modulation (DM), ADM. Noise in PCM and DM svstems. Time Division Multipexing(TDM).

Basic digital modulation schemes

ASK, PSK, QAM and FSK

Baseband Digital Transmission
Baseband binary PAM systems. Intersymbol interference (ISI). Nyquists's criterion for distortionless baseband binary transmission. Nyquist and Raised Cosine Pulses. Square-Root Splitting of the Nyquist Pulse. Baseband M-ary, PAM systems. Optimum detection. Matched filters, correlation receivers.

Information Theory

Discrete message, Amount of information, Entropy, Information rate, Channel capacity, Shanon's Theorem, Capacity of Gaussian Channel, Bandwidth-SNR trade off.

Coding: Source coding & Channel coding, Parity Check bit coding for detection, Error correction & detection, Block codes, Convolutional code, Comparison of error rates in coded & uncoded transmission, Automatic repeat request (ARQ), Performance of ARQ system.

BOOKS & REFERENCES

1. Principles of Communication Systems: Taub & Schilling, Tata Mc Graw Hill.

CS 676 Computer Graphics
Theory: 100 marks
Sessional: 50 marks
Time: 3 hours

OBJECTIVES:

1. Understand the fundamental graphical operations and the implementation on a computer.
2. Understand the mathematics behind computer graphics including the use of spline curves and surfaces.
3. Get a glimpse of recent advances in computer graphics.
4. Understand user interface issues that make the computer easy to use even for novices.

COURSE CONTENTS:

Introduction

What is computer graphics? Elements of a graphic workstation, device independence, fundamental problems in geometry. [10%]

Basic Raster Graphics

Scan conversion, filling and clipping. [32%]

Geometry Manipulation

Transformation matrices, homogeneous coordinates. [20%]

Elementary 3D Graphics Plane projections, vanishing points, specification of a 3D view. [15%]

Visibility: Image & object precision, z buffer algorithms, floating horizon. [23%]

Advance Issues: Any of the following topics:

1. Curves and S-surfaces: Parametric representation, Benzier and B-spline cuves.
2. Rendering: Ray tracing, antialiasing, faractals, Gourard and phong shading.
3. User interface: Issues of user interface, elements of window system (X, Mac-OS, MS-Windows), elements of tool-kit programming (Windows or JAVA based)

Text Books / References:

- R. H. Bartels, J. Beatty, B. A. Barsky – Introduction to Splines for Use in Computer Graphics, Morgan Kaufmann.
- J. Foley, A. Van Dam, S. Feiner and J. Hughes – Computer Graphics: Principles and Practice, Addison Wesley.
- D. Hearn and P. Baker – Computer Graphics, Prentice Hall.
- C. E. Leiserson, T. H. Cormen and R. L. Rivest – Introduction to Algorithms, McGraw Hill Book Company.
- W. Newmann and R. Sproull, Principles of Interactive Computer Graphics, McGraw Hill Book Company.
- R. Plastock and G. Kalley – Theory and Problems of Computer Graphics, Schaum's Outline Series of McGraw Hill Book Company.
- F. P. Preparata and M. I. Shamos – Computational Geometry: An Introduction, Springer-Verlag, Inc, New York.

BRANCH: **INDUSTRIAL & PRODUCTION ENGG. (6TH Semester)**

SL.No	Course No	SUBJECT	PERIOD			EVALUATION SCHEME					
	Theory					Sessional/Exam.			ESE	Subject Total	Credit
			L	T	P	TA	CT	Total			
1	ME 621	Machine Design - II	3	0	0	30	20	50	100	150	4
2	ME 622	Operation Research	4	0	0	30	20	50	100	150	4
3	ME 624	Engg. Inspection and Metrology	3	1	0	30	20	50	100	150	4
4	IP 633	Plant Layout and Material Handling	4	0	0	30	20	50	100	150	4
5	IP 634	Machine Tool Technology	4	0	0	30	20	50	100	150	4
6	IP 635	Computer Methods and Data Processing	3	1	3	30	20	50	100	150	4
7	IP 636	General Proficiency							50	50	2
		Practical/ Drawing/Design									
8	ME 621L	Machine Design – II	0	0	3	30	20	50		50	2
9	ME 624L	Engg. Inspection and Metrology	0	0	2	30	20	50		50	2
10	IP 633L	Plant Layout & Mat. Handling	0	0	2	30	20	50		50	2
11	IP 634L	Machine Tool Technology	0	0	2	30	20	50		50	2
Total			21	2	12						34

Total marks : 1150 **Total Periods: 35** **Total Credits : 34**

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

ME 621: MACHINE DESIGN II (3-0-3) (for ME & IPE)

Theory 100 marks Sessional50marks Laboratory 50marks Time 4 hours

Unit I : Design against static load Different type of load and stress, Mode of failure. Factor of Safety.

Unit II : Design against fluctuating load Stress concentration, fluctuating stresses, Fatigue failure, endurance limit, Notch sensitivity, cumulative damage in fatigue, Soderberg and Goodman Diagrams, Fatigue design under combined stresses.

Unit III : Design Considerations and simple cases of design for

h) Mechanical Spring – helical spring
i) Friction clutches – single and multidisc clutch, cone clutch
j) Brakes – Disc, cone, band, and internal expanding shoes
k) Spur Gear, Helical gear
l) Bearing – radial and Thrust journal bearings, antifriction bearings
m) Cams
n) Gasket for static load, in vessel opening

Reference Books:

1. Machine Design (Tata McGraw Hills) ----- Blach and Adams
2. Design of Machine elements (-do-) ----- B. V. Bhandari
3 Machine Design (….) ------- Bahl & Goel
4. Machine Design ----- Hall
5. Machine design ----- Shigley
6. Design of Machine elements ----- M. F. Spot.

ME 622: Operations Research (4-0-0) (for ME &IPE)

Theory100 Sessional 50 Time: 3hours

7. Introduction to OR, Engineering applications, Statement of an OR problem, Type of problems handled in OR.
8. (a) Linear programming (deterministic) – Problem formulation, Feasibility and Optimality, Basic and Non-Basic solutions
   (b) Graphical method of solving LPP, Simplex Algorithm and problem solutions, Use of Slack, Surplus and Artificial variables and their meanings
   (c) Big-M method and 2-phase method
   (d) Dual Simplex algorithm
   (e) Meaning and examples of Unique, Alternate/Multiple, Unbounded and Infeasible solutions.
   (f) Degeneracy and Cycling
9. Special Linear Programming problems – their formulations and solutions in such cases as Integer Programming Problem (IPP), Transportation Problem (TP) and Assignment Problem (AP). Discussion on method extended to Travelling Salesman Problem (TSP).
10. Classical Optimisation – Introduction, Single and Multi-variate problems, Lagrangean method, Karush-Kuhn-Tucker (KKT) conditions
11. Inventory modelling – Classification of inventory, Deterministic versus Stochastic problem situations, Formulation and Solution of Deterministic inventory problems,
12. Simulation – Meaning, Monte-Carlo simulation, generation of random observations, Use of digital computers in simulation, Discussion on simulation examples such as inventory, queuing etc.

Text and references

8. Operations Research – H A Taha
9. Operations Research – Gupta and Hira
10. Operations Research – Billy E Gillet
11. Operations Research – Panneerselvam
12. Optimisation – S S Rao
13. Operations Research – N G Nair
14. System Simulation by digital computers – N Deo

ME 624: ENGINEERING INSPECTION AND METROLOGY (3-1-2),(for ME &IPE)

Theory: 100 Sessional: 50 Laboratory: 50 Time: 3hours

1. **Introductory concept**: Meaning of engineering inspection and Meaning of engineering metrology. Controlling quality through inspection, types of inspection, merit/demerit of 100% inspection, Sampling inspection – Representative sample. Different methods and techniques of measurement. Standards of measurement and sub-division of standards.
2. **Statistical Process Control**: Product variations – Chance causes and assignable causes, Control charts and its significance in statistical process control, Computer implementation of control charts.

3. **Limits of size and fits**: Concept of tolerance, allowance and clearance. Natural tolerance limits, process capability and Specification limits. Hole and shaft basis systems of specifying limits of size and tolerances. Indian Standard for fits and tolerances.
   Limit gauges – hole and plug gauge, Taylor's principle of gauging. Tolerances and allowances during design of gauges.
   Interchangeability – its importance in production, techniques of achieving interchangeability during manufacturing.
4. **Measurement of screw threads**: Terminologies of screw threads. Measurement of various parameters of screw thread such as diameter, thread angle, effective diameter and pitch. Use of screw gauge and pitch gauge, Use of diameter and pitch measuring machines. Two and three wire methods.
   Use of Profile projectors and Tool Maker's Microscope (TMM) in the measurement of thread elements
5. **Measurement of gears**: Gear tooth profiles – involute and cycloidal, involute function. Spur gear measurements for run-out, pitch, profile, backlash. Parkinson gear tester. Measurement of tooth thickness – chordal thickness method, constant chord method, base tangent method. Check for pitch circle diameter and tooth spacing.
6. **Surface texture**: Meaning of surface texture, order of geometrical irregularities, elements of surface texture. Meaning of roughness and fineness. Roughness width cut-off. Representation of surface roughness. Estimation of surface roughness. Measurement of surface roughness by stylus equipment.
7. **Interferometry**: – Principle of interference. Use of optical flat. Gauge interferometer – Principle NPL gauge interferometer. Laser interferometer.
8. **Alignment testing:** – Optical methods for alignment testing, Laser alignment testing.

Texts and references:

1. Engineering Metrology – K J Hume
2. Engineering. Metrology – K W B Sharp
3. Engineering Metrology – R K Jain
4. Engineering metrology – M Mahajan
5. Dimensional metrology – M K Khare and S Vajpayee.

IP 633 : PLANT LAYOUT AND MATERIAL HANDLING [4-0-2]

Theory100marks Sessional50 marks Lab./ pract50 marks Time 3 Hrs

Unit I : Introduction Definition and objective of plant layout – problems and principle of plant layout : different types of layout.

Unit II : Factors in plant Layout. Different factors influencing the Layout …….man machine. Material movement, service, building, storage etc. Analysis and co-ordination – plant layout procedure – Symptom's of bad Layout.

Unit III : Planning and Layout Process planning : materials, building, determination of equipment cost.

Layout fundamentals : Getting the facts, flow studies, proximity cross charts ; Flexibility and Layout aids templates. Tapes, re-production methods – Evaluation of the layout.

Unit IV : Installing the Layout . Plant layout procedure, plant Engineering and acceptance.

Unit V : Introduction to Material Handling. Objective and elements – material handling activities and function, systems of bad material handling.

Unit VI : Material Handling Organisations. Fundamental principles. : relation to plant layout, safety in operation, traffic and Handling equipments.

Systems of bad material handling system.

Unit VII : Material Handling Equipment. Classification and types : Conveyors, its types ;. Noists, Mobile equipments – positioning equipment , Supper equipment, selection of material handling equipments.

Unit VIII : Economics Unit load concept in material handling, systematic handling analysis : economics of material handling.

Reference books

1. Plant layout and Mmaterial Handling ----- G. K. Agarwalla.
2. Practical Plant Layout ------ Mather.
3. Material Handling -------- Immer.
4. Plant Layout Design ------ Moore.
5. Industrial Engineering and production Management -------- M. Telsang

IP 634 : MACHINE TOOL TECHNOLOGY [4-0-2]

Theory100 marks Sessional50 marks Lab./Pract50 marks Time 3 Hrs

Unit I : Introduction Characteristics and objectives of m/c tools – Basic features – classification, process capability and compliance, essential requirements – selection and maintenance – Efficiency, quality and Performance of a m/c tool.

Unit II : Kinematics of m/c tools. Classification and choice of driving systems. Basic considerations in the design of drives – Speed and structure program. Selection of optimum ray diagram. Transmission in the systems of stepped regulation. Spindle speed and design of all beared headstock – intermediate shaft diameter calculation.

Stepless drives and hydraulic drive. Feed gear boxes.

Unit III : Beds, Tables and Columns Various types of beds, their materials, construction and design features ; tables design principle – stiffness and natural frequency.

Columns -- material and design criteria.

Unit IV : M/C tool guides and Spindle. Classification and requirements of guides and spindle materials –Lubrication, kinematic Friction and stick slip vibration – Design criteria. Wearing of guides and influences of material hardness on guidewear. Temperature deformation. Effect of microstructure, chemical composition and surface preparation. Methods of calculating pressure on guides.

Spindle units – material, construction and supports.

Unit V : Rigidity and Vibration in m/c Tools. Introduction – Static and Dynamic rigidity, forced damped, self, excited and stick slip vibration.

Vibration isolators.

Unit VI : Testing of m/c Tools. Necessity – Alignment tests and performances tests in Lathe, drilling and milling machines – preparation of tests charts.

Unit VII : Semi Automatics and Automatics. Introduction : …tan and turrent Lathe ; principles …….. and working – comparison with engine lathe. …….. including and bar feeding mechanism. Tooling for simple products.

Automatic machines : Single and multi-spindle. Swiss type automatics.

Reference books

1. Principles of Machine Tools ---------- Sen and Bhattacharya.
2. Design of Machine tools ------ S. K. Basu.
3. Machine Tool Engineering -------- G. R. Nagpal.
4. The Design and construction of M/C tools ------ H. C. Town.
5. Machine Tools Design hand Books -------- C.M.T.I.

IP 635 : COMPUTER METHODS AND DATA PROCESSING [3-1-3]

Theory100marks Sessional /Lab.50marks Time 3 Hrs

Unit I : Basic elements and use of computers – Analog and Digital, Programming and Software, Machine language.

Unit II : Machine processable data, Number system, Alphanumerical systems and organisation of data.

Unit III : Introduction to Data structures, Arrays, Lists, Stacks, Queues, Trees, Graphs, Structured programming using high level programming language. Introduction to data base management systems.

Unit IV : Introduction to data processing – processing facilities, implication for production engineering and management, Industrial and production management problems of the data processing.

Unit V : Processing equipment, computers and future developments. Application through case study.

Reference books

1. Digital Computer Fundamentals ------ V. Rajaraman, PIH

2. Introduction to Data Structures ------ Horowitz and Sahani, GB.
3 Introduction to Data Base Systems. ------ C. J. Date, Addission, Wesley, 1985
4. First Course in Data Base systems ------ Jeffrey D Ullman and Jenifer Widom, Prentice Hall, 1997
5. Data Structure, algorithm and Softaware principles in C ----- Thomas A Standish, Addition Wesley, 1995.