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

SL. NO.	COURSE NO.	SUBJECT	PERIOD			EVALUATION SC				
Theory			L	T	P	Sessional Examination			ESE	
						TA	CT	Total		
1.	CE 811	Design of Structures-IV.	3	1		50	25	75	100	
2.	CE 812	Flood Management & River Engineering.	3	1		50	25	75	100	
3.	CE 813	Construction Management.	3	1		50	25	75	100	
4.	CE 814	Elective-III.	3	1		50	25	75	100	
5.	CE 815	Elective-IV.	3	1		50	25	75	100	
6.	CE 817	General Viva-Voce.							75	
7.	CE 816	Project-II.								
Total			15	9						

Total marks: 1100 Total Periods: 24 Total Credits: 30

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

Electives: -

Civil Engineering: Elective-III: Prestressed Concrete Design/ Water Resources Engineering/ Design of Substructures.

Elective-IV: Water Power Engineering/Hydraulic Machines/ Disaster Management/Environmental Impact assessment.

* Project-II **:** TA **:** 60 Marks.
Report **:** 40 Marks.
Presentation **:** Mid Semester- 25 Marks.
End Semester- 25 Marks.

CE 811: DESIGN OF STRUCTURES- IV

Theory – 100.
Sessional – 75.

Time – 4 hrs.

FIRST HALF (40%)

1. **Elements of seismology** (prerequisite; refer CE 404)**.**
2. **Concept of Earthquake Resistant Design:**

   Ductility and design force, significance of ductility, Design for ductility.
3. **Use of Indian standard codes: IS: 1893, IS: 4326, IS: 13920.**

SECOND HALF (60%)

4. **General consideration of bridges:**

   Types of bridges, economic spans, selection of suitable types of bridges.

5. **Loads and their distribution:**

   IRC loads, Railway loads, military loading classes, analysis of deck slab for wheel loads, load distribution among various longitudinal beams of a bridge.

6. **Design of super-structure:**

   R.C.C. Tee beam bridge, balanced cantilever bridge, Pratt truss steel bridge.

7. **Design of sub-structure:**

   Various types of bearing and design, different types of foundation design.

CE: 812: **FLOOD MANAGEMENT AND RIVER ENGINEERING**

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

FIRST HALF: FLOOD CONTROL

Introduction: Definition, causes and effects of flood; incidence and extent of floods with special reference to North East region, flood damages, Dambreak or Embankment breaching Flood in North East.
Flood estimation: Rational, empirical and unit hydrograph methods; design flood, flood frequency analysis – annual series and partial duration series, probability and return period of flood, Gumbel and Log pearson distributions, design flood selection criteria, design storm, probable maximum flood.
Flood management: Flood damage mitigation, reduction of peak flood – reservoirs and detention basin; confinement of flow embankment, flood walls, ring bunds; reduction of peak stage – channel improvement, cut – off Diversion of flood water – emergency flood ways, river diversion, inter basin transfer; flood abatement – watershed management measures, weather modification; flood plain management land use regulations, flood plain zoning, flood proofing, flood insurance; emergency measures.
Dams and embankments: Elements of gravity, arch and earth dams, selection of sites, stability analysis, embankments – materials of construction, typical sections, effectiveness and side effects.

SECOND HALF: RIVER ENGINEERING

Introduction: River course – upper, middle and delta reaches; Himalayan and Peninsular rivers, principal river systems of India
Types of rivers: Perennial, flushy and virgin rivers; incised, boulder, flood plain, delta and tidal rivers; aggrading, degrading, meandering and braided rivers.
Sediment transport: Sediments – bed load, suspended load and wash load; riverbank erosion, incipient motion, mode of sediment transport – rolling, sliding, saltation and suspension; introduction to theories of sediment transport including Shield's Theory.
Regimes of flow: Definition, description of regimes of flow: plane bed, ripples, dunes, transition and anti dunes; prediction of regimes of flow.
River behaviour: Behaviour of rivers in straight reaches and bends, meandering – causes and general features, factors effecting meanderings, cut – off – development and effects, causes of braiding and delta formation.

River training: Definition, objectives, classification – high water, low water and mean water river training; river training works – marginal embankment, spurs, guide bank, porkupines, bank pitching and revetment, cut off, pitched island, sills and bottom paneling, bandalling and river training works in Assam.

Time 3 hrs.

CE 813: CONSTRUCTION MANAGEMENT

Theory – 100.
Sessional – 75.

Time – 3 hrs.

Introduction: Civil Engineering and management as business management, construction management and sustainability.

Stages of Construction: Tendering-purpose and methods, notice inviting tender, prequalification, pretender conference, tender documents, fast-track projects, acceptance and selection criteria, elements of contract as per India contract Act 1872, types of contracting systems, sub-contract, construction team and conflicting interests, managerial interventions, responsibility of team members, Indian Arbitration Act 1940.

Bar charts and networks: limitation of bar charts, CPM and PERT in construction industry for time and material management, probabilistic assessment of project completion time, introduction to risk management in construction.

Special features of in-situ construction: Construction hazards and application of top down construction technique, micro piles, diaphragm wall.

Role of equipments and modern construction industries: Equipment-intensive constructions, selection of construction equipments-factor affecting, typical and special equipments for civil engineering structures such as-roads, bridge, multistoreyed buildings and towers, some national and international specialist construction industries, industrialized building, suitability of in Indian context, advantage and disadvantage of industrialized buildings, role of modular co-ordination and standardization.

References:

i. Dhir, B. M. and Gahlot: Construction Planning and Management:, P. S. New Age International Publisher.
ii. Benjamin, J. and Cornell, C. A.: Probabilit, Statistics and Decision for Civil Engineers, McGraw-Hill, New York.
iii. Indian Contract Act 1872.
iv. Pro of the International Conf. On case histories in Geotechnical Engineering, St. Louis, 1988.
v. Bora, A, and Ranjan, G. (1997). "Strengthening of Existing Foundations Using Micro Piles". Proc. of International Conf. on Civil Engineering for Sustainable Development, University of Roorkee, Vol.-1 pp 359-388.
vi. Bora, A. (1997a). "Sustainability Parameters and Role of Civil Engineers". Proc. of International Conf. on Civil Engineering for Sustainable Development, University of Roorkee, Vol.-2 pp 807-818.
vii. Relevant Indian Standard codes of practices.

CE 814 (ELECTIVE – III) (A) PRESTRESSED CONCRETE DESIGN

Theory- 100.

Sessional – 75.

1. <u>Deflection of prestressed concrete Beams</u>:

Factors influencing deflection, Deflection of uncracked and cracked members, Long time deflection, codal practices.

2. **Design of prestressed concrete sections:**

   Design for flexure, shear, axial force, bond and bearing. Design 6 pre-tensioned members.

3. **Transfer of prestress:**

   Transfer by bond, transmission length, code provision for bond and Transmission length.

4. **Design of Anchorage Zone:**

   Stress distribution in End block, comparative analysis, Anchorage zone reinforcement.

5. Design of partially prestressed members, simple problems of propped cantilever, Fixed and continuous beams.

6. **Limit state design criteria of prestressed concrete members:**

   Criteria for limit states, strength and serviceability limit states, crack widths in prestressed members, durability limit state, Design procedure.

CE 814 (ELECTIVE – III): (B) WATER RESOURCES ENGINEERING

Theory – 100.
Sessional 75.
Time 3 hrs.

1. Introduction: -

Fields of water resources engineering; problems of water resources engineering, economics in water resources engineering, Social aspects of water resources engineering, planning of water resources projects, the future of water resources engineering. Water resource in North East and its use.

2. Probability concepts in planning: -

Frequency series, recurrence interval, statistical methods for estimating the frequency of rare events, Gumbel's method, Log Pearson type III distribution, confidence limits, partial duration series, flood frequency at points without stream flow records, probable maximum flood.

3. Engineering Economy in Water Resources Planning: -

Social importance, steps in an Engineering economy study, discount rate, sunk cost, intangible values, economic life, physical life and period of analysis of a project, cash flow diagram, discounting factors – single payment factors and uniform annual series factors, discounting methods, present worth method, rate of return method, annual cost method, benefit cost ratio method.

4. Cost Allocation: -

Definition, separable cost, joint cost, common cost, method of cost allocation–remaining benefits method and alternative justifiable expenditure method.

5. Planning for Water Resources Development: -

Levels of planning, phases of planning objectives, data required for planning, projections for planning, project formulation, project evaluation, environmental considerations in planning multipurpose project planning, requirement of uses in multipurpose projects, drawbacks in project planning.

6. Reservoir: -

Purpose, physical characteristics of reservoir, storage capacity determination from the site, reservoir site selection, life storage capacity by mass curve method, reservoir sedimentation, trap efficiency, distribution of sediment in a reservoir, useful life of reservoir, reservoir operation, reservoir sedimentation control, reservoir yield, economic height of a dam, reservoir working table.

CE 814 (ELECTIVE – III) (C) DESIGN OF SUB – STRUCTURES

Theory 100.
Sessional 75.
Time 3 hrs.

Geotechnical and Structural design of shallow foundations: Loads for design, determination of safe bearing capacity & allowable bearing pressure of footings in clay & sand, dimensioning of single isolated footing, considerations for dimensioning of groups of footings for equal settlements – the standard current practices.
Structural design of isolated footings, strip footings, combined footings.

Raft in clay & sand: Types and their suitability, determination of safe bearing capacity & allowable bearing pressure.
Structural design of raft by conventional (rigid) method as per IS: code of practice.

Pile Foundation: Determination of allowable load on single & pile group in clay & sand, fixation of length, diameter, number and spacing of piles, introduction to micro piles.
Analysis of Laterally loaded piles by Reese & Metlock approach.
Structural design of pile, pile group and pile cap.

Elements of Bridge Sub Structure: Forces on bridge sub – structure (IRC & IRS specification), well foundation with components only.
Structural design of bridge piers, abutment.

Earthquake Engineering in Foundation Design: Interpretation of IS: Code provisions for design of foundations for buildings, retaining walls, water towers, etc under earthquake loading.

CE 815 (ELECTIVE – IV): (A) WATER POWER ENGINEERING

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

Introduction:
Energy, work and power; water energy, hydropower and other powers, their relative merits, comparison of hydro, thermal and nuclear power; hydropower potential and its estimate in North East.

Estimation of available power: Flow and power duration curves, firm power, secondary power, dump power, load distribution – base load, peak load factor, capacity factor, pondage, storage, mass curve – determination of reservoir yield and capacity.

Types of hydropower plants: High, medium and low head plants; runoff river plants, storage plants, diversion canal plants, pumped storage plants, tidal power plants; base load and peak load plants; concentrated fall and divided fall developments, components of hydropower schemes, general layout of hydropower plan with all its components, Notable Hydropower projects in North East.

Water Conveyance: Intakes – types, trash rack, control gates; canals, fore bay, tunnels, pipes.

Penstock: Design criteria, economic diameter, anchor, blocks, water hammer analysis – Alleviels equation, resonance.

Surge Tanks: Functions, types, design criteria, stability analysis with physical verifications by laboratory model (existing).

Turbines: Types, functions, characteristics; working principles, pelton wheel, Francis turbine, Kaplan turbine, turbine characteristics – specific speed, characteristic curves, selection of type and numbers of turbines; scroll case, draft tubes, governing of turbines.

Power House: Components, general layout – surface and underground power houses.

CE 815 (ELECTIVE – IV): (B) HYDRAULIC MACHINES

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

Introduction: Energy, work and power; basic principles of fluid flow – continuity equation, energy equation and momentum equation; angular momentum.

Impact of jets: Application of momentum principles – forces of jets on flat plates and curved vanes, water wheel, velocity triangle, radially rotating vanes, jet propulsion.

Water turbines: Classification, component parts, working principles, work done, efficiency, impulse turbine – Pelton wheel; reaction turbine – Francis turbine, Kaplan turbine, propeller turbine; scroll case, draft tube, governing of turbines.

Performance of Turbines: Turbine characteristics, principles of similarity, performance curves, selection of turbines – type and number of units.

Centrifugal pumps: Classification, component parts, layout, working principles, work done, manometric head, efficiencies, pressure increase, minimum starting speed, multi stage pumps. Vertical turbine pump.

Reciprocating pump: Component parts, types, layout, discharge, slip, indicator diagram – effects of acceleration and friction, work done, air vessels – its effects, maximum speed of rotating crank.

Other machines: Hydraulic press, hydraulic jack, accumulations, intensifier, hydraulic ram, jet pump, air lift pump, aerial flow pump.

CE 815 (ELECTIVE-IV) : (C) DISASTER MANAGEMENT

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

Meaning of hazard, vulnerability, risk, disaster; types of disasters and their social and economic significance, international concern.

Need of comprehensive approach for management of disasters, Introduction to sustainable development and disaster management.

Disasters in regional context: Earthquakes, landslides and floods; basic ideas related to causes of earthquakes, earthquake magnitude and intensity scales, seismic waves, earthquake disaster scenario, comprehensive earthquake disaster management plan. Factors affecting landslide and flood disaster, comprehensive landslide and flood disaster management plan.

Books:

Dr. Indu Prakash, 1994, ***Disaster Management***, Rastriya Prahari Prakashan, Sahibabad, Ghaziabad.
V. K. Sharma (Editor), 1995, ***Disaster Management***, Indian Institute of Public Administration, New Delhi.
U.R. Rao, ***Space Technology For Sustainable Development***, Tata McGraw Hill.

CE 815 (ELECTIVE – IV) (D) ENVIRONMENTAL IMPACT ASSESSMENT

T

h e o r y - 1 0 0 .

Sessional - 75.
Time -3 hrs.

1. Environmental Impact Assessment: An Overview

Introduction to EIA; Basic methodology: Screening, scoping Baseline data, Stake holder's involvement, Prediction of effects, Mitigation, EIA in decision making , Documentation, Project Implementation

2. Environmental Laws:

Introduction, Constitutional Provisions, Union list, sate list, concurrent list, Environmental Protection Acts, Functions of central and state boards, penalties, water act.

3. Screening and Scoping:

Aims and objectives, Checklists and matrix, choosing tools.

4. Environmental Indices and Indicators for Describing the Affected Environment:

Background Information, Environmental-Media Index- Air Quality, Environmental-Media Index- Water Quality, Environmental-Media Index- Noise, Environmental-Media Index- Ecological Sensitivity and Diversity, Environmental-Media Index- Archaeological Resources, Environmental-Media Index- Visual Quality, Environmental-Media Index- Quality of life, Development of indices

5. Prediction and Assessment of Impacts on the Air, Surface water, Soil, Ground Water, Noise Environment, Biological Environment, Cultural Environment and socio-economic environment:

Key regulations, Addressing Environment impacts: identification of the types, qualities/quantities of pollutants and effects, Base line data, Relevant quality standards and regulations, Impact Prediction, Assessment of impact significance, identification and incorporation of mitigation measures

6. Public Participation in EIA.
7. Rapid Environmental Impact assessment.
8. Environmental Risk assessment.
9. Preparation of written document.
10. Environmental Monitoring.
11. Some case studies and project work.

Text Book:

1. Environmental Impact Assessment, Larry W Canter, McGraw-Hill.
2. Renewable Energy Resources and Their Environmental Impact, S A Abbasi and Naseema Abbasi, Prentice Hall India.

CE 816 : PROJECT-II

Marks - 150.

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 design of Multi Storeyed building/ bridge/ other Civil Engineering structures.

Each group will work under one or more supervisor(s) from the department. After completion of the work, the students will submit a report on the project alongwith working drawings and also appear in a viva-voce examination.

CE 817 VIVA-VOCE

Marks – 75.

A final semester viva-voce examination will be held at the end of 8th semester. The viva-voce will be to assess the student on his/her overall knowledge of the subjects related to Civil Engineering in addition to the project works he/she had undertaken in 7th and 8th semester.

Mechanical Engineering:

8th 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 821	Manufacturing Method-AB	3	1	0	50	25	75	100	175	4
2	ME 822	Industrial Engg & Management-SKD	3	1	0	50	25	75	100	175	4
3	ME 823	Internal Combustion Engine-DKM	3	1	1	50	25	75	100	175	4
4	ME 824	Elective – III-HKT/AJB+BIB	3	1	0	50	25	75	100	175	4
5	ME 825	Elective – IV (Open)-BIB/KKD	3	1	0	50	25	75	100	175	4
Practical/ Drawing/Design											
6	ME 826	Project – II	0	0	12					150*	8
7	ME 827	Viva-Voce	0	0	0					75	2
Total			15	5	13					1100	

Total marks : 1100 **Total Periods: 33** **Total Credits : 30**

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

Electives : Mechanical Engineering

Elective – III : Air Conditioning/Compressor & Gas Turbine

Elective – IV : Power Plant Technology/Robotics & Applications

* Project – II : TA = 60 marks ; Report = 40 marks ; Presentation } Mid Semester = 25 marks

End Semester = 25 marks

ME 821: MANUFACTURING METHODS (3-1-0)

Theory – 100 Sessional – 75 Time: 3Hours

Unit-I – Melting and Casting of metals:

Solidification behaviour of pure metals and alloy materials, Centreline shrinkage, Comparative study of different melting furnaces. Special casting methods – Permanent mould casting – Pressure Die casting – Hot chamber, Cold chamber Air blown methods – Low pressure Die casting, Continuous casting. Non-metallic mould casting – Centrifugal casting, Investment casting. Casting defects, their causes and remedies – Fettling of casting – Inspection.

Unit-II – Mechanical working of metals:

Introduction – Classification – Hot, Cold and Warm working – Variables affecting mechanical working process.

Rolling – Principle – Condition for continuous rolling – Methods for reduction of roll separating force – Types of rolling mills – Roll pass design – Roll Piercing.

Forging – Forgeability – Forgeable materials – Metallurgy of Forging – Classification – Hand forging operations – Forging hammers – Drop forging – Press forging – machine forging – Forging Defects – Die design considerations.

Extrusion – Classification – Principle of operations – Variation of ram pressure with ram travel – Principle of operations of Hydrostatic extrusion, side extrusion, impact and Hooker's extrusion.

Wire, Rod and Tube drawing – Principle and Operation.

Unit-III – High Energy Rate Forming (HERF):

Introduction – Reasons that prompted transition to HERF – Classification – Principles and operations of Explosive Forming, Electro-hydraulic Forming, Electro-magnetic Forming. High Velocity Forming – Principles and Operations of Petro-forging, Dynapak.

Unit-IV – Press Working:

Introduction – Different types of Press and Selection of Presses – Press safety devices – Press Operations - Stock and Pattern layout – Press working dies – Principles and Operations of Cutting/Shearing and Deep drawing operations – Cutting and drawing dies – Design considerations – Defects in sheet metal formed parts.

Unit-V – Surface Finishing Operations:

Introduction – Classification – Principle and Operations of Lapping, Honing, Super finishing, Polishing, Buffing, Tumbling and Burnishing.

Unit-VI – Manufacture of threads and gears:

Threads manufacturing – Different methods – Casting, Thread Chasing, Thread Rolling, Die and Tapping, Milling and grinding.

Gear manufacturing - Different Methods – Casting, Forming and Metal removal. Gear Cutting and Generation Processes. Gear Finishing Operations

Unit-VII – Powder Metallurgy (P/M):

Introduction – Applications of P/M – Powder Characteristics – Powder production methods. Mixing and Blending, Briquetting techniques, Sintering. Infiltration and Impregnation. Cemented carbides. Advantages and Disadvantages of P/M.

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 Science – Amitabha Ghosh and Asok Kumar Mallick, East West Press
4. Production Engineering – P.C. Sharma, S. Chand & Company Ltd.
5. Metal Forming Technology – Dr. R. Narayanasamy, Ahuja Book Co. Pvt. Ltd
6. Mechanical Metallurgy – G.E. Dieter, McGraw Hill

ME822: Industrial Engineering & Management (3-1-0)

Theory: 100 Sessional : 75 Time: 3hours

1. **Organization**: Definition of organization, organizational structure, types of organization, span of control, delegation of authority and responsibility.

2. **Network Analysis:** Objectives, Network development technique, Network computations – Critical Path and its significance, Earliest and Latest dates, calculation of float. Deterministic and probabilistic network models, Assumptions and computations related to PERT model, Crashing of jobs for minimum cost-time schedule for CPM models.

3. **Work Study: (i)** Meaning and scope, subdivisions of work study – Method/Motion study and Work Measurement **(ii)** *Method/Motion study*- its meaning and scope, steps in method/motion study, Tools and techniques of method/motion study, Principles of motion economy **(iii)** *Micro-motion study* – Meaning and scope, therbligs, use of motion camera in micro-motion study **(iv)** *Work measurement* – concept of observed time, rating/levelling factor, average worker and standard time for jobs. Use of *stop watch* and *work sampling* techniques in the determination of standard time.

4. **Plant Location and layout: (i)** Objectives, Locational factors, Economics of plant location **(ii)** Meaning, objectives and types of plant layout and their relevance to mass, batch and job-order production systems. **(iii)** Systematic Layout Planning (SLP) procedure **(iv)** Use of computers for layout design **(v)** Group Technology (GT), Flexible manufacturing systems (FMS) and Computer integrated manufacturing (CIM) **(iii)** Assembly Line Balancing (ALB) - meaning and objective, Heuristic methods for solution of ALB problems.

5. **Product design and Development: (i)** Meaning of product, Product life cycle (PLC) and Product mix **(ii)** Decisions to be taken during product development and design

(iii) Procedure for product development and design **(iv)** Value of a product – its meaning, Value Analysis (VA) – its objectives, procedure and example, Simplification and Standardization.

6. **Production Planning and Control (PPC): (i)** Meaning and Objectives, Effects of types of production **(ii)** Steps in PPC primarily stressing the needs of marketing research, technological forecasting, process planning/routing, scheduling of flow-shop and job-shop productions, Use of Gantt chart, Machine loading, Make/Buy decision and Break-even analysis, Master production schedule, MRP and MRP-II, Supply Chain and Inventory management, Just In Time (JIT) and Kanban systems **(iii)** Production control – monitoring, expediting and re-planning.

(7) **Maintenance Management:** Meaning and Types of maintenance, and their suitability, Standards of maintenance, Total Productive Maintenance (TPM).

(8) **Total Quality Management (TQM): (i)** Meaning of Quality, Total Quality and Total Quality Management, Basic premises of TQM – customer satisfaction, process improvement, employee involvement, supplier partnership and management leadership. **(ii)** Tools and techniques for TQM **(iii)** Quality system and Quality assurance - ISO 9000 standards.

Recommended books:

1. Industrial Engineering – M Telsang
2. Essentials of Management – Koontz O' Donnel
3. Industrial engineering – M Mahajan
4. Production planning & control – L C Jhamb
5. Operations Management – Panneerselvam
6. Operations Management - Chezy
7. Motion and Time study – R M Barnes
8. Systematic layout planning – R Muther
9. Product design and manufacturing – Chitale and Gupta
10. Network and project management – Punmia
11. PERT & CPM – Weist and Levy
12. Production, operations and computer integrated manufacturing – M P Groover
13. Total Quality Management – Besterfield et.al.
14. Industrial Engineering and Management - O P Khanna.
15. Operation Management - BUFFA (John Wiley)
16. Elements of Production Planning and Control - EILON (McMillan)
17. Production , Planning and inventory control - P J Billington (PHI, 2nd Edition,1995)
18. Industrial Organisation and Management - BETHEL, AFWATER, SMITH, STACHKMAN.

ME823: INTERNAL COMBUSTION ENGINES(3-1-1)

Theory: 100 Sessional: 75 Time: 3Hours

Fuel Air cycle – effect of variation of specific heats, fuel-air ratio, compression ratio and dissociation. Actual cycle – losses in actual cycle.

Exhaust gas analysis – its interpretation and use in determination of combustion characteristics; Pollution norms.

I C engines fuels - - Petrol, Diesel, natural gases and some other alternative fuels and their characteristics and use in engines. Combustion process in S. I. And C. I. engines, abnormal combustion, detonation and fuel knock – additives. Rating of I. C. engine fuel.

Design features of combustion chambers used in S I and C I engines, some important types of combustion chambers.

Carburetion – desirable characteristics – compensation for simple jet carburetor, calculation for air-fuel ratio.

Injection processes – requirements and methods –mechanical, electronic and MPF injection system.

Ignition processes in petrol engines – requirements and types – battery magneto and electronic.

Performance characteristics of petrol and Diesel engines. Part load and full load characteristics in respect to thermal efficiency, mechanical efficiency, fuel consumption, bmep and torque. I C engine ratings and volume capacity compression ratio and weight to power output ratio and its trends in power – weight characteristics. Supercharging of I C engines – effect of supercharging on Diesel and petrol engines – performance characteristics for supercharged engines.

Supercharger – types, principles of duel-fuel and multi-fuel engines and Stratified combustion engines.

Recommended books:

1. A course in Internal Combustion engines – by M. L. Mathur and R. P. Sarma
2. Internal Combustion Engine fundamentals – by John B. Heywood-McGraw-Hill international edition.(1988)
3. Internal Combustion engines by V. Ganesan-Tata McGraw –Hill Publishing.-2nd edition(2003)
4. Engineering Fundamentals of Internal Combustion Engine by W.W. Pulkrebek, Pearson Education.
5. Fundamentals of Internal Combustion Engine by H.N.Gupta

ME824(Elective III): AIR – CONDITIONING(3-1-0)

Theory: 100 Sessional: 75 Time: 3Hours

Psychrometry: Psychrometric properties, representations of properties in charts, preparation of charts.

Psychrometric processes: Constant sensible heat and latent heat processes, adiabatic saturation and enthalpy deviation. Adiabatic mixing of air stream. Humidification, Dehumidification water spray processes, sensible heat factors, grand sensible heat ratio lines, apparatus dew points, Bypass factors, Air washer-humidifying efficiency.

Comfort A/C: Air temperature, human health, body temperature regulation, comfort indices, comfort charts and their limitations.

Load analysis: Inside and outside design conditions, load classification, summer cooling loads, solar heat gain and transmission and radiation. Flywheel effect of building materials, equipment temperature differential loads due to human beings, load due to electric light, equipments and appliances. Infiltrator and ventilator loads, product loads, miscelleneous loads such as duct heat gain, duct air leakage, fans, pumps etc. Winter heat load – computation of loads.

Duct design and Air distribution: Different methods of duct design such as velocity reduction, equal friction and static regain, aspect ratio duct losses, distribution of air in rooms, nature and supply grill; duct arrangement and air handling system.

A/C System: Unitary control system, special features of residential, commercial and industrial A/C system, Uear roun a/c zoning.

Equipments: (1) Fans – types of fans, characteristics, curves, fan selection. (2) Air filter and cleaner. (3) Cooling towers, evaporators, condensers (4) Cooling coils and water capacity, (5) Chemical dehumidifiers, (6) Heaters, radiators, Convection coils.

Instruments and controls: Temperature, humidity, air velocoty measuring instruments, Thermostat, humidiostat. By pass and damper control. Dew point control, noise control, Pneumatic control.

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 825(E-IV-OPEN): POWER PLANT TECHNOLOGY (3-1-0)

Theory: 100 Sessional: 75 Time: 3Hours

UNIT I : Introduction, power plants, types of power plants, requirements of plant design, Resources and development. Concepts of captive power plant and co-generation.

UNIT II : Power plant lay-out and economics, general design of power plant, unit plant station, cost of energy, selection of types of generator, selection of equipments, performance and operating characteristics, Load division, Tariff methods.

UNIT III : Steam Power Plants : Site selection, General lay-out of thermal power plants, Steam generation – high pressure boiler, Economiser, Superheater, Reheater, Regenerator, Super-critical cycles, efficiency and heat rate, Air preheater, Fuel handling equipments, coal firing furnace, fluidised bed combustion. Ash handling systems, Cooling tower and ponds. Steam turbines and ponds. Steam turbines – Installations, testing and maintenance, trouble shooting, Optimisation of power plant operating efficiency, Emission control.

UNIT IV : Diesel Power Plants: Introduction, plant lay-out, Engine performance, hea balance, Installation and maintenance of Diesel Engines, advantages, trouble shooting, methods of starting.

UNIT V : Gas turbine plants : Site selection, layout, installation maintenance, inspecting governing, fuels, materials, combined cycle, waste heat boiler.

UNIT VI: Hydroelectric Power Plants: Classification, types, governing, installation, operation and maintenance.

UNIT VII: Nuclear Power Plants : Fission and fusion, Thermal fission reactors, types of plants, fast breeding reactors.

UNIT VIII: Measurement and instrumentation : Importance, water purification and gas analysis.

UNIT IX : Environment aspects : Thermal pollution, Greenhouse effect, Acid precipitation, Radioactivity, Noise pollution, methods of reduction of pollution.

UNIT X: Non-Conventional Power Plants: Introduction to non-conventional non-polluting types – geothermal, wind, solar power plants and direct energy conversion systems.

ME 826L: PROJECT – II (0-0-12)

Sessional marks: 150

Pass marks: 75

Under this course the students are required to submit a project report on Mechanical Engineering topics. The report should be submitted in a standard FORMAT prescribed by the department .

ME 827L: VIVA – VOCE

Total marks: 75

Pass marks: 38

A final semester viva voce examination will be held at the end of B.E.8th semester examination. The viva voce will be to assess the student on his/her overall knowledge of the subjects related to Mechanical Engineering in addition to the project works he/she had undertaken in 7th and 8th semester.

Branch: Electrical Engineering Year: Fourth

Semester: Eighth

Sl No.	Course No.	Subject	Period			Evaluation S			
	Theory		L	T	P	Sessional Examination			E
						TA	CT	Total	
1.	EE 841	Power System Interconnection & Control	3	1		50	25	75	1
2.	EE 842	Digital Signal Processing	3	1		50	25	75	1
3.	EE 843	Industrial Drives & Control	3	1		50	25	75	1
4.	EE 844	Elective -I	3	1		50	25	75	1
5.	EE 845	Elective-II	3	1		50	25	75	1
6.	EE 846	Project -II		6				100	5
7.	EE 847	Viva-Voce							7
TOTAL			15	11		300	150	475	6

Total Marks: 1100 **Total Periods: 26**

Total Credits: 30

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

Electives: Elective-I: Reliability Engineering/Expert Systems/Digital Image Processing
Elective –II: Utilization & Conservation of Electric Energy/ High Voltage Engineering

EE 841: POWER SYSTEM INTERCONNECTION AND CONTROL (3-1-0)

Full marks: Theory—100
Sessional--75
Time—3 hrs

1. **Economic Operation Of Thermal plants**:

Methods of loading turbo-generators, input-output curves, heat ratio and incremental cost, co-ordination equation, economic loading of units, with and without transmission loss, penalty factor, iterative methods of solving co-ordination equation, economic thermal dispatching with network losses considered, B-matrix loss formula and its derivatives, economic dispatch versus unit commitment(UC), constraints in UC, UC solution method, optimal load flow solution, power system security, introduction to load forecasting.

2**. Hydrothermal co-ordination:**

Advantages of combined operation , base load and peak load consideration , combined operation of run-off river and thermal plants , hydro electric plant models, scheduling problems, short-term hydro-thermal scheduling, long-term aspects of hydro and thermal plants, co-ordination equations in hydro-thermal operations, use of dynamic programming in hydro-thermal scheduling.

3. **Power system Interconnection**:

Introduction, types of interconnections and their advantages, tie-line control in interconnected systems, economics of interconnected systems, estimation, economic dispatch calculation for interconnected systems, transmission losses in interconnected systems.

4. **Automatic generation and voltage control:**

Introduction , reactive power requirements in peak and off-peak hours, real and reactive power control, effect of real power on system frequency , automatic excitation control, reactive power injection and use of tap changing and regulating transformers, use of models in the control of generation (generator, load, prime-movers, governor and tie-line models),generator allocation, automatic generation control(AGC), AGC features.
Load frequency problem, load frequency control(LFC) for single area case , equipments for LFC, LFC and economic dispatch control, two area control, optimal LFC, LFC with generation rate constraints(GRCs), speed governing systems, speed governor dead band and its effect on AGC. Introduction to neural networks, fuzzy logic control.

5. **State estimation in power systems:**
Introduction, maximum likelihood weighted least-square estimation.

6. **Introduction to the IEEE study model of an interconnected power system.**

BOOKS

1. Wood and Wollenburg: Power generation, operation and control—John Wiley and sons.

EE 842/IE 854: DIGITAL SIGNAL PROCESSING

Theory Marks:	**100**	**L – T - P**
Sessional& Lab:	**75**	**4 – 0 - 1**

1. **Introduction**: Definition of signal and system, classification of signals, basic elements of digital signal processing, advantages of digital over analog signal processing, concept of frequency in continuous- time (CT) and discrete- time (DT) signals, elementary DT signals, classification, representation of DT systems, analysis of DT-LTI systems and its properties, DT system described by difference equations, sampling and reconstruction of signals.

2. **Frequency Analysis of DT Signals**: Fourier series and power density spectrum, Fourier transform and energy density spectrum, Fourier transform properties, Frequency-domain characteristics of LTI systems, LTI systems as Frequency-Selective Filters, Invertibility of LTI systems.

3. **Discrete Fourier Transform (DFT)**: DFT and its properties, DFT as a Linear Transformation, circular convolution, relationship of the DFT to other transforms, frequency analysis of signals using DFT.

4. **Fast Fourier Transform (FFT)**: FFT algorithms and its applications, linear filtering approach to computation of the DFT, quantization effects in the computation of the DFT.

5. **Implementation of DT Systems**: Structures for FIR and IIR Systems, State-space system analysis and structures, quantization of filter coefficients, round-off effects in digital filters.

6. **Design of Digital Filters**: General considerations, FIR and IIR filter design, computer aided design techniques.

References:

1. Proakis, J. G. and Manolakis, D. G., **Digital Signal Processing: Principles, Algorithms and Application**s, 3rd Edition, Prentice Hall of India.
2. Oppenheim, A. V. and Schafer, R. W., **Discrete Time Signal Processing**, Prentice Hall of India.
3. Roberts, M. J., Signals and Systems, Tata McGraw Hill.
4. Mastering MATLAB, Pearson Education (for laboratory use).

L T P
(3 1 0)

EE 843: INDUSTRIAL DRIVES AND CONTROL

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

1. **Dynamics of Electric drives:**

Classification of electric drives, types of load, speed-torque characteristics of loads and motors, selection of motors, dynamics of motor- load combination, four-quadrant operation, moment of inertia, steady state and transient stabilities of electric drives.

2. **Characteristics of motors**:

Review of the speed-torque characteristics of the important AC and DC drive motors.

3. **Starting:**

Effect of starting on power supply, motor and load, starting method of automatic alerting circuits, time and current limit acceleration, energy relations and reduction of energy loss during starting, master controllers.

4. **Electric braking**:

Braking methods, speed-torque characteristic under braking conditions, energy relations and reduction of energy loss during braking.

5. **Rating of motors:**

Heating: Heating and cooling of motors, loading condition and classes of duty, power rating and selection of motors for different applications, load inertia and load equalization.

6. **Mechanical Features for Electrical Motors:**

Types of enclosures, bearings, mountings and transmission of drive, reduction of noise.

7. **Thyristorised DC motor Drives:**

Speed equations and performance characteristics of DC motors, single phase and three phase controlled converter drives, dual converter schemes, two/four quadrant chopper drives, regenerating braking with DC series motor fed from a chopper, closed loop control.

8. **Industrial application of electric motors**:

Important processes, requirements of drives and types of motors used in rolling mills, pulp and paper mills, cement mills, sugar mills, and coal mining, machine tool drives.

9. **Thyrisorised AC motor drives:**

Speed equations and performance characteristics of three phase induction motors, induction motor drives using thyristors for static voltage control, slip-power recovery and rotor resistance control, variable frequency operation of three-phase induction motors with constant flux and torque. Inverter/cycloconverter control of induction and synchronous motors, closed- loop control.

Books/References:

1. Pillai, S.K.: Afirst Course in Electric Drives- Wiley Eastern
2. Partab,h.: Art and science of utilization of electric energy-Dhanpat Rai & Sons.
3. Chilkin, M.: Electric drives—Mir publishers, Moscow.
4. Rashid ,M.H.: Electronics-Prentice hall of India.
5. Subramanium,V.: Thyristor control of Electric motors-TMH
6. Vicker, H.: Induction motor-McGraw Hill.

EE 844/IE 854: RELIABILITY ENGINEERING (Elective)

Theory Marks: 100
Sessional Marks: 75

L	T	P
4	0	0

1. **Introduction to Reliability Engineering**: Definition of reliability, reasons for reliability engineering programmes, applications and benefits, reliability and cost, reliability and quality, definition of availability and maintainability.

2. **Reliability Mathematics**: Basic probability theorems, rules for combining probabilities-independent events, mutually exclusive events, complementary events, conditional events, simultaneous occurrence of events; Random variables-discrete and continuous, their properties; Data reduction to frequency histograms and polygons, frequency distribution and probability density function, failure probability density function and its estimate, cumulative frequency and cumulative distribution, data and distribution descriptive values-central tendencies (mean, mode and median), distribution moments, variance and standard deviation, coefficient of variation, skewness, kurtosis, fractiles, percentiles and quantiles, distribution parameters-location, shape and scale parameters; Standard distributions-discrete and continuous, discrete-Binomial and Poisson distributions, continuous-exponential, normal, log-normal, Rayleigh, Weibull, Gamma and extreme-value distribution.

3. **Concepts of Reliability**: Definition of reliability; Failure- causes of failures, modes of failures, life characteristics pattern (Bath-tub curve); Measures of reliability-failure rate, mean time between failure (MTBF), mean time to failure (MTTF), derivation of reliability function and its properties, relationship between density function, distribution function, reliability and failure rate; Hazard rate function-constant hazard model, linear hazard model; Reliability evaluation at component level; Probability plotting.

4. **System Reliability Evaluation**: Reliability block diagram; Systems-series, parallel, series-parallel, parallel-series, k-out-of-m system, standby system; Complex system- decomposition technique, tie set and cut set method, Boolean truth table method; Fault tree and Event tree method; Redundancy technique in system design-component versus unit redundancy, weakest link technique, mixed redundancy, standby redundancy.

5. **Availability Analysis**: Markov process and general concept of modeling; Instantaneous and Steady-state availabilities; State-space diagram; Markov model for-two repairable components, three repairable components, standby redundant system, non-repairable system; Stochastic transitional probability matrix; Steady-state availability calculation of systems.

6. **Maintained Systems**: Maintenance, objectives of maintenance, forms of maintenance, types of maintenance; Preventive maintenance-idealized maintenance, effect of preventive maintenance on reliability; Corrective maintenance; Definition and derivation of Maintainability function.

7. **Economics of Reliability Engineering**: Economic issues, manufacturer's cost, customer's cost, reliability achievement cost models, reliability utility cost models, depreciation-cost models; availability-cost model for parallel systems.

References:

1. Reliability Engineering - E. Balagurusamy, Tata McGraw Hill Publishing Comp. Ltd., 1984.
2. Reliability Engineering – A. K. Govil, Tata McGraw Hill Publishing Comp. Ltd., 1983.
3. Introduction to Reliability Engineering- E. E. Lewis, John Wiley and Sons, 1996.
4. Reliability Engineering Handbook (Vol 1) – Dimitri Kececioglu, Prentice Hall PTR, 1991.
5. Reliability Evaluation of Engineering Systems-concepts and techniques-Roy Billinton and Ronald N. Allan (2nd Edition), Plenum Press, 1992.
6. Probabilistic Reliability- an engineering approach- M. L. Shooman, McGraw Hill Book Company, 1968.

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EE 844/IE 854: Digital Image Processing (Elective)

L	T	P
4	1	0

Max Marks: 100
Sessional: 75
Time: 3 hours

Human Visual System and Image perception; Monochrome and colour vision models; Image acquisition and display; Video I/O devices; Standard video formats; Image digitization; display and storage; 2D signals and systems;

Image Transforms: 2D, DFT, DCT, Harr transform;

Image enhancement: Some simple intensity transformations, Histogram processing; Image subtraction; Image averaging.

Spatial filtering: Background; Smoothing filters; Sharpening filters.

Image Restoration: Degradation Model; Inverse filtering; Least mean square (Wiener) Filter.

Image Compression: Lossy Compression; Lossless Compression.

Image Segmentation: Detection of discontinuities; Edge linking and Boundary Detection; Thresholding;

Representation and Description: Representation schemes; Boundary descriptors; Regional descriptors; Morphology.

Applications of Digital Image Processing

Books:

1) Funndamentals of Digital Image Processing, A.K.Jain, Pearson Education.
2) Digital Image Processing, R.C.Gonzalez & R.E.Woods, Perason Education.
3) Digital Image Processing with MATLAB, R.C.Gonzalez & R.E.Woods, S.L.Eddins, Pearson Education.

EE 844/IE854: Expert Systems (Elective) (4-1-0)

Theory: 100 Marks
Sessional: 75 Marks

Theory of Expert Systems:, Rule Based Systems, Forward & Backward Chaining, Matching, Partial Fuzzy Matching, Rate Algorithm, Handling Uncertainty, Uncertainty Factor, Bayesian Methods, Dempster –Shafer Theory, Fuzzy Logic, Model & Temporal Logic, Truth Maintenance, Default Reasoning, Structural Representation Systems_Frames, Semantic Nets, Object Based, Scripts, Indexing, Retrieval Technique, Learning, Expert System Shells, Expert System Development Cycle, Debugging Knowledge Bases, Expert System Tools.

Books:

1) P. Jakson- Introduction to Expert Systems, Addison Wesley.
2) D.W. Ralston- Principles of Artificial Intelligence& Expert Systems, McGraw Hill.
3) B. Buchanaen & E. Shorteiffe—Rule Based Expert Systems.
4) L. Brownston__Programming Expert Systems in OPSS, Addison Wesley.

EE 844/IE 854: RELIABILITY ENGINEERING (Elective)

Theory Marks: 100
Sessional Marks: 75

L	T	P
4	0	0

8. **Introduction to Reliability Engineering**: Definition of reliability, reasons for reliability engineering programmes, applications and benefits, reliability and cost, reliability and quality, definition of availability and maintainability.

9. **Reliability Mathematics**: Basic probability theorems, rules for combining probabilities-independent events, mutually exclusive events, complementary events, conditional events, simultaneous occurrence of events; Random variables-discrete and continuous, their properties; Data reduction to frequency histograms and polygons, frequency distribution and probability density function, failure probability density function and its estimate, cumulative frequency and cumulative distribution, data and distribution descriptive values-central tendencies (mean, mode and median), distribution moments, variance and standard deviation, coefficient of variation, skewness, kurtosis, fractiles, percentiles and quantiles, distribution parameters-location, shape and scale parameters; Standard distributions-discrete and continuous, discrete-Binomial and Poisson distributions, continuous-exponential, normal, log-normal, Rayleigh, Weibull, Gamma and extreme-value distribution.

10. **Concepts of Reliability**: Definition of reliability; Failure- causes of failures, modes of failures, life characteristics pattern (Bath-tub curve); Measures of reliability-failure rate, mean time between

failure (MTBF), mean time to failure (MTTF), derivation of reliability function and its properties, relationship between density function, distribution function, reliability and failure rate; Hazard rate function-constant hazard model, linear hazard model; Reliability evaluation at component level; Probability plotting.

11. **System Reliability Evaluation**: Reliability block diagram; Systems-series, parallel, series-parallel, parallel-series, k-out-of-m system, standby system; Complex system- decomposition technique, tie set and cut set method, Boolean truth table method; Fault tree and Event tree method; Redundancy technique in system design-component versus unit redundancy, weakest link technique, mixed redundancy, standby redundancy.

12. **Availability Analysis**: Markov process and general concept of modeling; Instantaneous and Steady-state availabilities; State-space diagram; Markov model for-two repairable components, three repairable components, standby redundant system, non-repairable system; Stochastic transitional probability matrix; Steady-state availability calculation of systems.

13. **Maintained Systems**: Maintenance, objectives of maintenance, forms of maintenance, types of maintenance; Preventive maintenance-idealized maintenance, effect of preventive maintenance on reliability; Corrective maintenance; Definition and derivation of Maintainability function.

14. **Economics of Reliability Engineering**: Economic issues, manufacturer's cost, customer's cost, reliability achievement cost models, reliability utility cost models, depreciation-cost models; availability-cost model for parallel systems.

References:

7. Reliability Engineering - E. Balagurusamy, Tata McGraw Hill Publishing Comp. Ltd., 1984.
8. Reliability Engineering – A. K. Govil, Tata McGraw Hill Publishing Comp. Ltd., 1983.
9. Introduction to Reliability Engineering- E. E. Lewis, John Wiley and Sons, 1996.
10. Reliability Engineering Handbook (Vol 1) – Dimitri Kececioglu, Prentice Hall PTR, 1991.
11. Reliability Evaluation of Engineering Systems-concepts and techniques-Roy Billinton and Ronald N. Allan (2nd Edition), Plenum Press, 1992.
12. Probabilistic Reliability- an engineering approach- M. L. Shooman, McGraw Hill Book Company, 1968.

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EE 845: High Voltage Engineering (Elective)

L	T	P
4	1	0

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

1. **Conduction and Breakdown in Gases**:

Desirable properties of gas and insulating medium, Townsond's current growth equations, Townsond's criterion for breakdown, Electronegative gases and their breakdown, Streamer theory, Baschen' s law.

2. **Conduction and Breakdown of liquid Dielectrics**:

Pure and commercial liquids, origin and purification, breakdown of commercial liquids, Transformer oil- composition, properties and deterioration: Inhibitor.

3. **Breakdown of solid Dielectrics**:
Different types of breakdown, measurement of intrinsic strength, partial discharge.

4. **Electrical Properties of High Vacuum**:
High Vacuum as dielectric, breakdown conduction, factors affecting breakdown voltage, breakdown phenomenon.

5. **Lighting Over-voltage**:
Measuring instruments, Magnetic surge crest ammeter, Kyldonograph, Fulchronograph, Oscillograph, Protective devices, surge absorbers, ground and counterpoise wires, lighting arresters, switching over voltages- origin, wave shape and magnitudes, protective devices.

6. **High-voltage Generation**:
Alternating voltage: transformers in cascade, single units, high frequency transformers, direct voltage: Voltage multipliers and cascade circuits using rectifiers, electrostatic machines, voltage stabilization, transient voltage, impulse generator, analysis of the basic circuits, standard impulse wave-shape, multi-stage circuits, wave shape control, triggering, general construction, synchronization with oscilloscope.

7. **High-voltage Measurement**:
Measurement of high direct, alternating (rms and peak) and impulse voltage and currents. Uniform field electrodes, measurement of dielectric constant and loss factor, Schering bridge, Wagner earth discharge and measurement.

8. **High-voltage Testing**:
Low-frequency tests, impulse tests, test circuits, control gear, testing of overhead line insulators, cables and transformer oil.

9. **High-voltage Equipment**:
Bushings: classification, construction and application, Grading, Breakdown of bushings, design and constructional features of high-voltage resistors, High-voltage capacitors, guard rings and shields.

10. **High-voltage Laboratory**:
Planning, testing and other facilities, test equipment, clearance and layout safety measures, grounding, High-voltage connections.

References:

1. Kuffel E. and Abdulla , M., 'High Voltage Engineering', Paragon Press, London.
2. Naidu, M. S., and Karmaju, V., 'High Voltage Engineering', Tata Mc Grow Hill.
3. Chourasia, M. P., 'High Voltage Engineering', Khanna publishers.
4. Alsten, 'High Voltage Engineering'.
5. Jha, R., A. S., 'High Voltage Engineering', Dhanpat Rai & Sons.
6. Rind , D. 'High Voltage Laboratory Technics, PHI.

EE 845: Utilization & Conservation of Electrical Energy (Elective)

(4-1-0)

Max Marks: 100
Sessional: 75
Time: 3 hours

1) **Electric Heating:-**

Advantages, Classification, Resistance Heating, Furnaces, Requirements and Design of heating elements, Temperature control, Electric arc furnaces, Direct & Indirect, Construction & Operation, Electrodes & Power Supply, High Frequency Heating, Induction Heating, Working principle, Power & High frequency Heating, Choice of Frequency, Core type & Coreless Furnaces, Skin Effect & Pinch effect, High Frequency Supply, Advantages & Disadvantages, Dielectric Heating, Working principle, Choice of Voltage and Frequency, Advantages & Applications.

2) Electric Welding:-

Classifications, Resistance Welding:: Spot, Butt, Seam. Arc welding:: types, electrode used, power sources and control circuits. Atomic hydrogen welding. Modern development.

3) Electric traction:-

Advantages. Systems of electric traction. Choice of system voltage and frequency. The Indian scenario. Types of train services. Train movements and energy consumption.speed-time, distance-time and energy consumption curves.Tractive effort, Adhesion, Train resistance. Power supply arrangements. Substation equipment. D.C AND A.C. traction motors, their disposition and operation on tram cars, motor coaches and locomotives. Control systems; Rheostatic, field control and series-parallel using shunt and bridge transition methods. Multiple unit control. Metadyne control. Controllers for dc & ac traction motors. Tram Cars, Motor coaches, & Trolly Buses. Auxiliary Electrical Equipments for Tram cars, Motor Coaches & Locomotives. Braking:: mechanical, vacuum & electrical.

1) Energy Storage:-

Size & Duration of storage. Modes of energy storage::mechanical,
electrical, magnetic, thermal & chemical. Comparison of the different systems.

2) Electrical Losses & Energy Conversion:-

Electrical transmission, distribution & utilization losses. Classification. Reduction of losses. Benefits of electrical energy conservation. Energy conservation in lighting, electric furnaces, electric drive, traction systems. Use of energy –efficient equipment.

6) Electrical Energy Audit:-

Introduction, benefits, procedure for energy audit. Instruments for energy audit. Methodology. Case study.

Books:-

1) Tripathy, S.C ; Electrical Energy Utilization & Conservation, TMG
2) Suryanarayan, N.V. ; Utilization of Electric power ; Wiley Eastern Ltd.
3) Pratab, H.; Utilization of Electrical Energy; Dhanpat Rai & Sons.

EE 846: Project-II (0-6-0)
Max Marks: 150

This subject has two components. The first is sessional, under which 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 project. 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.

The second component of the subject is the End Semester Examination for which a seminar and viva-voce

CH 881: TRANSPORT PHENOMENA
Introduction:
examination will be held at the end of the semester after the satisfactory completion of the project work. .

EE 847: Viva-Voce

The viva-voce examination will be held at the end of the semester. Those students who have successfully completed their project works can only appear in this examination. The viva voce examination will cover the entire syllabus of Electrical engineering of B.E. course.

Branch: Chemical **Year**: Fourth **Semester**: Eighth

Sl. No.	Course No.	Subject	Periods			Evaluation Scheme					
Theory			L	T	P	Sessional Exam			ESE	Subject Total	Credit
						TA	CT	Total			
1	CH 881	Transport Phenomena	3	1		50	25	75	100	175	4
2	CH 882	Chemical Proc Design & Drawing	3	1		50	25	75	100	175	4
3	CH 883	Math Modeling and Simulation	3	1		50	25	75	100	175	4
4	CH 884	Elective-III*	3	1		50	25	75	100	175	4
5	CH 885	Elective-IV**	3	1		50	25	75	100	175	4
Practicals/Project											
7	CH 886	Project-II			12					150+	8
8	CH 887	Viva Voce								75	2
Total			15	5	12						

Total Marks: 1100 **Total Periods: 32** **Total Credits: 30**

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

***Elective-III: CH 884 (a) Petroleum Production technology**
(b) Advanced Separation Techniques
© Computational Fluid Dynamics

****Elective-IV: CH 885 (a) Energy Auditing**
(b) Environmental Impact assessment
© Safety in Chemical Industries

+ Project-II:
Teachers assessment: 60; Report : 40; mid-sem presentation: 25; end-sem presentation:25

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

- Transport phenomena and Unit Operation

- Equilibrium and rate processes.
- Role of intermolecular forces.
- Heat, mass and momentum transport by molecular mechanism.
- The Analogy – Case of Heat Transfer, Case of Mass Transfer, Case of Momentum Transfer, the analogous forms.
- Heat Transfer.
- Mass Transfer – Equimolar Counter Diffusion, Partial Pressure.
- Momentum transfer.
- The balance or conservation concept- input-output balance, generation, accumulation, the

Molecular Transport Mechanisms and General Property Balance:

balance equation in differential form.

- The one directional balance equation including molecular and convective transport.
- The three dimensional balance equation.
- The continuity equation.
- The general property balance equation for an incompressible fluid.
- Steady transport in one dimension involving input-output with no generation (constant area and variable area transport).
- Steady transport with generation (Heat and mass transport with constant generation, momentum transfer with generation at steady state – laminar flow in a tube, Hagen-Poisseuille Equation, laminar flow between parallel plates).
- Convective flux caused by forced convection.
- Relation between shear stress and shear rate.
- Navier-Stoke's Equation.
- Fick's Law.

Books :

1. Brodkey, R.S. & Hershey, H.C., Transport Phenomena – An Unified Approach, McGraw-Hill.
2. Bird, Stewert & Lightfoot, Transport Phenomena, John Wiley.

CH 882: CHEMICAL PROCESS DESIGN AND DRAWING

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

1. DESIGN OF MASS TRANSFER EQUIPMENTS: Design and Drawing of mass transfer equipments such as distillation columns, absorption columns, extraction columns, evaporator, dryers and cooling towers.

2. TARGETTING: Heat exchanger networks, targeting, energy targeting, area targeting, unit targeting, shell targeting, cost targeting, super targeting. Problem representation, temperature enthalpy diagram, simple match matrix Heat content diagram.

3. Economic Design Criteria: The evolution of design criteria, accounting for risk, the effects of limited capital, a summary of industrial design criteria, estimating the economic life of a process.

4. Engineering in the presence of uncertainty: Anticipating the future, sizing new chemical plants in a dynamic economy, parametric sensitivity.

5. Failure Tolerance: Reliability under extreme conditions, safety through proper layout, the theory of reliability.

6. ENERGY RESOURCE ANALYSIS FOR VARIOUS PROCESSES: Batch processes, flexible processes, distillation processes, evaporation processes, reaction processes, process using mass separating agents.

TEXTBOOKS:

1. R .H. Perry, "Chemical Engineers' Hand Book", 6" Edn., McGraw Hill Company, 1984

2. D F Rudd and Charles C Watson, " Strategy Of Process engineering", Wiley International Edition

2. J. M. Coulson and J. F. Richardson, "Chemical Engineering", Vol. 6, Pergamon Press, 1993.

3. Uday V. Shenoy Gulb "Heat Exchanger Network Synthesis", by Publishing Co. USA, 1995.

4. Linnhoff, D. W. Townsens, D. Boland and G.F. Hewitt, "User Guide on Process Integration for the efficient use of Energy", Institution of Chemice Engineers, U.K., 1994.

5. R. Smith, "Chemical Process Design", McGraw Hill Book Co., New York 1997

REFERENCES:

1. L.E. Brownell and E.H. Young, "Process Equipment Design Vessel Design' Wiley Eastern Edn. New York, 1968.

2. M. V. Joshi, "Process Equipment Design and Drawing", Mac Millan Press, New Delhi, 1996.

CH 883 Mathematical Modeling and Simulation

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

1. Introduction: Process synthesis, Process analysis, Optimization, Process plant Simulation.

2. Modeling Aspects: deterministic vs. stochastic Processes, Physical Modeling, mathematical Modeling, Chemical Systems modeling, cybernetics, Controlled System, Principles of similarity.

3. Classification of Mathematical Modeling: Independent and dependent Variables and Parameters, Classification based on variation of Independent Variables, Classification based on the State of the Process, Classification based on the type of the Process, Boundary conditions, The Black Box principle, Artificial Neural Networks.

4. Chemical system modeling: Models in mass transfer Operations, Models in heat Transfer Operations, Models in Fluid-Flow operations, and Models in Reaction Engineering.

5. Treatment of Experimental Results: error Propagation and data regression.

6. Optimization: Optimization techniques.

7. Simulation: Modular Approaches and Equation Solving Approach, Decomposition of Networks, convergence Promotion and Physical and thermodynamic Properties, specific Purpose simulation and Dynamic simulation, Simulation Packages

Text Book:

1. B V Babu, Process Plant Simulation, Oxford University Press
2. Hussain A, Chemical Process simulation, Wiley Eastern

Reference Books:

1. Rudd D F and Watson C C, Strategy of Process engineering, Wiley International
2. Stephanopoulos G, Chemical Process Control, Prentice Hall India
3. Singh S K , " Computer aided Process Control, Prentice Hall India

CH 884 (b) Advanced Separation techniques (elective-III)

L – T – P
3 – 1 – 0

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

1. Introduction, Separation Factor.
2. Inherent separation factor, infinite separation factor, reverse osmosis,
3. Rate governed separation factor, membrane characterization, motion of molecules through membranes, classification and characterization of membrane processes
4. Reverse Osmosis: Chemical Potential and Osmotic pressure, solvent and solute transport through membrane, solution diffusion model, physical and separation characteristics of RO membranes, mechanism of salt rejection by membranes, concentration polarization, membrane separator unit design, applications
5. Ultra filtration: types of transport, Separation factor, membranes used, fouling and concentration polarization, evaluation of mass transfer coefficients, determination of real rejection, osmotic pressure model, separation schemes using UF, Dia-filtration, Process design, Application.
6. Dialysis: Solute transport in dialysers, analysis of dialyser operations. Mode of dialysis, enhancement of separation by secondary chemical reaction, hemodialysis(blood purification), dialysis equipment, applications
7. Electro dialysis: Types of electro dialysis, ion transport fundamentals, concept of limiting current density, concentration polarization in ED cells, resistances and voltages in ED cells, power requirements, ED membranes and cells, problems of ED operation, plant design and process cost.
8. Liquid membrane Separation process: nature and types of available liquid membranes, separation factor, liquid membranes on solid membranes, applications.
9. Gas separations using polymeric membranes: membrane gas separation, industrial applications.

Book:

1. Synthetic membranes, Bugay, Lonsdale, De Pinho
2. membrane Separation Processes, P Meares
3. Progress in Separation and Purification (3 Volumes) E s Perry and C J Van Ness
4. Membrane technology and industrial techniques, P R Keller
5. Industrial Processes with membranes, Lacey and Loeb.
6. Reverse Osmosis: S Sourirajan
7. Ultra filtration hand book, M Cheryan
8. Desalination by reverse Osmosis, Morten

CH 885 (c) SAFETY IN CHEMICAL INDUSTRIES (Elective-IV)

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

1. INTRODUCTION: Industrial safely principles. Site selection and plant layout. Legal Aspects. Design for ventilation. Emergency response systems for hazardous goods basic rules and requirements which governs the chemical industries.

2. HAZARDS: Chemical hazards classification. Hazards due to fire, explosion and radiation. Reduction of process hazards by plant condition monitoring. Materials Safety Data sheets and National Fire protection agency's classifications.

3. DISEASES: Dangerous occupational diseases, poisoning, dust effect. The biomedical and engineering response to health hazards.

4. CONTROL OF HAZARDS: Engineering control of plants instrumentation. Color codes for pipe lines. Safety aspects of reactive chemicals.

5. OPERATION AND PROCESS HAZARDS: Safety in operations and processes. Runaway reactions, unstable products.

TEXTBOOKS:

1. H. H. Fawcett and W. S. Wood, "Safety and Accident Prevention in Chemical Operation", 2nd Edn., Interscience, 1982.

2. "Loss Prevention and Safety Promotion in Chemical Process Industries", Vol.III Published by Institution of Chemical Engineers U.K., 1983.

REFERENCES:

1. T.Yoshida,"Safety of Reactive Chemicals",Vol.l,Elsevier,1987.

2. H. Willium, "Industrial Safely Handbook", 2"d Edn.,McGraw Hill, 1968.

3. R. V. Betrabet and T .P. S. Rajan, "Safety in Chemical Industry in Chemical Tech. I", Chemical Engg. Education Dev. Centre, IIT, Madras.

CH 885 (b) Environmental Impact Assessment (Elective-IV)

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

1. Environmental Impact Assessment: An Overview

Introduction to EIA; Basic methodology: Screening, scoping Baseline data, Stake holder's involvement, Prediction of effects, Mitigation, EIA in decision making , Documentation, Project Implementation

2. Environmental Laws:

Introduction, Constitutional Provisions, Union list, sate list, concurrent list, Environmental Protection Acts, Functions of central and state boards, penalties, water act.

3. Screening and Scoping: Aims and objectives, Checklists and matrix, choosing tools.

4. Environmental Indices and Indicators for Describing the Affected Environment: Background Information, Environmental-Media Index- Air Quality ,Environmental-Media Index- Water Quality, Environmental-Media Index- Noise, Environmental-Media Index- Ecological Sensitivity and Diversity, Environmental-Media Index- Archaeological Resources, Environmental-Media Index- Visual Quality, Environmental-Media Index- Quality of life, Development of indices

5. Prediction and Assessment of Impacts on the Air, Surface water, Soil, Ground Water, Noise Environment, Biological Environment, Cultural Environment and socio-economic environment: Key regulations, Addressing Environment impacts: identification of the types, qualities/quantities of pollutants and effects, Base line data, Relevant quality standards and regulations, Impact Prediction, Assessment of impact significance, identification and incorporation of mitigation measures

6. Public Participation in EIA
7. Rapid Environmental Impact assessment:
8. Environmental Risk assessment,
9. Preparation of written document
10. Environmental Monitoring
11. Some case studies and project work

Text Book:

3. Environmental Impact Assessment, Larry W Canter, McGraw-Hill
4. Renewable Energy Resources and Their Environmental Impact, S A Abbasi and Naseema Abbasi, Prentice Hall India

CH 884 (a) PETROLEUM PRODUCTION TECHNOLOGY

(Elective –III)

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

L – T – P
3 – 1 – 0

Introduction.

Geologic consideration in Production Operations: Habitat for oil & gas, Traps of oil & gas, Structural geology, folds, faults, Sedimentary petrology, Sand stone Reservoir, Carbonate Reservoir, Migration.

Reservoir consideration: Hydrocarbon properties of oil & gas, Characteristics of reservoir rocks, porosity, permeability, wettability etc, Fluid flow in the reservoir, Reservoir drive Mechanism, reservoir Homogeneity.

Drilling technology: Methods of Drilling, Rotary Drilling rig, Rotary rig circulation system, Basic operation in drilling, the drill stem, Introduction of offshore, types of offshore rigs, casing, tubing & line pipes, Cementing, Introduction, Packers.

Analysis of Derrick structure – Major design factors: Self weight of the structure, operation of line load, Wind loads.

Problem well analysis: Low reservoir pressure, Low reservoir permeability, plugging, high viscosity oil, Removal of wax deposits etc.

Formation damage: Significance, Damage mechanism, Determination of permeability reduction.

Well production testing: Periodic production test, Productivity or Deliverability test, Transient pressure test.

Fundamental of stimulation/Activation techniques: Acidization, Fracturing, Sand control, Gravel packing, Nitrogen application etc.

Work over rigs and work over jobs: Main composition of WOR, Routine maintenance, Major overhauls.

Oil separation, storage and gathering system

Corrosion Control.

Reference: Production operation Vol I and Vol II –by Thomas O. Allen P. Roberts.

CH 885 (a) ALTERNATIVE ENERGY RESOURCES (ELECTIVE – IV)

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

Energy Crisis – Present position in India and World. Remedial measures.

Energy Resources – Survey, classification and scope of utilization, Alternative uses of conventional sources of energy, Gasification of coal, Synthetic liquid fuels.

Hydroelectricity – its production and future prospects in India.

Nuclear Energy – Nuclear reaction, materials and reactors, Reprocessing of spent nuclear fuels.

Solar Energy and its effective utilization for room and water heating and other industrial processes, Solar Heat Pump, Silicon cells, storage of solar energy.

Energy from Biomass – Animal and vegetable wastes, Utilization of Municipal Solid Waste as a renewable source of energy.

Geothermal, Wind and Tidal Energy – Energy from geothermal, tidal and ocean thermal sources, Energy from high velocity winds and high pressure gases.

Developments in energy routes, Fuel cells, MHD systems.

Energy carriers.

Conservation of energy.

BOOKS :

1. Renewable Energy Resources and their Environmental Impact,
S A abbasi and Naseema abbasi, Prentice Hall India
2. Chem. Tech.-I, Chemical Engineering Education development Centre, IIT, Madras.
3. Kashkari, C., Energy Resource, Demand and Conservation in India, Tata McGraw-Hill.
4. Tyner, Energy Resources and Economic Development in India, Allied Publishers.
5. Culp, Jr., Principles of Energy Conservation, McGraw-Hill.

6. Sarkar, S., Fuels and Combustion, Orient Longman.
7. Fuel Combustion Energy Technology, S N Saha, Dhanpat Rai Publishing Company

CH 885 (b) Environmental Impact Assessment
(Elective-IV)

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

1. Environmental Impact Assessment: An Overview

Introduction to EIA; Basic methodology: Screening, scoping Baseline data, Stake holder's involvement, Prediction of effects, Mitigation, EIA in decision making , Documentation, Project Implementation

2. Environmental Laws:

Introduction, Constitutional Provisions, Union list, sate list, concurrent list, Environmental Protection Acts, Functions of central and state boards, penalties, water act.

3. Screening and Scoping: Aims and objectives, Checklists and matrix, choosing tools.

4. Environmental Indices and Indicators for Describing the Affected Environment: Background Information, Environmental-Media Index- Air Quality ,Environmental-Media Index- Water Quality, Environmental-Media Index- Noise, Environmental-Media Index- Ecological Sensitivity and Diversity, Environmental-Media Index- Archaeological Resources, Environmental-Media Index- Visual Quality, Environmental-Media Index- Quality of life, Development of indices

5. Prediction and Assessment of Impacts on the Air, Surface water, Soil, Ground Water, Noise Environment, Biological Environment, Cultural Environment and socio-economic environment: Key regulations, Addressing Environment impacts: identification of the types, qualities/quantities of pollutants and effects, Base line data, Relevant quality standards and regulations, Impact Prediction, Assessment of impact significance, identification and incorporation of mitigation measures

6. Public Participation in EIA
7. Rapid Environmental Impact assessment:
8. Environmental Risk assessment,
9. Preparation of written document
10. Environmental Monitoring
11. Some case studies and project work

Text Book:

5. Environmental Impact Assessment, Larry W Canter, McGraw-Hill
6. Renewable Energy Resources and Their Environmental Impact, S A Abbasi and Naseema Abbasi, Prentice Hall India

CH 886 PROJECT – II

Sessional: 150 ; Pass mark: 75

In this course each student is required to submit a Project Report on the designing of a Chemical Plant. The Report will consist of important chapters such as the following :

- Introduction
- Literature Survey
- Selection of the Process and Process Details with justification of selection.
- Thermodynamic and kinetic Considerations
- Material Balances with Flow Sheet
- Physico-Chemical data and Properties
- Energy Balane with Flow Sheets
- Process Design of Equipments and Optimum Conditions of Operation (Design of a minimum of two process equipments must be undertaken)
- Fabrication drawing of one of the major equipments
- Instrumentation & Process Control, Plant Layout, Safety, Precaution, etc.
- Cost Estimation
- Site Selection and Conclusion.

CH 887: VIVA VOCE
75 Marks, Pass Mark: 38

A final semester viva voce examination will be held at the end of 8th semester. The viva voce will be to assess the student on his/her overall knowledge of the subjects related to Chemical Engineering in addition to the project works he/she had undertaken in 7th and 8th semester.

8th Semester

Theory : 5 X 100 = 500
Sessional : 5 X 75 = 375
Viva : 75
Project : 150
Total :1100

Branch: ETE **Year**: Fourth year

Sl.	Course	Subject	Periods	Evaluation Scheme

No.	No.		L	T	P	Sessional Marks			ESE	Total Marks	Credit
						TA	CT	Total			
1	ET 861	Digital System Design	3	1		50	25	75	100	175	4
2	ET 862	Antenna and Wave Propagation	3	1		50	25	75	100	175	4
3	ET 863	VLSI technology	3	1		50	25	75	100	175	4
4	ET 864	Elective-III	3	1		50	25	75	100	175	4
5	ET 865	Elective-IV (open)	3	1		50	25	75	100	175	4
6	ET 866	Viva								75	2
7	ET 868	Project II			12					150 **	8
Total			15	5	12						

Total Marks: 1100 **Total Periods: 20** **Total Credits: 20**

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

Electives:

Elective III: Digital Image Processing/Wireless Communications and Networking/Reliability Engg/ Statistical Signal Processing

Elective IV: Optical Communication/Biomedical Engineering/Satellite Communication/Advanced Processor Architecture

** TA: 60 Marks Report: 40 Marks Presentation: 50 (Midsem: 25 Endsem: 25)

ET 861 Digital System Design
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Synthesis of clock mode (synchronous) sequential circuits

Analysis of sequential circuits. Design procedure With synthesis of state diagrams Mealy and Moore machines. Partitioning and state assignment. Finite state machine model.

Synthesis of asynchronous sequential system design

Pulse mode circuits and fundamental mode circuits with synthesis.

Design Convention

Register transfer, biasing and sequencing of control. Electronic realization of hardwired control unit. Conditional transfer.

Introduction to HDL

Operand convention of AHPL, APL and AHPL operators. AHPL conventions for combinational logic and memory arrays.

RIC

Basic organization, register transfer and AHPL control programmes. Multiple cycle instructions.

Microprogramming

Introduction to microprogramming. Microprogramming the RIC. Microprogramming of bus oriented machines in assembly language for microprogrammes.

High speed addition, Multiplication, division and floating point arithmetic

Text Books/references:

1. J. Frederic and G. R. Peterson - Digital Systems: Hardware Organization and Design, John Wiley and Sons, 3/e.

2. F. J. Hill and G. R. Peterson - Switching Theory and Logical Design. John Wiley and Sons, 3/e.

ET 862 Antenna and Wave Propagation
Theory:100 marks
Sessional: 75 marks
Time: 3 hours

Electromagnetic Fields

Review of EM theory, Maxwell's Equations, wave equations, solutions, plane waves, poynting vector, power flow and potentials.

Elementary Radiations

Hertzian and half wave dipoles and loops, radiation patterns, radiation resistance, gain, beam width, directivity, efficiency, effective length, effect or ground resonant and non resonant antennas., Flolded dipoles.

Arrays

Broadside and endfire arrays. Array analysis, elements of arrays. Synthesis, beam width, Yagi-Uda antenna. rhornbic antenna, log-periodic and helical antennas.

Microwave Antennas

Parabolic reflectors, horns , lens and slot antennas. Their characteristics and typical applications. Beam-width, polarization and bandwidth.

Matching Network

Antenna coupling and matching networks. Baluns.

Wave Propagation

Propagation modes for different frequencies. Descriptions and salient features of ground waves, sky wave and space propagation. Tropospheric propagation, ionospheric propagation. Computation of field strength. MUF, virtual height, critical frequency, skip distance. Microwave propagation. Fading Diversity reception.

Text Books/ References:

1. F. C. Jordan & K. G. Balmain - Electromagnetic Waves and Radiating Systems - PHI, 1995 4/e.
2. CA Balanis - Antenna Theory: Analysis and Design - J. Wiley & Sons 1982. 3. J. D. Krans - Antennas - Mc Graw Hill 1988. 2/e.
4. P. Krans - Electromagnetics - McGraw Hill 1991, 4/e.
5. R. E. Collin - Antenna & Radio wave Propagation - McGraw Hill.

ET 863 VLSI Technology
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

The MOS field effect transistor. Basic Structure and operation of a MOSFET. Behavior of the gate to bulk capacitor. Threshold voltage and the derivation of the $I_p - V_{ps}$ equation. Parasitic elements and the layout of a MOSFET. PMOS and NMOS depletion and types. Review of fabrication processes. Aluminum gate and polysilicon gate devices. MOSFFT based digital circuits - the inverter with active pull-up, NAND and NOR gates, I/O characteristics and power delay product. Static and dynamic memory cells. Pass transistor circuits. The CMOS structure -fabrication processes, NAND and NOR gates, transfer characteristics and power delay product. Modeling and simulation of MOSFET circuits on SPICE.

Stick diagram. Layout of simple digital circuit blocks. λ – based rules and colour schemes of various layers. Project work that involves the design of a digital system and its layout. CAD tools for simulation and for the design and layout of VLSI circuits. ASICs, FPGAs and CPLDs - their use and programming with CAD tools.

Text Books / references :

1. Douglas A Pucknell and Kamran Esharaghian, Prentice Hall of India.

2. R. Jacob Baker, Henry W. Li and David E. Boyce - CMOS - Circuit Design, Layout and Simulation, Prentice Hall of India.

3. Richard S. Muller and Theodore I. Kamins - Device Electronics for Integrated Circuits, John Wiley and Sons Inc..

ET 864 Statistical Signal Processing
Theory: 100 marks
Sessional: 75 marks

Time: 3 hours

Review of Random Variables and Random Process
Independent, uncorrelated and orthogonal random variables, Stationary process, Autocorrelation and autocovariance matrices, Ergodicity, Spectral representation of random signals.

Signal Modeling
AR, MA and ARMA models.

Parameter Estimation Theory
Principle of estimation and properties of estimates, The methods of maximum likelihood, moments, least-square errors and maximum entropy; Autoregressive parameter estimation: Levinson-Durbin algorithm and lattice filter; LMMSE filtering: Wiener and Kalman filtering; Spectral estimation: smoothed and windowed periodograms, minimum variance, maximum entropy and parametric methods for spectral estimation; Adaptive filters: LMS and RLS filtering.

Text books/references:

1. M. Hays: Statistical Digital Signal Processing and Modelling, John Willey & Sons, 1996.

2. Simon Haykin: Adaptive Filter Theory, Prentice Hall International, 1996.

3. S.M.Kay: Modern Spectral Estimation, Prentice Hall, 1987.

4. B.Porat: Digital Processing of Random Signals, Prentice Hall, 1994.

5. J.R.Treichler, C.R.Johnson (Jr.), M.G.Larimore: Theory and Design of Adaptive Filters, PHI, 2001.

ET 864 Digital Image Processing
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction
Scope and application of digital image processing. Image acquisition and display. Mathematical preliminaries. Human visual perception.

Image Transforms

2D-Fourier Transforms. 2D DFT. KLT, 2D DCT, Haar transform.

Image Enhancement

Histogram processing. Spatial Filtering. Frequency Domain Filtering.

Image Restoration

Degradation Model. Inverse Filtering. Wiener Filtering.

Edge Detection and Segmentation

Edge detection. Line detection. Segmentation. Texture Analysis and Classification.

Image Compression

Lossy Compression. Loss-less compression. Run-length and Huffman Coding. Transform Coding. Image Compression Standards

Color Image Processing

Color model. Color Image Processing.

Text Books/references :

1. R. C. Gonzalez & R. E. Woods - Digital Image Processing, Addison Wesley, 1993.

2. A. K. Jain - Fundamentals of Digital Image Processing, PHI

3. K. R. Castleman - Digital Image Processing, PHI 1996

4. W. K. Pratt - Digital Image Processing, John Wiley Interscience, 1991

ET 864 Wireless Communications and Networking
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction
Overview of wireless communication systems and networking. Examples of wireless communications systems: how a cellular telephone call is made? Challenges in wireless communication networking. Evolution of modern wireless communication systems: 1G, 2G, 3G and beyond.

Fundamentals of cellular communications
Frequency reuse and the cellular concept. Interference and system capacity. Trunking and grade of services. Other mechanisms for capacity improvement.

Mobile radio propagation
Characterization of wireless channels. Multipath propagation environment
Linear time-varying channel model. Large-scale path loss. Small-scale fading and multipath.

Modulation/transmission techniques for mobile radio
Digital modulation vs. analog modulation: an overview. Digital modulation techniques. Probability of transmission error.

Receiver design
Equalization and diversity. Equalizers in a communication receiver. Diversity techniques. Channel equalization: linear equalization and nonlinear equalization.

Multiple access techniques for wireless communications
Multiple access in a radio cell. FDMA: 1G AMPS. TDMA: IS-136 and GSM. CDMA: spread spectrum and 3G air interface design. OFDM and 4G mobile communications.

Mobile management in wireless networks
Call admission control. Handoff management. Location management. Wireless and wireline interworking. Internet protocol: IPv6 versus IPv4. IP enhancement for mobile. Transmission control protocol (TCP). Wireless application protocol (WAP) and its security issues. Mobile ad hoc networks.

Text Books/ References:
1. T. S. Rappaport, Wireless Communications, 2nd Edition, Prentice Hall, 2002.

2. J. Mark and W. Zhang, Wireless Communications and Networking, Prentice Hall, 2003.

3. R. Steele and L. Hanzo, Mobile Radio Communications, 2nd Edition, John Wiley and Sons, 2001.

4. T. Ojanpera and R. Prasad, WCDMA: Towards IP Mobility and Mobile Internet, Artech House Publishers, 2001.
5. S. Hara and R. Prasad, Multicarrier Techniques for 4G Mobile Communications, Artech House Publishers, 2003.

ET 864 Reliability Engineering
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Fundamentals of reliability engineering

Definition of reliability, types of failures, failure mechanism and failure modes. Component co-units, bathtub curves, measures of reliability, failure rates, MTBF (Mean Time Between Failures), MTTF (Mean Time To Failure), reliability functions and hazard rate.

Reliability mathematics

Basic probability theorems, conditional probability, Baye's theorem, basic statistical parameters such as mean, mode, median, variance, standard deviation, high order moments, types of probability distribution and their mean and variance. Binomial, Poisson, normal, log normal, exponential, Raleigh, Weibull and Gamma distributions.

Reliability modeling and assessment

Reliability Logic Diagram (RLD), types of systems - repairable and non-repairable. System configuration – series, parallel, m out of n, standby systems, redundancy. Types and influence on reliability of subsystems. System reliability and evaluation methods - inspection methods, event space method, path tracing method, decomposition method and cut-set and tie-set method. Upper and lower bounds on system reliability.

Reliability data analysis

Data acquisition, documentation and storage problem. Derivation of various reliability parameters from data. Analysis of constant hazard, data and estimation of reliability parameters.

Basic reliability design consideration

Simple creative designs. Reliability consideration, reliability optimization with reference to some given constraints. Reliability and redundancy apportionment procedures.

Fault tree analysis

Fault tree construction, direct evaluation of fault trees, fault tree evaluation by cut-sets.

Maintenance models

Definition of maintainability and availability, preventive maintenance and assessment of influence on reliability/availability of a system.

Text Books/references:

1. M. L. Shooman - Probabilistic Reliability: An Engineering Approach, McGraw-Hill, 1968.
2. E. E. Lewis - Introduction to Reliability Engineering, John Wiley and Sons.
3. K. C. Kapur and L. R. Lamberson - Reliability Engineering Design, PHI, 1985.
4. W G. Ireson - Reliability Handbook, McGraw-Hill, 1966.

5. A. K. Govil - Reliability Engineering, TMH, 1994.

ET 865 Optical Communication
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction

Advantages of communication. Elements of optical communication link.

Optical Fibers

Ray theory, fiber cables, step index and graded index fibers. Numerical apertures attenuation dispersion, modal noise and polarization. Fiber modes, single-mode fibers, ultimode fibers. Fiber splices and joint losses. Connectors. Dispersion, mode coupling, and loss mechanics. Glass materials, fiber fabrication, and characterization techniques.

Optical Sources

Basic concepts, optical emission from semiconductor injection lasers. Multimode and single mode, injection lasers. Laser characteristics. LEDs' structures and characteristics. Modulation response, modulation of lasers and LEDs. Source-fiber coupling.

Detectors and Receivers

Photodetectors, receivers. Receiver noise and sensitivity. Photo detector noise and thermal noise. Receiver structures, preamplifiers and receiver performance calculations.

Optical Communication Systems

System design: link power budget, rise time budget and range System design. Line coding LED and laser drive circuits. AGC and equalization. Subcarrier modulation and coherent systems. Single-Wavelength Fiber-Optic Networks (FDDI, SONET) Wavelength-Division Multiplexing (WDM)

Text Books / references:

1. J. Senior - Optical Fiber Communications, Prentice Hall International.

2. G. Keiser - Optical Fiber Communication, McGraw-Hill.

3. J. Gowar -- Optical Communication Systems, PHI.

ET 865 Biomedical Engineering
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction

Development of biomedical instrumentation. Biometrics. Physiological systems of the body. Problems encountered in measuring a living system. Physiological effects of electical Current. Shock hazard from electrical equipment. Methods of accident prevention.

Bioelectric potential

Resting membrane potential of nerves. Nerve action potential. Propagation of action potential. Neuromuscular transmission. Contraction and excitation of smooth muscles.

Cardiovascular instruments

The heart and cardiovascular system. Measurement of blood pressure and flow. Cardiac output. Plethysmography, heart sounds, pacemakers, defibrillators.

Electrocardiogram (ECG)

Temporal and special characteristics of normal ECG Electrocardiography leads. Vectorial analysis of normal ECG. Electrocardiography interpretation of cardiac abnormalities. Digital signal processing methods (LPC, digital filters etc.) for detection of diagnostic parameters of ECG signals.

Patient Monitoring System

Elements of intensive care monitoring. Diagnosis, calibration and reparability of patient monitoring equipment. Instrumentation for the mechanics of breathing. Respiratory therapy equipment. Temperature measurements. Ultrasonic measurements and diagnosis.

The nervous system

Anatomy of the nervous system and neuronal communication. Somatic nervous system and spinal reflexes. Automatic nervous system Characterization of electroencephalographic (EEG) signal. Psychophysilogical measurements. Instruments for testing motor responses. Instruments for sensory measurements.

Biotelemetry

Physiological parameters adaptable to Biotelemetry. Components of a biotelemetry system. Implantable units. Application of telemetry in patient care.

X-ray and radioisotope instrumentation

Generation of ionizing radiation. Instrumentation of diagnostic X rays. Instrumentation for the medical use of radioisotopes. Radiation therapy.

Medical imaging

Principles of CAT scan. MRI and Ultrasound imaging. Sampling, interpolation and reconstruction. Image enhancement and restoration. Image quantization.

Text Books/references :

1 L. Cromwell, F. J. Weibell and E. A. Pfeiffer- Biomedical Instrumentation and Measurements, PHI, 1996, 2/e.

2. A. C. Guyton - Textbook of Medical Physiology, Prism Books Pvt Ltd., Bangalore.

3. J. G. Webster - Medical Instrumentation: Application and Design, John Wiley and Sons.

4. L. A. Geddes and L. E. Baker - Principles of Applied Biomedical Instrurnentation, John Wiley and Sons.

5. Z. H. Cho, J. P. Jones and Manbir Singh - Foundations of Medical Imaging, John Wiley and Sons.

ET 865 Satellite Communications
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction
History of satellite communications. Overview of the course. This course consists of three parts. The first part addresses the satellite systems covering the topics of orbits and constellations, satellite space segment, and propagation and satellite links. The second part reviews satellite communications techniques including modulation, coding, multiple access and on-board processing. The third part presents various satellite communications systems and applications with emphasis on recent development in LEO satellite systems for personal communications.

Satellite Systems
Orbits and constellations: GEO, MEO and LEO. Satellite space segment. Propagation and satellite links; Free-space loss. Attenuation, polarization, fading and scintillation. Link budget analysis.

Satellite Communications Techniques
Modulation and coding techniques. Digital modulation schemes: FEC and ARQ. Multiple Access: FDMA, TDMA and CDMA. Aloha and Demand assignment. On-board processing techniques.

Satellite Communications Systems and Applications
INTELSAT systems. VSAT networks. GPS. GEO, MEO and LEO mobile communications: INMARSAT systems, Iridium, Globalstar and Odyssey

Broadband and Multimedia Systems
Spaceway and Teledesic.

Text Books / references :

1. M. Richharia - Satellite Communication Systems, Second edition, 1999.

2. Pratt, Bostian, and Allnutt - Satellite Communication Systems, 2nd Edition, John Wiley & Sons, 2003

3. D. Roddy - Satellite Communications, McGraw-Hill Professional, 2001.
4. M. Richharia - Satellite Communication Systems, McGraw Hill, 1999.

5. G. Maral & M. Bousquet - Satellite Communication Systems, John Wiley and Sons, Inc., 1999.

ET 865 Advanced Processor Architechture
Theory: 100 marks
Sessional: 75 marks
Time 3 hours

Cost / Performance

Issues in high performance processor design. Performance matrices, architectural abstractions, the instruction-set architecture.

Instruction set

Principles and design, case studies.

The Arithmetic Unit

Arithmetic instructions and various methods of implementation.

The Data path and Control Unit

Data path requirements for different instruction classes. Fixed-Cycle Vs Variable Cycle instruction implementation. Approach to Control Unit design. FSM control and micro programmed control. Exceptions and exception handling.

Performance Enhancement Techniques

Pipelining and memory, hierarchy. Data path pipelining. Instruction level pipelining. Performance issues in pipelining. Software pipelining. Space-time locality and cache memory. Virtual memory, paging and TLB.

I/0 Interface

I/O performance measures. Interfacing I/O to the memory, processor and OS.

Case Studies (in brief)

Intel X86 family and the Pentium. RISC architectures like MIPS, SPARC, Power PC and PARIC.

Introduction to DSP Architectures

Key issues in DSP architecture design, pipelining and parallelism in instruction set. On chip memories and I/O peripherals. Introduction to ADSP 21XX / 210XX family and TMS 320CXX family DSPs. Software and hardware developmant tools.

Text Books / References:

1. D. A. Patterson and J. L. Hennessy: "Computer organization and design", Morgan Kaufman, 1998, 2/e.

2. J. M. Feldman and C.T. Retter: "Computer Architecture - A designer's text based on generic RISC", McGraw-Hill, 1994.

3. D.Tabak: "Advanced Microprocessors", McGraw Hill, 1995.

4. J. P. Hayes: "Computer Architecture and Organization", McGraw-Hill, 1988, 2/e.

5. M. Mano "Computer System Architecture". PHI, 1993 3/e.

Branch: Instrumentation Engineering Year: Fourth
Semester: Eighth

Sl No.	Course No.	Subject	Period			Evaluation S			
	Theory		L	T	P	Sessional Examination			E
						TA	CT	Total	
1.	IE 851	Industrial Instrumentation	3	1		50	25	75	1
2.	IE 852	Telemetry and Tele-control	3	1		50	25	75	1
3.	IE 853	Optical Instrumentation	3	1		50	25	75	1
4.	IE 854	Elective -I	3	1		50	25	75	1
5.	IE 855	Elective-II	3	1		50	25	75	1
6.	IE 856	Project -II		6				100	5
7.	IE 857	Viva-Voce							7
TOTAL			15	11		300	150	475	6

Total Marks: 1100 **Total Periods: 26**
Total Credits: 30

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

Electives: Elective-I: Reliability Engineering/ *Expert Systems* /Digital Image Processing
Elective –II: Bio Medical Instrumentation/ Digital System Design/ Fluidic Power Control

IE 851: INDUSTRIAL INSTRUMENTATION

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

1. Measurement of mass and weight- Analytical Balance, Spring Balance, Pendulum Scale, Industrial Weighers.

2. Density/ Specific gravity- Density of solids, liquids and gases. Online Measurement Techniques. Float type, Liquid Level Method, Displacement Meter, Hydrometer Specific Gravity Meter, Radioactive Method.

3. **Measurement of displacement, force, torque, velocity and acceleration**.

4. **Temperature Measurement-** (i) Resistive Thermometers- resistance of metals, Platinum RTD's, construction and calibration. (ii) Bimetallic Thermometers- industrial applications. (iii) Thermistor Thermometers- linearization and signal conditioning techniques. (iv)Thermocouple Thermometers- Functional models of thermoelectric circuits. Calibration, Thermocouple Failure and Validation, Applications. (v) Semiconductor Junction Thermometers- Transistor as temperature sensor, integrated temperature sensors (LM 75, LM 135/235/335, AD 590). (vi) Pyrometers. IR thermometers. Manometric thermometers, Fiber-Optic temperature Sensors.

5. **Measurement of Pressure**- (i) Manometers, Elastic Transducers, Electric Pressure Transducers (capacitive, inductive, resistive). Other Transducers (force balance, piezo electric). (ii) Vacuum Measurement- Mc Lead Gauge, Knudsen Gauge, Ionization Gauge, and Pirani Gauge. Pressure Switches and transmitters.

6. Measurement of Flow- (i) Variable Head Flow Meter (ii) Variable Area Flow Meter – Rotameters. Ultrasonic, electromagnetic flow meters , hot-wire anemometer, laser Doppler anemometer. Open channel flow metering. Flow meters for solid materials.

7. Measurement of level- Float gauge, float-tape, float-shaft methods, bubbler system, etc. Electrical transducers – resistive, inductive, capacitive.

BOOKS:

1. Principles of Industrial Instrumentation- Patranabis, TMH.
2. Measurement Systems – Application & Design: Doeblin, MGH.
3. Industrial Instrumentation-Principles & Design: Padmanabhan T R, SPRINGER.
4. Principles of Measurement & Instrumentation – Morris A S, PHI.
5. Mechanical Measurements- Jain.
6. Industrial Instrumentation Fundamentals- Fribance, McGraw Hill.
7. Transducers & Instrumentation- Murthy D V S, PHI

IE 852: Telemetry and Tele-control

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

Introduction. Telemetry links, Telemetry errors caused by noise, interference and distortion, signal characterization in time and frequency domain, analog and digital signals, landline telemetry, mechanical , pneumatic and electrical systems, Industrial telemetry and carrier communication systems, modulation techniques: AM and FM, demodulation, sensitivity of wire & wireless transmission, PLCC, sampling theorem, Nyquist frequency sampling techniques and signal reconstruction, pulse modulation- PAM,PWM,PPM signals, pulse code modulation, coding

formats, Digital data communication techniques- multiplexing, FDM & TDM systems, their relative merits, ASK,FSK,PSK and higher order modulation, local area and public data networks, modems and coders, IRIG and CCITT standards, Fiber and satellite communication, remote control, mechanical , electrical and electronic methods, special considerations, typical Telemetry and Tele-control schemes related to industry and space applications.

Books/References:

1. Information Transmission etc.: Schwartz, M.
2. Tele-control Methods etc.: Swaboda, Van Norstad.

IE 853: Optical Instrumentation

L T P
(3 1 0)
Theory Marks=100
Sessional Marks=75
Time: 3 hours

Characteristics of charged coupled devices. Opto-couplers and their applications in analog and digital devices. Optical fiber fundamentals , modes in optical fibers, step index and graded index fiber, green lenses , fiber coupling, fiber optic sensors for industrial applications –displacement ,pressure, acceleration ,force ,velocity and flow sensors , fiber optic current and voltage sensors . Ch. Of laser radiation, structure of gas and solid state lasers, pulse mode laser, Q-switched laser, semiconductor laser. Holographic data systems. Memories and read out. Optical data processing fundamentals. Instruments – microscopes ,binocular ,stereoscope, polarization and phase contact microscope , photographic systems ,telephoto lens ,Fizean interferometer , Twyman Green interferometer ,Mach–Zehnder interferometer . Laser modes – Q-switching, frequency doubling, laser application – distance measurement , laser Doppler velocity-metery ,welding ,cutting , machining , holography , holographic inferometry.

Books/References:

1. Optics: Ghatak, TMH
2. Opto-electronics: An Introduction – Wolf and Smith, PHL
3. An Introduction to Fibre Optics – Shotwell; PHI (EEE)

EE 844/IE 854: Digital Image Processing (Elective)

EE 844/IE854: Expert Systems (Elective) (4-1-0)

EE 844/IE 854: RELIABILITY ENGINEERING (Elective

IE 855: Biomedical Instrumentation (Elective) (4-1-0)

Theory :100
Sessional : 75

Introduction to the physiology of cardiac, nervous and muscular and respiratory systems.
Transducers and Electrodes: Different types of transducers and their selection for Bio medical applications, Electrode the
Different type of Electrodes – Hydrogen Calomel, Ag-AgCl, pH, P_{o2}, Pco2 electrodes, selection criteria of electrodes.

Cardio vascular measurements: The heart and other cardio vascular systems, Measurement of blood pressure, blood fl cardiac output and Cardiac rate, Electro cardiography, Phonocardiography, Ballistocardiography, Plethysmography, Mag Cardiography, Cardiac Pace maker, Computer applications.
Measurement of Electrical Activities and muscles and brain: Electromyography, Electroencephalography and t interpretation, Respiratory system Measurement: Respiratory mechanism, Measurement of gas volume, flow rate car dioxide and oxygen concentration in inhaled air, respiratory controller. Instrumentation For clinical Laborat Measurement of pH value of blood, ESR measurements.

Hemoglobin measurement, oxygen and carbon dioxide concentration in blood, GSR Measurement, polarograp measurements, computer applications.

Medical Imaging: Ultrasound imaging, Radiography, MRI, Electrical Tomography and application.
Biotelemetry: Transmission and Reception aspects of Biological signals via long distances.

Aspect of patient care monitoring.

Books: 1. Webster JS – Medical Instrumentation – Application & Design.
2. Cromwell L- Biomedical Instrumentation, PHI.
3. Khandpur RS- Handbook of Biomedical Instrumentation, TMH, New Delhi,1991.
4. Astor BR – Introduction to Biomedical Instrumentation and Measurement, McMillan.

EE 845/IE 856: Digital System Design (4-0-0)

IE 855: Fluidic Power & Control (Elective) (4-1-0)

Max Marks: 100
Sessional marks: 75
Time: 3 hours

Scope & potential of application of pneumatics, hydraulics in instrumentation and control, fundamentals of fluid flow through orifices, restrictions, linearization of fluid flow equations. Pneumatic system elements and devices and their linearized modeling , e.g.- sources, regulated sources, valve actuators etc…Hydraulic system elements & devices & their linearized modeling. Feedback & its applications to development of hydraulic controllers. Pneumatic controllers, control schemes & control circuits, pneumatic telemetering, hydraulic power transmission. Hydraulic pumps & motors, hydraulic and pneumatic valves Fluidic elements, characteristics, logic devices. Analysis & synthesis of fluid logic systems with applications.

Books:

1) Control system components, Gibson & Tutor, McGraw hill.
2) Analysis & design of pneumatic Systems, Anderson & Blaine,.
3) Fluidic power systems, Morse, AC
4) Fluid Power & applications, Espisito

IE 856: Project-II (0-6-0)
Max Marks: 150

This subject has two components. The first is sessional, under which 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 project.

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.

The second component of the subject is the End Semester Examination for which a seminar and viva-voce examination will be held at the end of the semester after the satisfactory completion of the project work. .

IE 857: Viva-Voce

Max Marks : 75

The viva-voce examination will be held at the end of the semester. Those students who have successfully completed their project works can only appear in this examination. The viva voce examination will cover the entire syllabus of Electrical engineering of B.E. course.

8th Semester

Project : 150
Theory : 5X100 =500
Sessional : 5 X 75 =375
Viva : 75
Total :1100

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 871	Digital System Design	3	1		50	25	75	100	175	4
2	CS 872	Modeling & Simulation	3	1		50	25	75	100	175	4
3	CS 873	Principles of Compiler Design	3	1		50	25	75	100	175	4
4	CS 874	Elective-III	3	1		50	25	75	100	175	4
5	CS 875	Elective-IV(Open)	3	1		50	25	75	100	175	4
6	CS 877	Viva								75	2
7	CS 878	Project			12					150 *	8
Total			15	5	12						

Total Marks: 1100 **Total Periods: 36** **Total Credits: 34**

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

Electives:

Elective III: Parallel Processing/ Robotics/Reliability Engg/Mobile Computing/Image processing

Elective IV: Expert Systems/Distributed Systems/Neural Networks & Fuzzy Control/Switching & Routing in Comm. Systems.

** TA: 60 Marks Report: 40 Marks Presentation: 50 (Midsem: 25 Endsem: 25)

CS 871 Digital System Design
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Synthesis of clock mode (synchronous) sequential circuits

Analysis of sequential circuits. Design procedure With synthesis of state diagrams Mealy and Moore machines. Partitioning and state assignment. Finite state machine model.

Synthesis of asynchronous sequential system design

Pulse mode circuits and fundamental mode circuits with synthesis.

Design Convention

Register transfer, biasing and sequencing of control. Electronic realization of hardwired control unit. Conditional transfer.

Introduction to HDL

Operand convention of AHPL, APL and AHPL operators. AHPL conventions for combinational logic and memory arrays.

RIC

Basic organization, register transfer and AHPL control programmes. Multiple cycle instructions.

Microprogramming

Introduction to microprogramming. Microprogramming the RIC. Microprogramming of bus oriented machines in assembly language for microprogrammes.

High speed addition, Multiplication, division and floating point arithmetic

Text Books/references:

1. J. Frederic and G. R. Peterson - Digital Systems: Hardware Organization and Design, John Wiley and Sons, 3/e.

2. F. J. Hill and G. R. Peterson - Switching Theory and Logical Design. John Wiley and Sons, 3/e.

CS 872 Modeling & Simulation
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

1. Introduction:

Concepts of Systems - System Environment - Stochastic activities - Continuous and discrete systems - Modeling and types - Principles of modeling.

2. System Studies:

Types of systems study -System analysis, system design, system postulation

3. System Simulation:

Techniques - Monte Carlo method - comparison of simulation and analytical methods - Experimental nature simulation - types of simulation - lag models - Cobweb models - progress of simulation study

4. Continuous System Simulation:

Continuous system model - Different equations. Analog methods - analog and hybrid computers - Digital analog simulators - CSSLS. Feedback systems _ Interactive systems - Real time simulation.

5. System Dynamics:

Exponential models - Systems dynamics diagram - World model.

6. Discrete Systems Simulation:

Discrete events - Time representation - Oathering statistics - Discrete simulation languages - Models of telephone system - study of GPSS, SIMSCRIPT languages.

7. Model of multi-user and multitasking computer system, Review of probability concepts - Arrival pattern & service times - Analysis of simulation output.

Text & References:

1. Geoffrey Gordon - System Simulation, PHI

2. Narsingh Deo - System Simulation and Digital Computer, PHI.

3. T. M. D. Donavan - GPSS simulation made simple, John Wiley Sons

CS 873 Principles Of Compiler Design
Theory: 100 Marks
Sessional: 75 Marks
Time: 3 Hours

Lexical analysis:

Finite automata, DFA construction and minimization and automatic tools.

Syntax analysis:

Context free grammars, top down and top bottom up parsing techniques. Construction of effcient parser. Syntax directed translation and automatic tools.

Semantic analysis:

Declaration processing. type checking, symbol tables and error recovery.

Intermediate code generation:

Run-time environments and translation of language constructs.

Code Generation:

Flow graphs, register allocation and code generation algorithms. Introduction to code optimization techniques.

Textbooks / References:

1. AAho, R. Sethi & Ullman - Compilers Principles, Techniques & Tools - Addison-Wesley 1995.

2. A. I. Holub - Compiler Design in C - PHI 1993.

3 A. S. Tremblay and P S Sorenson - The Theory and Practice of Compiler Writing - McGraw Hill 1985.

CS 874 Robotics
Theory: 100 Marks
Sessional: 75 Marks
Time: 3 Hours

Overview of Robotics.

Mechanical Design of robots, sensors, actuators, gearboxes, robot end-effectors, resolution, accuracy, precision.

Describing the position and orientation of objects in 3D space. Coordinate frames, position, orientation and velocity vectors in 3D, coordinate transformations. Applies directly to Computer Graphics.

How to mathematically define a path in space. How to control the robot to follow that path Contact tasks, force sensing and control. Also: Haptic interfaces paralllel kinematics

Overview of computer vision and robotic applications of vision. Elements of a vision system, lighting, sensors, optics. Geometry of imaging, projections, distortions, depth of field. Digitization, brightness, color space, color depth, image formats. Camera calibration.

Binary images, thresholding, histograms. Area/moment statistics, morphological operations. Segmentation, blob analysis, labeling. Spatial operations and transformations: Pixel neighborhoods, convolution. Mean, Gaussian, Laplacian, gradient filters. Edge detection, Canny, Hough transform.

Overview of mobile robotics, applications. Sensors and estimation. Distributed robotics.

Overview of MEMS, scaling effects, micromanipulation. Microscope optics, depth from defocus, focus measures. Examples from current research

CS 874 Reliability Engineering
Theory: 100 Marks
Sessional: 75 Marks
Time: 3 Hours

Fundamentals of reliability engineering:

Definition of reliability, types of failures, failure mechanism and failure modes. Component co-units, bathtub curves, measures of reliability, failure rates, MTBF (Mean Time Between Failures), MTTF (Mean Time To Failure), reliability functions and hazard rate.

Reliability mathematics:

Basic probability theorems, conditional probability, Baye's theorem, basic statistical parameters such as mean, mode, median, variance, standard deviation, high order moments, types of probability distribution and their mean and variance. Binomial, Poisson, normal, log normal, exponential, Raleigh, Weibull and Gamma distributions.

Reliability modeling and assessment:

Reliability Logic Diagram (RLD), types of systems - repairable and non-repairable. System configuration – series, parallel, m out of n, standby systems, redundancy. Types and influence on reliability of subsystems. System reliability and evaluation methods - inspection methods, event space method, path tracing method, decomposition method and cut-set and tie-set method. Upper and lower bounds on system reliability.

Reliability data analysis:

Data acquisition, documentation and storage problem. Derivation of various reliability parameters from data. Anbalysis of constant hazard, data and estimation of reliability parameters.

Basic reliability design consideration:

Simple creative designs. Reliability consideration, reliability optimization with reference to some given constraints. Reliability and redundancy apportionment procedures.

Fault tree analysis:

Fault tree construction, direct evaluation of fault trees, fault tree evaluation by cut-sets.

Maintenance models:

Definition of maintainability and availability, preventive maintenance and assessment of influence on reliability/availability of a system.

Books/references:

1. M. L. Shooman - Probabilistic Reliability: An Engineering Approach, McGraw-Hill, 1968.
2. E. E. Lewis - Introduction to Reliability Engineering, John Wiley and Sons.
3. K. C. Kapur and L. R. Lamberson - Reliability Engineering Design, PHI, 1985.
4. W G. Ireson - Reliability Handbook, McGraw-Hill, 1966.
5. K. B. Misra - Reliability Analysis and Prediction: A Method Oriented Treatment, Elvester Sc. Publication, Netherlands, 1992.

6. A. K. Govil - Reliability Engineering, TMH, 1994.

CS 874 Mobile Computing
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Course Outline:

Recent Advances in Mobile Networks
Performance Analysis and Enhancement for IEEE 802.11 MAC protocol
A Novel Analytical Modeling for Optimal Channel Partitioning in the Next Generation Integrated Wireless and Mobile Networks
Multicast in Wireless Environment
Strategies for Enhancing Routing Security in Protocols for Mobile Ad Hoc Networks
Generic and Scalable Security Schemes for Ad Hoc Networks
Energy Efficient Routing Protocols with Comprehensive Information Retrieval for Wireless Sensor Networks: Wireless LANs and PANs
Topics in Bluetooth

Books/references:

CS874 Parallel Processeing
Theory: 100 Marks
Sessional: 75 Marks
Time: 3hrs

Introduction to Parallel Processing
Flynn's classification, SIMD and MIMD operations, Shared Memory vs. message passing multiprocessors, distributed shared memory.

Shared Memory Multiprocessors
SMP and CC-NUMA architectures, Cache coherence protocols, Consistency protocols, Data Pre fetching, CC-NUMA Memory Management.

Interconnection Networks
Static and Dynamic networks, Switching Techniques, Internet Techniques, Network Processors.

Message passing Architectures
Message passing paradigms, Grid Architecture, Workstation clusters, User-level software.

Multiprocessor Scheduling
Scheduling and Mapping, Internet wave servers, Multimedia servers, Content aware load balancing.

Books and References:

John Hennessy and David Patterson, Computer Architecture: A quantitative Approach, Morgan Kauffman Publisher.

CS 874 Image Processing
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction :
Scope and application of digital image processing. Image acquisition and display. Mathematical preliminaries. Human visual perception. Image Transforms: 2D-Fourier Transforms. 2D DFT. KLT, 2D DCT, Haar transform

Image Enhancement:
Histogram processing. Spatial Filtering. Frequency Domain Filtering. Image Restoration Degradation Model. Inverse Filtering. Wiener Filtering.

Edge Detection and Segmentation:
Edge detection. Line detection. Segmentation. Texture Analysis and Classification

Image Compression:
Lossy Compression. Loss-less compression. Run-length and Huffman Coding. Transform Coding. Image Compression Standards.

Color Image Processing:
Color model. Color Image Processing

Text Books/references :

1. R. C. Gonzalez & R. E. Woods - Digital Image Processing, Addison Wesley, 1993.
2. A. K. Jain - Fundamentals of Digital Image Processing, PHI
3. K. R. Castleman - Digital Image Processing, PHI 1996
4. W. K. Pratt - Digital Image Processing, John Wiley Interscience, 1991

CS 875 Distributed Systems
Theory: 100 Marks
Sessional: 75 Marks
Titme: 3 Hours

Characterization of Distributed Systems, Design issues and user requirements. Interprocess Communication-Synchronous and Asynchronous, Client-server communication, Group communication.
Remote rocedure Call-Design issues & Implementation. Distributed S-Design issues & Implementation. File Services Design issues, Implementations and case studies. Name Service-Design issues and case studies. Time and Co-ordination Physical & Logical Clocks, Distibuted Co-ordination. Replicaton issues and implementations. Shared data and Trransactions, Distibuted tansactions, concurrency control. Recovery and Fault Tolerance. Security-Design issues and case studies.

Books/References:
Coulouris, Dollimore and Kindberg, Distributed Systems-Concepts and Design, Pearson Education Asia
P K Sinha, Distibuted Operating System, PHI, IEEE Press
Singhal and Shivaratri, Advanced Concepts in Operating Systems, TMH
Tanenbaum, Distributed Systems: Principles and Paradigms, Pearson Education

CS 875 Expert Systems
Theory: 100 marks
Sessional: 75 marks
Titme: 3 hours

Abduction and causation. Architecture of expert systems. Rule based systems - forward and backward chaining, matching match measures, partial fuzzy matching, the Rate algorithm. Structured representation systems - frames, semantic nets, object based, scripts, indexing, retrieval techniques. Handling uncertainty and errors. Bayesian methods, uncertainty factors, Dempster-Shafer theory. Probabilistic and fuzzy reasoning, defeasible reasoning, truth maintenance. Knowledge engineering and acquisition - expert system development cycle, capturing and representing knowledge of experts through interaction, debugging knowledge bases. Explanation based learning. Expert system tools.

Text books / references:

1. P. Jakson - Introduction to Expert Systems, Addison Wesley

2. D. W. Ralston - Principles of Artificial Intelligence and Expert Systems, McGraw Hill

3. B. Buchanen and E. Shorteiffe - Rule Based Expert Systems

4. L. Brownston - Programming Expert Systems in OPSS, Addison Wesley

CS 875 Neural Network and Fuzzy Control
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Introduction.

Early Adaptive Networks.

Hopfield Networks.

Back-error propagation.

Back propagation applications and examples .

The brain and its neurons.

The Kohonen feature map.

Basic elements of fuzzy and fuzzy system:

The idea of a fuzzy set. Basic definition and properties related to fuzzy sets. Decision making in a fuzzy environment. Control process with a fixed and specified termination time.

Text books/references:

1. Judith Dayhoff - Neural Network Architecture: An Introduction, International Thomson Computer Press.

2. Janusa Kacprzyk - Multistage Fuzzy Control, John Wiley and Sons.

CS 875 Switching and Routing in Communication Systems
Theory: 100 marks
Sessional: 75 marks
Time: 3 hours

Communication Network: Routing: routing algorithms, essence of problem, features of telephone network routing. Transmission: multiplexing, link technologies, analogue to digital conversion, voice coding. Switching: motivation, space division switching, time division switching. Signalling: signalling network, switch controller, Signalling System 7 (SS7), state transition diagram.

Voice over Internet Protocol: Enabling technologies; Real Time Transport protocol (RTP), RTP Control Protocol (RTCP). Signaling protocol: Session Initiation Protocol (SIP), SIP's call establishment procedure

Circuit Switching: Link systems: concentrator, route switch, expander, multi-stage switching network. Grades of service of link systems. Strict-sense nonblocking networks. Time-division switching, grades of service of time-division switching networks.

Routing in the telephone network: Telephone network topology. Features of telephone network routing. Alternate/dynamic routing, Trunk reservation. Random routing, Least loaded routing, Real world examples: DNHR, RTNR. Erlang fixed point approximation

IP routing and label switching in Multi-Protocol Label Switching (MPLS): Label switching routers, label switched path. IP packet forwarding, IP routing, label switching. Label assignment, label allocation, label distribution.

Books / references :

1. John E. Flood, Telecommunications Switching, Traffic and Networks, Prentice Hall, 1995.
2. Keshav S : An Engineering Approach to Computer Networking: ATM Networks, the Internet, and the Telephone Network, Addison Wesley , 1997.
3. D. E. Comer, Computer Networks and Internets, with Internet Applications, Prentice Hall, 2001.
4. G. R. Ash, Dynamic Routing in Telecommunications Networks, McGraw-Hill, 1997.
5. Uyless Black, MPLS and Label Switching Networks, Prentice Hall, 2001.

BRANCH: **INDUSTRIAL & PRODUCTION ENGG. (8TH Semester)**

SL.No	Course No	SUBJECT	PERIOD			EVALUATION SCHEME					
Theory						Sessional/Exam.			ESE	Subject Total	Credit
			L	T	P	TA	CT	Total			
1	IP 831	Computer Aided Design and Manufacturing.	4	1	0	50	25	75	100	175	4
2	IP 832	Design of Jigs, Fixture and Press Tools	3	1	0	50	25	75	100	175	4

3	IP 833	Material Management	3	1	0	50	25	75	100	175	4
4	IP 834	Elective – III	3	1	0	50	25	75	100	175	4
5	IP 835	Elective – IV (Open)	3	1	0	50	25	75	100	175	4
		Practical/ Drawing/Design									
6	IP 836L	Project - II	0		12					150*	8
				0							
7	IP 837L	Viva-Voce	0		0					75	2
				0							
Total			16		12					1100	
				5							

Total marks : 1100 **Total Periods: 33** **Total Credits : 30**

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

Electives : Industrial and Production Engineering

Elective – III : Industrial marketing

Elective – IV : Project Planning and appraisal/ Management and Information System

* Project – II : TA = 60 marks ; Report = 40 marks ; Presentation } Mid Semester = 25 marks
End Semester = 25 marks

IP 831 : COMPUTER AIDED DESIGN AND MANUFACTURING [4-1-0]

Theory -100 marks Sessional-75 marks Time 3 Hrs

Unit I : Concept of CAD / CAM --- Computer system and related Technology : selection of Computer, CAD/CAM hardware and System, Computer Languages. CAD/CAM Fundamental and Operating software.

Unit II : Computer Graphics and Modelling – Software Configuration, Geometric and solid Modelling, Building block for Solid, Wire frame Modelling – Finite element Analysis. Database Management – Databank Concept, CAD/CAM Databases – Databank Information Storage and retrieval, Data life Cycle – integrated data Processing.

Unit III : Numerical Control and Part Programming -- Growth development and Component in NC system – Operation of an NC machine tools system – Co-ordinate system – Binary System – Basic motions of NC System. CNC system – CNC-DNC and adaptive Control. Justification and Economics – Part programming and Computer Languages.

Unit IV : Group Technology and FMS – Concept of Group Technology, Process Planning and Group technology, benefits of Group Technology. Definition and concept of of FMS -- Work Stations – Planning, different Types and Technology required for FMS – justification.

Unit V : Computer Integrated Manufacturing Systems (CIM) – elements of CIM – approach to CIM and Steps – Planning and Implementation – Material requirement planning, Capacity Planning – Shop floor Control. Role of Management in CIM.

Reference books

1. CAD/CAM (Dhan Pat Rai & Sons.) ------ S. Kumar and A.K. Jha
2. Computer Integated Manufacturing (PHI) ------ S. K. Vajpayee.
3. Mechatronics, HMT Ltd., (Tata Mc Graw Hills) .

IP 832 : DESIGN OF JIGS, FIXTURE AND PRESS TOOLS [3-1-0]

Theory -100 marks Sessional-75 marks Time 3 Hrs

Unit I : Introduction : Classes of Engineeirngproduction – Definition and functions of Jigs and fixtures.

Principles of location – Locator Types, clamping principles – Types of clamp : Drill bushes and plate – bush types and materials.

Design considerations.

Unit II : Design of Drill Jigs : Types, Jigs and Machine relationship. Jig body and feet. Examples of typical drill Jigs.

Design for specific product.

Unit III : Design of Fixtures : Types, Fixture and machine relationship – Examples of typical milling fixtures – Design.

Turning, Grinding and broaching fixtures.

Unit IV : Press Tools : Types of Presses ; Press Tool operations – Computation of capacities and tonnage for blanking, Piercing, bending, forming and drawing operations.

Principle and design procedure for press tools. Detailed designing procedure for bencing and planking operations examples.

Unit V : Dies : types – Combination and progressive die ; Single, double and triple action dies.

Detailed design procedure for blanking and piercing dies with examples.

Reference books

1. Production Tooling Equipment (B.I. Publication) ------ S.A.J. Parsons.
2. Fundamentals of Tool design (PHI) ------ A S T M E.
3. Jigs and Fixture (Jain Brothers) ------ Griant.
4. Jigs and Fixture (TATA McGraw Hill) ------ Joshi
5. Press Tool : Design and Calculation ------ P. H. Joshi
(A.H. Wheeler % Co.)

IP 833 : MATERIALS MANAGEMENT [3-1-0]

Theory -100 marks Sessional-75 marks Time 3 Hrs

Unit I : Definition, Importance and Objective – Integrated Material management ; Organisation and control ; Codification – requirement, Types and method.

Simplification and standardisation.

Unit II : Material requirement Planning (MRP) : Principle, Pre-requisites, Assumptions – MRP systems and Logic. Materials Budget – Techniques and preparation – Forecasting Techniques and guidelines.

Value Engineering : definition, scope and Techniques of value Analysis ; value analysis and value Engineering, steps and principles.

Unit III : Inventory Control : Functions, classification, determining Inventory levels, Inventory Models and Costs – EOQ – optimum lot size – Economic lot size. ABC analysis and classification – Class A, B and C items – Objective – Limitation of ABC analysis.

Unit IV : Store Keeping : Functions and Organisation – Centralised and de-centralised systems – Role of Store Keeper, essentials of good store keeping. Precaution and security measures in store room. Receipt of Materials – Checking Quality and Quantity ; Damage / Storage Report. Use of Bin Cards and Stock register. Inspection of incoming materials – Identification of stores – Material Coding. Store Accounting.

Unit V : Purchasing : Organisation, Duties, Centralised and decentralised Purchasing – Purchasing Officer – Sources of supply and supplier selection, Buyer – Seller relationship and ethics --- Buying locally and reciprocal buying – Single and multiple source.

Legal aspects in buying.

Unit VI : Purchasing procedure and record : Purchase classification – Requisition, purchase order, follow up and expediting systems. Receipt and inspection.

Records of Purchase – contract, quotation, vendors, records – summary of purchase work and miscellaneous records.

Import procedures and documents.

Reference books

1. Materials Management (AICTE : Code No. 333) ----- K. C. Sahu.
2. Materials Management (Forward book depot) ------ C. B. Agarwal.
3. Integrated Materials Management ------ Gopala – Krishna.
(Tata McGraw Hills)
4. Purchasing and Materials Management (Tata McGraw Hill) ---- Lee Dobler.

IP 834 (Elective III) : INDUSTRIAL MARKETING [3-1-0]

Theory -100 marks Sessional-75 marks Time 3 Hrs

Unit I : Basic Consideration : Concept, nature and scope of Industrial marketing management and marketing functions, Planning : Annual Plan ; element of marketing mix, Factors affecting marketing mix – variable relating to market.

Unit II : Market segmentation : Definition and Importance – types – product oriented market segmentation, criteria for segmenting a market. Marketing Information system, Information needs of Marketing Executive – Information based decision making.

Unit III : Marketing Research : meaning, aims and objectives – organisation of research groups – sources of marketing research and technique : Questionnaire and marketing research, steps designing and questionnaire. Marketing research and market research.

Unit IV : Consumer behaviour ; demand for goods, buying decision process, buyers behaviour Models. Buying motives, Motivation research Techniques : Buyer and Seller relationship – decision making theories in brief – decision making model and procedure. Marketing Environment.

Unit V : Advertising and Sales promotion : Role and importance of advertising in selling – social responsibilities in advertising – advertising methods – product branding, packaging and labelling. Sales promotion management – Personal selling – sales forecasting. Industrial marketing control.

Unit VI : Pricing : Strategy and decision : Conditions affecting Price – Pricing policies : Cost analysis and pricing – pricing methods -- price discrimination. Evaluation of Marketing performance.

Reference books

1. Marketing Research (King's Book) ------ M.M. Verma and R.K. Agarwal.
2. Element of Marketing Management (KedarNath, RamNath)---- P. Kumar.

IP 835 (Elective IV) : PROJECT PLANNING AND APPRAISAL [3-1-0]

Theory -100 marks Sessional-75 marks Time 3 Hrs

Unit I : Introduction – Concept of Project – Characteristics and classification – aspect of project : Project identification – selection criteria and feasibility analysis. Project Formulation – Steps – Planning and Evaluation.

Unit II : Project appraisal : Concept and scope – stages in project appraisal – appraisal criteria and Methodology.

Unit III : Financial analysis and Project Finance : significance of Financial analysis ; Financial Tools – preparation of fund flow statement, Cash flow measurement ; ratio analysis – Advantages and limitations – Break-Even analysis. Project Financing – Sources.

Unit IV : Analysis of Project Networks -- PERT and CPM -- Network representation – Rules to setup Networks – Analysis. Structuring of PERT Data – Arrow diagram, Work break down structure.

Unit V : Project Monitoring and control Aspects ; Project Management under risk and uncertainty – using computer for project management. Towards better project management – Bottlenecks and remedies.

Reference books

1. Project Management (Himalaya Publishing house) ------ V. Desai.
2. Project Management (Code No. 129, AICTE) ------ K. C. Sahu.
3. Project Management with PERT, CPM etc. (Jain Brothers) ---- J.C. Pant.

IP 835 (Elective IV) : MANAGEMNET INFORMATION SYSTEMS [3-1-0]

Theory -100 marks Sessional-75 marks Time 3 Hrs

Unit I : Management Information System (MIS) ; Concept, role and impact – organisation – Information characteristics ; Taxonomies of information systems. Structure and developments of MIS – Effectiveness.

Unit II : MIG basics -- Decision making concept and MIS : organisation and information, MIS and information : System concept and control : MIS and system concept : System analysis and MIS.

Unit III : Development of MIS – Long range plans ; class of information and requirement.
Implementation of MIS – Procedure, evaluator ; Management of Quality in MIS.

Unit IV : Technology of information system -- data, transaction and application processing ; TQM for information systems : Human factors and user interface.
Real time systems and design.

Unit V : Database Management System – concept, models and design---Conceptual and Physical model. Performance monitoring. MIS AND RDBMS.

Unit VI Application of MIS in manufacturing and service sectors. Enterprise management system(EMS)---Enterprise resource planning(ERP). EMS and MIS.

Reference books

1. Management Information Systems (Tata McGraw Hill) ------ W.S. Jawadakar.
2. Management Information Systems (BFB Publication) ------ T. Lucey
3. Management Information Systems (Code No. 489, AICTE)----- D.F. Goyal.

IP 836L: PROJECT – II (0-0-120

Sessional marks: 150 Passmarks: 75

Under this course the students are required to submit a project report on Industrial &Production Engineering topics. The report should be submitted in a standard FORMAT prescribed by the department .

IP 837L: VIVA – VOCE

Total marks: 75 Pass marks : 38

A final semester viva voce examination will be held at the end of I.P.E.8^{th} semester examination. The viva voce will be to assess the student on his/her overall knowledge of the subjects related to Industrial and Production Engineering in addition to the project works he/she had undertaken in 7^{th} and 8^{th} semester.