UNIVERSITY OF MUMBAI

No.UG/ 135 of 2004

CIRCULAR :

A reference is invited to the Circular No.UG/95 of 2004 dat March, 2004 and the Principals of the affiliated colleges in Engineerin hereby informed that the recommendation made by the Faculty of Tech at its meeting held on 15th December, 2003 has been approved Academic Council at its meeting held on 3rd January, 2004 ***vide*** iter and that, in accordance therewith, the B.E. (Packaging Technology) course will be introduced from the academic year 2004-2005.

Further that the existing scheme and syllabus for the First Year (Semesters I & II) which is common for all the branches of Engineering be made applicable to the First Year (Semesters I & II) for the B.E. (Packaging Technology) degree course.

Mumbai 400 032

2nd April, 2004

for REG

To,

The Principals of affiliated colleges in Engineering.

A.C.4.23/03.01.2004

No.UG/ 135-A of 2004 2nd April, 2004.

Copy forwarded with compliments to for information:-

1) Dean, Faculty of Technology,
2) The Chairman, Board of Studies in various branches of Engineering.

for REGIS

Copy to :

The Director, Board of College and University Development, the Controll Examinations/the Deputy Registrar (Eligibility & Migration Section) Director of Students Welfare, the Personal Assistants to the Vice-Chanc the Pro-Vice-Chancellor, the Registrar and the Assistant Regi Administrative sub-centre, Ratnagiri, for informations.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Civil Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTIONS AND EXAMINATION
(R-2001)

SECOND YEAR ENGINEERING: (Civil Engineering)

Semester III

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Applied Mathematics III (Civil)*	4	-	-	3	100	-	-	-	100
2	Surveying I*	3	3	-	3	100	25	-	-	125
3	Strength of Materials*	5	2	-	3	100	25	-	-	125
4	Building Construction*	3	-	2	3	100	25	-	-	125
5	Construction Materials & Testing*	3	2	-	3	100	25	-	-	125
6	Fluid Mechanics*	4	2	-	3	100	25	-	-	125
	Total	**22**	**9**	**2**	-	**600**	**125**	-	-	**725**

* Common to Construction Engineering

Semester IV

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Applied Statistics & Numerical Methods*	4	-	-	3	100	-	-	-	100
2	Surveying II*	3	3	-	3	100	25	-	25	150
3	Structural Analysis I*	5	-	2	3	100	25	-	25	150
4	Engineering Geology*	5	2	-	3	100	25	-	25	150
5	Building Design & Drawing I*	1	3	-	4	100	25	-	25	150
6	Concrete Technology	3	2	-	3	100	25	-	25	150
	Total	**21**	**10**	**2**	-	**600**	**125**	-	**125**	**850**

* Common to Construction Engineering

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UNIVERSITY OF MUMBAI
SCHEME OF TEACHING AND EXAMINATION
(R-2001)

THIRD YEAR ENGINEERING: (Civil Engineering)

Semester V

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Presentation & Communication Techniques$	1.5	-	1.5	-	-	25	-	25	50
2	Structural Analysis II*	4	-	2	3	100	25	-	-	125
3	Soil Mechanics*	3	2	-	3	100	25	-	-	125
4	Building Design & Drawing II*	1	3	-	4	100	25	-	-	125
5	Applied Hydraulics I	3	2	-	3	100	25	-	-	125
6	Transportation Engineering I*	3	-	-	3	100	25	-	-	125
7	Entrepreneurship and Management	3	-	-	3	100	25	-	-	125
8	Site Visits I	-	3	-	-	-	-	-	-	-
	Total	**18.5**	**10**	**3.5**	**-**	**600**	**175**	**-**	**25**	**800**

* Common to Construction Engineering
$ common to all branches

Semester VI

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Foundation Engineering*	3	2	-	3	100	25	-	25	150
2	Design & Drawing of Steel Structures	5	-	3	4	100	25	-	25	150
3	Applied Hydraulics II	3	2	-	3	100	25	-	25	150
4	Transportation Engineering II*	4	2	-	3	100	25	-	25	150
5	Environmental Engineering I	4	2	-	3	100	25	-	25	150
6	Site Visits II	-	3	-	-	-	50	-	50	100
	Total	**19**	**11**	**3**	**-**	**500**	**175**	**-**	**175**	**850**

* Common to Construction Engineering

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UNIVERSITY OF MUMBAI
SCHEME OF TEACHING AND EXAMINATION
(R-2001)

FOURTH YEAR ENGINEERING: (Civil Engineering)

Semester VII

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Theory of Reinforced and Pre-stressed Concrete	5	-	2	3	100	25	-	-	125
2	Construction Engineering	5	-	2	3	100	25	-	25	150
3	Irrigation Engineering*	4	-	2	3	100	25	-	-	125
4	Environmental Engineering II	4	2	-	3	100	25	-	-	125
5	Elective I	4	-	2	3	100	25	-	25	150
6	Project – A	-	-	2	-	-	25	-	-	25
	Total	**22**	**2**	**10**	**-**	**500**	**150**	**-**	**50**	**700**

*Common to Construction Engineering

List of Electives

Semester VII. Elective I (Lecture: 4, Practical: 0, Tutorial: 2)	
1	Advanced Engineering Geology*
2	Advanced Surveying *
3	Advanced Construction Engineering
4	Applied Hydrology and Flood Control
5	Solid Waste Management
6	Management Decision Making*
7	Value Engineering*
8	Advanced Structural Analysis
9	Structural Dynamics
10	Advanced Structural Mechanics
11	Advanced Foundation Engineering
12	Ground Water Hydrology
13	Traffic Planning and Design
14	Air Pollution
15	Prestressed Concrete

* Common to Construction Engineering

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UNIVERSITY OF MUMBAI
SCHEME OF TEACHING AND EXAMINATION
(R-2001)

FOURTH YEAR ENGINEERING: (Civil Engineering)

Semester VIII

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Design and Drawing of Reinforced Concrete Structures	5	-	2	4	100	50	-	25	175
2	Quantity Survey, Estimation & Valuation	4	-	2	3	100	50	-	25	175
3	Construction Management	4	-	2	3	100	25	-	25	150
4	Elective II	4	-	2	3	100	25	-	25	150
5	Project – B	-	-	6	-	-	50	-	50	100
	Total	**17**	**-**	**14**	**-**	**400**	**200**	**-**	**150**	**750**

List of Electives

Semester VIII. Elective II (Lecture: 4, Practical: 0, Tutorial: 2)	
1	Rock Mechanics
2	Geographical Information System
3	Water Resources Engineering & Management
4	Bridge Engineering
5	Environmental Impact Assessment and Audit
6	Appraisal & Implementation of Infrastructure Projects
7	Risk and Disaster Management
8	Pavement Design and Construction
9	Advanced Design of Steel Structures
10	Earthquake Engineering
11	Advanced Computational Techniques
12	Soil Dynamics
13	Design & Drawing of Building Services
14	Design of Hydraulic Structures
15	Industrial Waste Treatment

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Theory of Reinforced and Prestressed Concrete

Class: B. E. (Civil Engineering)	Semester: VII
Periods per week: Lectures: - 5 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - Total: 125

Detailed Syllabus:	
1	Reinforced Concrete Fundamentals (working Stress Method): Concept of reinforced concrete, stress strain characteristics of concrete and steel reinforcement , elastic theory, singly reinforced, balanced section, under reinforced section and over reinforced section, analysis and design of singly reinforced doubly reinforced rectangular and T-sections, design of one way and two way slab as per IS-456(latest), shear and bond stresses and design for shear and bond, design of axially loaded columns, analysis of sections subjected to bending and axial forces(tension or compression) Brief introduction to fundamentals of ultimate strength theory: curved stress distribution, compressive stress block, simplified rectangular stress block as per Whitney's approach, ultimate moment of resistance of singly reinforced section
2	Limit state method of design as per IS 456 (latest edition): concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to limit states of collapse in flexure, direct compression, shear and limit states of serviceability in deflection and cracking, design of singly and doubly reinforced rectangular and T sections for flexure, design of members in shear and bond, design of axially loaded columns, design of one-way and two-way slabs, design of beam subjected to bending and torsion
3	Pre-stressed Concrete 3.1 Basic principles of pre-stressed concrete: materials used and their properties, methods and systems of pre-stressing, losses in pre-stress, analysis of various types of sections subjected to pre-stress and external loads 3.2 General design principles: concepts of center of compression, kern of a section, efficiency of the section, pressure line and safe cable zone, principal tension in pre-stressed concrete members
	Term Work: Each student is to appear for at least one written test during the term. Solution of at least 20 problems with neat sketches wherever necessary and the graded answer paper of the test shall be submitted as term work.
	Text books: 1. Plain and Reinforced Concrete, Vol. I, Jain & Jaikrishna, Nemchand Brothers. 2. Design of Reinforced Concrete Structures, Dayaratnam P, Oxford & IBH. 3. Design of Pre-stressed Concrete Structures, Lin T Y & Ned Burns John Wiley. 4. Prestressed Concrete, Krishna Raju, Tata McGraw Hill. 5. Ultimate Strength Design for Structural Concrete, Arthur P D & Ramkrishnan V, Wheeler & Co. Pvt Ltd 6. Limit State Theory for Reinforced Concrete Design, Huges B P, Pitman. 7. Limit State design - Reinforced Concrete. Jain A K, 8. Reinforced Concrete, Warner R F, Rangan B C & Hall A S, Pitman. 9. Reinforced Concrete, H.J. Shah, Charotar Publisher. 10. Theory of Reinforced Concrete, Shina & Roy 11. Prestressed Concrete, Evans R H & Benett E W, Chapman & Hall. 12. Limit State Design - Reinforced Concrete, Shah & Karve, 13. Illustrated Reinforced Concrete Design, Dr. V.L. Shah & Dr. S.R. Karve, Structures

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Construction Engineering

Class: B. E. (Civil Engineering)	Semester: VII
Periods per week: Lectures: - 5 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus	
1	Construction equipment: 1.1 Standard types of equipment, special equipment, cost of owning and operating equipment, depreciation costs, investment and operating costs, economic life, sources of construction equipment, factors affecting selection of construction equipment, balancing of equipment 1.2. Study of equipments with reference to available types and their capacities, factors affecting their performance: 1.2.1 Earthmoving equipment: tractors and attachments, dozers and rippers, scrapers, shovels, draglines, trenching machines, clamshell, hoes, trucks and wagons, dumpers, dozers, trenching machines, rollers and compactors 1.2.2 Drilling and blasting equipment: bits, jackhammers, drifters, drills, blasting material, firing charge, safety fuse, electric blasting caps, drilling patterns, transporting and handling of explosives 1.2.3 Pile driving equipment: types, pile driving hammers: single acting and double acting, differential acting hammers, hydraulic and diesel hammers, vibratory pile drivers 1.2.4 Pumping equipment: reciprocating, diaphragm & centrifugal pumps, wellpoint system 1.2.5 Stone crushing equipment: jaw, gyratory and cone crushers, hammer mills, roll crushers, rod and ball crushers, aggregate screens and screening plants, portable plants 1.2.6 Concrete manufacture, transport, placing and compacting equipment; mixers, central batching and mixing plants, pavers, transit mixers, concrete pumps, shotcrete 1.2.7 Air compressor 1.2.8 Equipment for moving materials: builder's hoists, forklifts, cranes, belt-conveyors, cableways, ropeways
2	Tunneling: geo-technical investigations, selection of alignment, methods of tunneling in soft soils and in hard rock, sequence of operations for drilling and blasting method, mechanical moles, boomers, tunnel boring machines, mucking, ventilation of tunnels, dust control, types of tunnel supports, sequence of lining operation, lining with pneumatic placers and by pumpcrete method
3	Concrete construction: concreting under water, concreting in different weather conditions, mass concreting, vaccum concrete, forms for concrete construction: slip forms, collapsible forms, cantilever forms
4	Miscellaneous: sand drains, stone columns, diaphragm wall, rock anchors, cofferdams, foundation grouting

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	Term Work: Each student is to appear for at least one written test during the term. At least two site visits should be arranged to give an exposure to various construction techniques discussed in the above syllabus. A report on site visit, at least 10 assignments (including sketches for various equipment and construction details) and the graded answer paper for the term test shall be submitted as term work.
	Recommended books: 1. Varma Mahesh, Construction Equipment & its Planning and Applications, Metropolitan 2. R L Purifoy and Ledbetter, Construction Equipment and Planning, McGraw Hill 3. USBR, Earth Manual 4. USBR, Concrete Manual 5. Wadell, Concrete Construction Handbook, 6. O'Brien, Havers & Stubb, Handbook of Heavy Construction, McGraw Hill 7. Jagadish Lal, Construction Equipment 8. Subhash Saxena, Tunnel Engineering 9. W C Teng, Foundation design 10. Bowels J E, Foundation Analysis and Design

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Irrigation Engineering

Class: B. E. (Civil / Construction Engineering)	Semester: VII	
Periods per week:	Evaluation System:	
Lectures: - 4	Theory paper (3 Hours):	100
Practicals: -	Term Work:	25
Tutorials: - 2	Practical:	-
	Oral:	-
	Total:	**125**

Detailed Syllabus:	
1	Introduction: irrigation, water resources in India, need of irrigation in India, development of irrigation in India, impact of irrigation on human environment, irrigation systems: minor and major, command area development
2	Hydrology: hydrologic cycle, rainfall - runoff process, factors affecting runoff, runoff hydrograph, runoff computations, flood discharge calculations, unit hydrograph method, S-hydrograph
3	Water requirement of crops: 3.1 Crops and crop seasons in India, cropping pattern, duty and delta 3.2 Quality of irrigation water 3.3 Soil-water relationships: soil characteristics significant from irrigation considerations, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation 3.4 Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation
4	Ground water and well hydrology 4.1 Ground water resources, occurrence of ground water, methods of ground water exploration, well irrigation 4.2 Well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests, design of water wells
5	Distribution system: 5.1 Canal systems, alignment of canals, canal losses, estimation of design discharge 5.2 Design of channels: rigid boundary channels carrying clear and sediment laden water, alluvial channels carrying clear and sediment laden water, Kennedy's and Lacey's theory of regime channels 5.3 Canal outlets: non-modular, semi-modular and modular outlets 5.4 Waterlogging: causes, effects and remedial measures 5.5 Lining of canals: economics of lining, types of lining 5.6 Drainage of irrigated lands: necessity, methods

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6	Canal structures: 6.1 Surface and sub-surface flow considerations for design of canal structures: hydraulic jump, seepage forces, uplift forces 6.2 Canal falls, cross regulator, distributary head regulator, canal escapes: types, components and design considerations 6.3 Cross drainage works: need, types, design considerations
7	Canal headworks: 7.1 Weir and barrage, different units of headworks, types of weirs, sediment control in canals, river training for canal headworks 7.2 Theories of seepage for design of weirs: Bligh's creep theory, Lane's weighted creep theory, Khosala's method of independent variables
8	Dams and spillways: 8.1 Embankment dams: Classification, selection of site for dam, design considerations, estimation and control of seepage, slope protection 8.2 Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile, structural joints, keys and water seals, galleries, outlets 8.3 Arch and buttress dams: types 8.4 Spillways: components of spillways, types, terminal structures, types of gates for spillway crests
9	Reservoirs: types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site, flood routing
	Term work: Each student is to appear for at least one written test during the term. At least 10 numerical problems and 10 descriptive assignments including sketches of relevant hydraulic structures and the graded answer paper for the term test shall be submitted as term work.
	Text books: 1. G L Asawa, Irrigation Engineering, Wiley eastern 2. S K Garg, Irrigation Engineering & Hydraulic Structures, Khanna Publishers 3. P N Modi, Irrigation Engineering & Hydraulic Structures, **Reference books:** 1. J D Zimmerman, Irrigation, John Wiley & Sons 2. Varshney, Gupta & Gupta, Theory and Design of Irrigation Structures, Nem Chand & Bros 3. Punmia B C & Pande B B lal, irrigation Engineering and Water Power Engineering, Laxmi Publications

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Environmental Engineering II

Class: B. E. (Civil Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - 2 Tutorials: -	Evaluation System: Theory paper (3 Hours): 100 Term Work: 25 Practical: - Oral: - Total: **125**

Detailed Syllabus:

1	Water 1.1 Man's environment: Importance of environmental sanitation. 1.2 Water supply systems: Need for planned water supply schemes, components of water supply system and determination of their design capacities. 1.3 Quality of water: Wholesomeness and palatability; physical, chemical, bacteriological standards. 1.4 Treatment of water; impurities in water-processes for their removal - typical flow-sheets. 1.5 Sedimentation: factors affecting efficiency, design values of various parameters, tube settlers. 1.6 Coagulation and flocculation: mechanisms, common coagulants, rapid mixing and flocculating devices, G and GT values, Jar test, coagulant aids - polyelectrolytes etc. 1.7 Filtration: classification, slow and rapid sand filters, dual media filters, sand, gravel and under-drainage system, mode of action, cleaning, limitations, operational difficulties, performance, basic design consideration, pressure filters: construction and operation. 1.8 Water softening: lime soda and base exchange methods, principle reactions, design considerations, sludge disposal. 1.9 Miscellaneous treatments: removal of iron and manganese, taste, odour and colour, principles and methods; de-fluoridation, reverse osmosis. 1.10 Disinfection: chlorination, chemistry of chlorination, kinetics of disinfection, chlorine demand, free and combined chlorine, break point chlorination, superchlorination, de-chlorination, chlorine residual, use of iodine, ozone, ultraviolet rays and chlorine dioxide as disinfectants, well water disinfection.
2	Sewage: 2.1 Characteristics of sewage: composition, chemistry of sanitary sewage, B.O.D., C.O.D., aerobic and anaerobic decomposition. 2.2 Sewage Disposal: discharge of raw and treated sewage on land and water, standards for disposal of raw and treated sewage on land and water, limits of dilution. 2.3 Self purification of streams: oxygen economy, sewage farming. 2.4 Sewage treatment: aims, methods of treatment and various flow-sheets for preliminary, primary, secondary and tertiary treatment, screens, grit chambers, primary and secondary clarifiers, disposal of screenings and grit. 2.5 Biological treatment methods; principles, trickling filter operation, re-circulation, activated sludge process and its modifications, hydraulic design of trickling filter and activated sludge process, sludge volume index, operational problems in activated sludge process and trickling filters, stabilization ponds. 2.6 Sludge digestion: principles of anaerobic digestion, quantity and characterisation of sludge, design of sludge digestion tanks, disposal of digested sludge, drying beds 2.7 Low cost sanitation: septic tanks and Imhoff tanks - principles, operation and suitability, design values, disposal of treated effluent.

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	Practicals: List of experiments on water and sewage samples: 1. Alkalinity 2. Hardness 3. pH 4. Turbidity 5. Jar test 6. Residual chlorine 7. Chlorides 8. Solids: suspended solids, dissolved solids, total solids, volatile solids 9. Dissolved oxygen 10. Chemical oxygen demand (COD) 11. Biochemical oxygen demand (BOD) 12. Sludge volume index (SVI) 13. Most probable number (MPN)
	Term Work: Each student is to appear for at least one written test during the term. Reports on experiments performed as detailed above and the graded answer paper for the term test shall be submitted as term work. A brief report on the visits to water and sewage treatment plants should also be included in the journal. Demonstration of available software for design of water and sewage treatment plant and sewer network is to be done.
	Text books: 1. Water supply and sanitary engineering , S.K.Hussain 2. Manual on sewerage and sewage treatment (latest ed.) and Manual on water supply and treatment, Ministry of works and Housing, New Delhi. **Reference books:** 1. Water supply and sewerage, E.W. Steel 2. Water supply and sewerage, T.J.McGhee 3. Water supply & pollution control, J.W.Clark, W.Viesman, M.J.Hammer. 4. Relevant Indian Standard Specifications. 5. CPHEEO Manual on Water supply and treatment 6. CPHEEO Manual on Sewerage and sewage treatment

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Elective I :Advanced Engineering Geology

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: **150**

Detailed Syllabus:	
1	Introduction Importance of geological studies in engineering investigations, precautions to avoid misleading conclusions likely to be drawn while interpreting drilling data with particular reference to RQD, case histories illustrating economies made possible by proper geological studies
2	Engineering geology of Deccan Trap basalts Factors affecting strength and water tightness, stability of cuts and ability to stand without support, significance of features like gas cavities, jointing, waeathering, hydrothermal alteration, volcanic bracias, techylytes, dykes, fractures, field structures of flows, stratigraphic sequence of flows etc. and their significance in civil engineering projects
3	Dams Strength and watertightness of Deccan trap rocks from foundation point of view, physical properties such as compressive strength, water absorption etc. of basalts, effect of weathering and hydrothermal alteration on engineering properties of rocks, deterioration of rock masses on exposure to atmosphere and suitable treatment for such rocks Investigations for determining the foundation treatment for adverse geological features, determination of foundation levels / cutoff levels for dams, groutability of rocks, correction of adverse feature by grouting, purpose of consolidated and curtain grouting, determining depth and zones of grouting, relation of zones of grouting with height of dams, foundation treatment for fractures having different manifestation, jointed racks, tachylytes and dykes Erosion of tail channel as a factor in selecting site for spllway, causes of rapid erosion from side spillways, geological conditions leading to erosion Case histories
4	Tunneling Methodologies of investigations for different types of tunnels for different purposes, location, spacing, angles and depths of drill holes for different types of tunnels, difference in behaviour of basalts because of jointing as exemplified by compact basalts and amygdaloidal basalts. Difficulties introduced by tachylytes, volcanic breccias, tuffs, intertrappean beds, fractures, dykes, hydrothermal alteration, flow contacts and unfavourable field characters. Computing structural discontinuities in rock masses, RQD, joint frequency index, RMR values, Q system, standup time. Selection and provision of protective measures such as guniting, rock bolting, shotcreting, steel fibre shotcreting, permanent steel supports, lagging, concreting and contact grouting above steel supports depending on geological conditions. Suitability of TBM for tunneling. Case histories
5	Bridges Investigations for bridge foundations, computing SBC for bridge foundation based on nature and structure of rock, foundation settlements Case histories
6	Geology of soil formation Residual and transported soils. Rock weathering conditions favourable for decomposition and disintegration, influence of climate on residual and transported soils in the deccan trap area. Nature of alluvium of deccan trap rivers and its engineering character. Effect of deposition of calcium carbonate. Scarcity of sand in the rivers in deccan trap area

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7	Geophysical investigations Seismic and electrical resistivity methods of explorations
8	Construction material Deccan trap basalts as construction material. Use of compact basalts and amygdaloidal basalts as rubble for masonry, metal for concrete making
	Practicals: • Logging of drill core, preparation of lithologs and interpreting drilling data, calculation of RQD and joint frequency index. Preparing geological cross-sections from drill hole data and using them for designing of civil engineering structures • Use of electrical resistivity method for determining depth of bed rock • Study of geological aspects of an engineering projects and writing a report based on studies carried out during visits to civil engineering projects
	Term Work: Each student is to appear for at least one written test during the term. Reports on experiments performed as detailed above and the graded answer paper for the term test shall be submitted as term work. A brief report on a visit to a project site with reference to geological conditions should also be included in the journal.
	Reference books: 1. PWD handbook, Engineering Geology, Government of Maharastra 2. Textbook of Engineering Geology, R E Gupte, PVG Prakashan 3. Geology of India, D H Wadia 4. Geology of India and Burma, M E Krishnan

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Elective I: Advanced Surveying

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

1	Modern Surveying Equipment Data and equipment needed for engineering projects, review of traditional surveying equipment. Changing scene in surveying and mapping, map substitutes, use and advantage of modern surveying equipment in project. Modern surveying electronic equipment, their principles, constructions, working and use – Electronic Theodolite, E.D.M. Instrumens – Geodimetor, Tellurometer, Distomat, total station. Application of lasers in distance and angular measurements, introduction of electronic navigation and position fixing – different systems and their characteristics
2	Global Positioning System Global positioning system – working principles and methods. Different approaches to is GPS and their accuracies, advantages of GPS in navigation, survey, planning and mapping
3	Geographic information system Geographic information system – data requirement and database creation. Use of field data, maps, aerial and satellite data. Advantages of GIS
4	Photogrammetry Definition of Photogrammetric terms, geometry of aerial and terrestrial photographs, aerial camera and photo – theodolite, scales of a photograph, tilt and height displacements, stereoscopic vision and stereoscopes, height determination from parallax measurements, flight planning, maps and map substitutes and their uses
5	Remote sensing Introduction and definition of remote sensing terms, remote sensing system, electromagnetic radiation and spectrum, special signature, atmospheric windows, different types of platforms, sensors and their characteristics, orbital parameters of a satellite, multi concept in remote sensing
6	Image interpretation Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantages of multidate and multiband images, digital image processing concept
7	Field astronomy Terms, co-ordinate systems, hour angle, right ascension, declination, altitude, azimuth: study of astronomical charts, determination of latitude and true bearing by observation on the sun and polestar, time, standard time, local time, universal time, equation of time

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Practicals:

- At least three practicals based on the above syllabus are to be conducted.

Term Work

Each student has to appear for at least one written test during the term. Report on the practicals conducted, at least five assignments and the graded test paper shall be submitted as the term work.

Reference Books:

1. Campbell J.B., "Introduction to Remote Sensing", The Guilford Press, London, 1986
2. Curran P.J., "Principles of Remote Sensing", Longman, London, 1985.
3. Kennie T.J.M Petrie G., "Engineering Surveying Technology"/ Blackie & Sons Ltd, London,1990.
4. Wolf P.R., "Elements of Photogrammetry", Tata McGraw Hill Book Company, New Delhi, 1986.

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Elective I: Advanced Construction Engineering

Class: B. E. (Civil Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus:	
1	Large and heavy engineering projects: characteristics and complexities, methods statement for major activities like excavation, concreting, steel fabrication and erection for projects like earthen dams, hydropower projects, nuclear power plant, refineries and other industrial projects etc.
2	Excavation for heavy engineering projects Excavation in various types of soils, selection of equipment, safety measures in excavation, drainage in excavation
3	Concrete construction for heavy engineering projects Selection of equipment for batching, mixing, transporting, placing and compacting for various types of jobs, safety measures during concreting, Special concretes and mortars: preplaced aggregate concrete, roller compacted concrete, grouting
4	Prefabricated construction Planning for pre-casting, selection of equipment for fabrication, transport and erection, quality measures, safety measures during erection
5	Steel construction Planning for field operations, selection of equipment and erection tools, tools and methods of welding, tools and methods of cutting and joining , bridge erection, quality measures, safety measures during fabrication and erection
6	Specific issues related to planning, site layouts, equipment selection and pre-project activities for large size construction projects like earthen dams, concrete dams, thermal power stations, nuclear power stations, light houses, airports and ports, bridges
7	Information related to special equipments and their applications to Off-shore construction, underground utility construction
8	New materials and equipment for construction
9	Case studies of heavy construction projects
	Term Work Each student has to appear for at least one written test during the term. A detail report of site visit to any heavy construction work, at least five assignments and graded test paper will be submitted as term work.
	Reference Books: 1. Thomas baron, Erection of steel structures 2. Stubbs, handbook of heavy construction 3. Journals of Civil Engineering and Construction Engineering

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Elective I: Applied Hydrology and Flood Control

Class: B. E. (Civil Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: **150**

Detailed Syllabus:	
1	Hydrological cycle, scope of hydrology
2	.Precipitation: types, measurement, rainfall records, missing data, mass curve analysis, station year method, depth - area - duration analysis
3	Water losses: evaporation, interception, transpiration and infiltration, determination of water losses
4	Stream flows: factors affecting runoff, rainfall - runoff relationship, run-off estimate using infiltration index
5	Stream gauging: techniques, latest methods for measuring depth, current meter- types, calibration, numerical examples on mid/mean section methods, stage discharge rating curve, coefficient of correlation etc.
6	Hydrograph analysis: characteristics, base flow separation, unit hydrograph, S-hydrograph, complex hydrograph, synthetic hydrograph, hydrograph for short term records for ungauged areas, dimensionless unit hydrograph
7	Floods: estimation, envelope curves, flood frequency studies, probability and stochastic methods, estimation of design flood, flood control methods, limitations
8	Flood routing: reservoir routing, channel routing
9	Reservoir design studies and reservoir sedimentation
10	Hydrological forecasting: general operation of flood forecasting, forecasting methods adopted in India, forecasting by unit hydograph method
11	Ground water hydrology: yield, transmissibility, Darcy's law, Dupuit's theory of unconfined flow, steady flow towards fully penetrating wells (confined and unconfined)
12	Unsteady flow towards wells: Jacobs curve and other methods, use of well functions, pumping tests for aquifer characteristics, methods of recharge
	Term Work Each student has to appear for at least one written test during the term. At least ten assignments and the graded test paper shall be submitted as the term work.
	Text books: 1. H M Raghunath, Hydrology, Wiley Eastern 2. K Subramanya, Engineering Hydrology, Tata McGraw Hill **Reference Books:** 1. V P Singh, Elementary Hydrology, Prentice Hall 2. V M Ponce, Engineering Hydrology: Principles and practice, Prentice Hall

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Elective I Solid Waste Management

Class: B. E. (Civil Engineering)	Semester: VII	
Periods per week:	Evaluation System:	
Lectures: - 4	Theory paper (3 Hours):	100
Practicals: -	Term Work:	25
Tutorials: - 2	Practical:	-
	Oral:	25
	Total:	**150**

Detailed Syllabus	
1	Definition of solid waste: - domestic : garbage, ashes, rubbish, dust, debris - commercial : wastes from offices, shops and markets etc. - hazardous waste : household, industrial
2	Sources of solid wastes: - household wastes - waste from commercial establishments, offices, vegetable markets, fish and meat markets, stables - solid waste from construction activities - hospital wastes, dead animals
3	Quantity, composition and properties of solid wastes: - per capita municipal solid waste - quantity of industrial solid waste per unit produced - composition: physical, chemical and biological constituents - sampling and characterization of solid wastes
4	Collection, segregation, storage and transportation of solid waste: - house to house collection, collection centers: location, sizes, types and maintenance, - transportation methods: manual, mechanical, methods with or without compaction, economy in transportation of waste, optimization of transportation routes
5	Effects of solid waste on environment: effects on air, soil, water surface and ground, health hazards
6	. Disposal of solid waste: - segregation, reduction at source, recovery and recycle - disposal methods: pen dumping, sanitary land filling, composting - anaerobic and anaerobic, incineration, sea disposal, vermin-composting
7	Modern trends thermal, biological and chemical conversion technologies
8	Industrial solid waste: Waste products during manufacture, filling and parking, operation of pollution control facilities, generation, minimization at source, recycling and disposal
9	Introduction to hazardous wastes: generation, minimization at source, treatment and disposal
10	Municipal solid wastes in Indian conditions, Legal aspects of solid waste disposal

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	Term work: Each student shall prepare a report on any industrial / hazardous / municipal solid waste comprising source, characterization, transportation, recycle, treatment and disposal. Each student is to appear for at least one written test during the term. The report mentioned above and the graded answer paper for the term test shall be submitted as term work.
	Recommended Books: 1. Integrated solid waste management, Techobanglous, Theisen and Vigil, McGraw Hill International 2. Hazardous waste management, Lagrega, Buckingham & Evans, McGraw Hill International 3. Solid waste management in developing countries, A D Bhide, Nagpur Publications 4. Environmental pollution control engineering, C S Rao, Wiley Eastern 5. Manual of Solid Waste Management, CPHEEO

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Elective I: Management Decision Making

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus:	
1	Concept of systems approach: system, boundaries of system, goals and objectives, optimality, mathematical models, objective function and constraints, problem solving mechanism, types of problems, modeling / problem formulation, sub-optimization, solution techniques, sensitivity analysis
2	Decision theory: classification of decision situations, decision tables and decision tree, criteria for decision making under certain, uncertain and risk conditions, utility theory
3	Time series analysis: variations in time series, trend analysis: method of moving averages, method of least squares
4	Index numbers: basic requirements of index numbers, constructing index numbers: using relatives, using aggregates
5	Linear programming: general nature of problem, formulation of problems, graphical method of solution, simplex method, dual, sensitivity analysis
6	Distribution models: transportation and assignment problems and their solutions
7	Queuing models: various situations, queue discipline and customer behaviour, single server model
8	Basic functions of inventory and inventory decisions, Inventory control model – economic order quantity
9	Simulation: general approach, Monte Carlo simulation, simple problems using hand calculations
	Term work: Each student is to appear for at least one written test during the term. At least two assignments and 3 problems on each of the topic and the graded answer paper for the term test shall be submitted as term work.
	Recommended Books: 1. Varma Mahesh, Construction Planning & Management through Systems Techniques, Metropolitan 2. Ossenbruggen P J, Systems Analysis for Civil Engineers 3. Shrivastava, Shenoy & Sharma, Quantitative Techniques for Managerial Decisions, Wiley Eastern

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Elective I : Value Engineering

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus:	
1	**Introduction** Definitions: Value, value engineering, value analysis, value management, background & history of value engineering, habits, roadblocks & attitudes and their relation to value engineering
2	**Value Engineering Job Plan** Various versions of job plan, phases of job plan: information, creative, analytical, investigation , recommendation, implementation
3	**Function Analysis** Function & its role in achieving value, function in terms of its cost & worth, Graphical function analysis: function analysis system technique
4	**Creative thinking** Definition, creative people, creative processes, conducting creative session
5	**Life cycle costing** Definition, purpose & implications, economic principles for life cycle costing, types of life cycle costs.
6	**Energy** Energy resources & consumption, energy cost escalation, sources of energy supply, end use of energy, energy embodiment of construction materials, buildings, infrastructures facilities & energy systems, energy models, factors affecting energy consumption, impact of maintenance on energy saving.
7	Value engineering case studies
	Termwork Each student is to appear for at least one written test during the term. At least five assignments and at least one case study report following complete job plan and graded answer paper of the term test will be submitted as term work.
	Recommended Books:- 1.Value Engineering – L.W. Zimmerman, G.D.Hart, CBS publishers & distributors 2.Proffessional Construction Management- Barrie & pualson, McGraw Hill 3. Value Engineering in the Construction Industry- Dell'lsola, A J, Construction Publication Company. 4. Value analysis in design & Construction, O'brien, J J, McGraw Hill

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Elective I Advanced Structural Analysis

Class: B. E. (Civil Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

1	**Introduction to Stiffness Method in Matrix Form:** Basic concepts of stiffness coefficients, member stiffness matrix for truss and beam elements, properties of stiffness matrix, co-ordinate transformation matrix, stiffness matrix in local and global co-ordinate axes system, assemblage of structure stiffness matrix and application of boundary conditions, equivalent joint loads, method of solution for displacements and computation of internal forces in members, application of stiffness method to beams, pin jointed trusses and rigid jointed plane frames.
2	**Conventional form of Stiffness Method, Moment Distribution Method:** Application to frames involving sideways, consideration of symmetry and antisymmetry of loads on symmetrical structures, modification of stiffness and carryover factors for symmetric and antisymmetric loads
3	**Flexibility Method in Matrix Form:** Review of concepts of flexibility coefficients, selection of primary structure, concept of structure flexibility matrix, compatibility equations and solution for redundant forces, computation of internal forces and jointed displacements, applications to continuous beams, pin jointed trusses and rigid jointed plane frames
4	**Conventional Form of Flexibility Method:** Elastic centre method and its application to rectangular box, rigid jointed portal frames, and fixed arches, introduction to column analogy method and its application to the determination of stiffness coefficients, carry over factors and fixed and moments for non prismatic member.
5	**Use of Muller Breslau's Principle:** For drawing influence line diagrams for statically indeterminate structures. Influence line diagrams for propped cantilevers, fixed beams and continuous beams.
6	**Approximate Methods for Analysis of Building Frames:** Substitute frame, cantilever and portal methods
7	**Introduction to Plastic Analysis of Steel Structure:** Concept of plastic hinge and plastic moment carrying capacity, shape factor, determination of collapse load for single and multiple span beams.
	Term Work: Each student has to appear for at least one written test during the term. At least 30 problems and the graded answer paper for the term test shall be submitted as term work. Exposure to computer aided analysis using available software be provided.
	Recommended Text Books: 1. Matrix Methods of Structural Analysis, Livesley R.K. 2. Analysis of Framed Structure, Gere J.M. & Weaver W. 3. Elementary Structural Analysis, Wilber. 4. Analytical Methods in Structural Analysis, S.A. Raz, New Age Int. Publishers. 5. Modern Methods in Structural Mechanics, B.N. Thadani. 6. Elementary Structural Analysis, C.S. Reddy. 7. Plastic Methods of Structural Analysis, B.G. Neal. 8. Structural Analysis, Laursen. 9. Structural Analysis, Vol. I & II, Gupta & Pandit, Tata McGraw Hill. 10. Intermediate Structural Analysis, Wang C.K., Tata McGraw Hill. 11. Matrix Method in Structural Analysis, Pandit & Gupta, Tata McGraw Hill.

Elective I : Structural Dynamics

Class: B. E. (Civil Engineering)	Semester: VII

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Periods per week:		Evaluation System:	
Lectures:	- 4	Theory paper (3 Hours):	- 100
Practicals:	-	Term Work:	- 25
Tutorials:	- 2	Practical:	-
		Oral:	- 25
		Total:	150

Detailed Syllabus:	
1	**Introduction:** To structural dynamics, definition of basic problem in dynamics, static v/s dynamic loads, different types of dynamic loads.
2	**Introduction to single degree of Freedom (SDOF) systems:** Undamped vibration of SDOF system, natural frequency and period of vibration, damping in structures, viscous damping and coulomb damping, effect of damping on frequency of vibration and amplitude of vibration, logarithmic decrement, forced vibration, response to periodic loading, response to periodic loading, response to pulsating forces, dynamic load factors, response of structure subjected to general dynamic load, Dulhamel's integral, numerical evaluation of dynamics response of SDOF systems, response of structure in frequency domain subjected to general periodic and non-periodic/impulsive forces of short duration, use of complex frequency response function, use of Fourier Series for periodic forces, introduction to vibration isolation, distributed mass system idealized as SDOF system, use of Rayleigh's method, response of SDOF system subjected to ground motion.
3	**Generalized Single-Degree of Freedom System:** Generalized properties: Assemblages of Rigid Bodies, Systems with distributed mass and elasticity, expressions for generalized system properties.
4	**Lumped mass multidegree of freedom (MDOF) system:** Coupled and uncoupled systems, direct determination of frequencies of vibration and mode shapes, orthogonality principle, vibration of MDOF systems with initial conditions, approximate methods of determination of natural frequencies of vibration and mode shapes-vector iteration methods. Energy methods and use of Lagrange's method in writing equations of motions, decoupling of equations of motion, modal equation of motion, concept of modal mass and modal stiffness, forced vibration of MDOF system, modal analysis, application to multistorey rigid frames subjected to lateral dynamic loads.
5	**Structure with distributed mass system:** Use of partial differential equation, free vibration analysis of single span beams with various boundary conditions, determination of frequencies of vibration and mode shapes, forced vibration of single span beams subjected to the action of specified dynamic loads.
6	**Random Vibrations:** Random processes, stationary and ergodic processes, autocorrelation function, power spectral density function, relationship between power spectral and autocorrelation functions, power spectral density and autocorrelation functions for derivatives of processes, superposition of stationary processes, stationary Gaussian processes, stationary white noise, probability distribution for maxima and extreme values.
7	**Stochastic Response of Linear SDOF Systems:** Transfer functions, relationship between input and output autocorrelation functions, relationship between input and output power spectral density functions, response characteristics for narrowband systems

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	Term Work: 1. Solution of at least 25 problems based on above syllabus. 2. Experimental determination of frequency of vibration and damping coefficient using simple displacement pickups. 3. At least one class test/quiz based on the above syllabus. Answer books graded by the teacher concerned shall be attached to the journal.
	Recommended Text Books: 1. Structural Dynamics-An Introduction to Computer Methods, John Wiley & Sons. 2. Dynamics of Structures, Anil K. Chopra, Prentice Hall, India. 3. Dynamics of Structures, Cloguh & Penzein, Tata McGraw Hill. 4. Structural Dynamics, John M. Biggs, Tata McGraw Hill.

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Elective I Advanced Structural Mechanics

Class: B. E. (Civil Engineering)		Semester: VII	
Periods per week:		Evaluation System:	
Lectures:	- 4	Theory paper (3 Hours):	100
Practicals:	-	Term Work:	25
Tutorials:	- 2	Practical:	-
		Oral:	25
		Total:	**150**

Detailed Syllabus:	
1	**Unsymmetrical Bending:** Principal axes of inertia, flexural stresses due to bending in two planes, shear centre, bending of unsymmetrical section.
2	**Bending of beams:** With initial curvature loaded in their plane of curvature, application to the analysis of hooks, chain links etc.
3	**Beams Curved in Plan:** Loaded perpendicular to their own plane, simply supported and continuous curved beams.
4	**Theories of Failure:** Maximum stress theory, maximum shear stress theory, maximum strain theory, maximum strain energy density theory, maximum distortion energy theory, Von Mises & Tresca's yield criteria.
5	**Beams on Elastic Foundation:** Beams of unlimited length, semi infinite length and beam of finite on elastic foundation
6	**Classification Plate Theory:** Naviers solution, finite difference method.
	Term Work: 1. Solution of at least 25 problems based on above syllabus. 2. At least one class test/quiz based on the above syllabus. Answer books graded by the teacher concerned shall be attached to the journal.
	Recommended Text Books: 1. Strength of Material Part I & II, Timoshenko. 2. Mechanics of Solids, Shames I. 3. Beams on Elastic Foundation, Hetency M. 4. Theory of Plates and Shells, Timoshenko. 5. Theory of Plates, Jagar, Macmillan. 6. Analysis of Plates, Theory of Problems, T.K. Vanadan & K. Bhaskars, Narosa Publishers

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Elective I: Advanced Foundation Engineering

Class: B. E. (Civil Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: **150**

Detailed Syllabus:	
1	Planning of subsurface investigation: Purpose and scope, Influence of soil conditions and type of foundation on exploratory programme, Subsurface soundings – static and dynamic methods, Planning of subsurface investigations, Type and sequence of operations, Lateral extent and depth of exploration, Interpretation of field and laboratory data
2	Consolidation: Terzaghi's theory of one-d consolidation – derivation of equation (solution in detail need not be covered), Estimation of Cc and Cv from laboratory tests, Estimation of Pc by various methods, Field consolidation curves, Quasi preconsolidation and secondary consolidation, practical applications
3	Stress and strain behavior of soil: Triaxial test - drained and undrained behavior of sand and clays, Failure criteria in soils – only Mohr – Coulomb's criteria, Ideal, plastic and real soil behavior, Shear strength of sand and clays
4	Estimation of stresses: Boussinesq's theory, Westergard's theory, Newmarks charts
5	Bearing capacity and settlement analysis of shallow foundations: Modes of failure, Failure criteria, Prandtl Reissner solutions, Buisman – Terzaghi solution, Assumptions in estimates of ultimate loads, Effect of shape, embedment of footing, eccentricity in loading, compressibility (including critical rigidity index), Choice of factor of safety, Settlement of foundations on sand – Schmertmann method, Foundations on collapsing and swelling soils, non-uniform soils, compressible soils and on rock, R.C.C. design of isolated and combined footings
6	Pile foundations: Use of load tests, Estimation of single pile capacity by static and dynamic methods, Group capacity, Separation of skin friction and end bearing capacity, Settlement of single and group of piles
7	Ground improvement: Improvement of deep cohesionless soils and cohesive soils (including stone columns), geological p[roperties of reinforced soils, Instrumentation – mainly pore pressure gauges and settlement gauges and their applications.
	Term work: The term work shall consist of the following: - A project report covering the selection of soil parameters and design of shallow/pile foundations and ground improvements, using stone columns and sand drains - At least one test based on the above syllabus. The graded test paper shall be attached with the report.
	Recommended Books: 1. Soil Mechanics and Foundation Engineering, Volume I and II, V. N. S. Murthy, Saitech Publication 2. Soil Mechanics in Engineering Practice, K. Terzaghi and R. B. Peck – Second Edition, Wiley International Edition 3. Principles of Foundation Engineering, Das B M, PWS Publications 4. Foundation Engineering Handbook, Winterkorn and Fang, Galgotia Publications

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Elective I: Ground Water Hydrology

Class: B. E. (Civil Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus:	
1	**Groundwater occurrence:** Geologic formations, types of zones, types of aquifers, storage coefficient.
2	**Groundwater movement:** Darcy's law, permeability, transmissibility, isotropic and anisotropic aquifers, ground water flow rates, flow net analysis, steady one dimensional flow in confined and unconfined aquifers, aquifer with recharge, tile drain problems for lowering groundwater table.
3	**Well hydraulics:** Yield, specific yield, aquifer constant, steady flow towards fully penetrating wells in confined and unconfined aquifers, unsteady radial flow in confined aquifer, Thies non-equilibrium equation and its solution by (i) Thies method (ii) Jacob method (iii) Chows method, Unsteady flow in unconfined and leaky aquifers, multiple well system, recuperation test
4	**Design of wells:** Methods of constructing shallow and deep wells, well completion, well development, testing of wells.
5	Artificial recharge of groundwater.
6	Ground water quality, sea water intrusion into coastal aquifers.
7	**Ground water modeling techniques:** Porous media models,(tank model), analog models(Hele-Shaw model), electric analog models, membrane model.
8	**Surface investigations of ground water:** Geologic methods, remote sensing, geophysical exploration, electric resistivity, seismic refraction.
	Term work: Each student is to appear for at least one written test during the term. At least ten assignments and graded test paper shall be submitted as term work.
	Recommended textbooks: 1. H.M. Raghunath, Ground Water, New ge international. 2. D.K. Todd, Ground Water Hydrology, John Wilely and sons. 3. Punmia B C & Pande B B lal, irrigation Engineering and Water Power Engineering, Laxmi Publications

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Elective I :Traffic Planning and Design

Class: B. E. (Civil Engineering)		Semester: VII	
Periods per week:		Evaluation System:	
Lectures:	- 4	Theory paper (3 Hours):	- 100
Practicals:	-	Term Work:	- 25
Tutorials:	- 2	Practical:	-
		Oral:	- 25
		Total:	150

Detailed Syllabus:	
1	**Traffic Engineering and control** 1.1 Review of various traffic surveys and traffic studies 1.2. Statistical methods for traffic engineering and their applications : Distributions, sampling theory and Significance testing, Regression and Correlation. 1.3. Intersection design: Principles, various available alternatives, rotary design, mini roundabout, traffic signals: types of traffic signals, advantages, determination of optimal cycle time and signal setting for an intersection with fixed time signals, co-ordination of signals, types, area traffic control, delay at signalized intersection. 1.4. Accident and road safety: accident causes, recording system, analysis and preventive measures, accident cost, alternative methodologies for calculation. 1.5. Traffic management: various measures and their scope, relative merits and demerits. 1.6. Highway capacity: passengers car units, level of service, factor affecting capacity and level of service, influence of mixed traffic.
2	**Transportation Planning and management** 2.1 Introduction to the process of urban transport planning. 2.2 Travel demand forecasting: 2.2.1 Trip generation analysis, trip classification, multiple regression analysis, category analysis 2.2.2 Modal split analysis: introduction, earlier modal split models, modal split models with behavioral basis. 2.2.3 Trip distribution analysis: introduction, methods of trip distribution, uniform and average factor method, Fratar method, Furness method, The Gravity model, Intervening and competing, Linear programming approach to trip distribution. 2.2.4 Traffic Assignment: purpose of traffic assignment, traffic flow characteristics, Assignment techniques: All or nothing assignment, Multiple route assignment, Capacity restraint assignment, Diversion curves. Rout building algorithms. 2.3 Land-use transport models: Introduction, selection of Land-use transport models, The Lowry model, Grain – Lowry model, Applications of Lowry model.
3	**Theory of traffic flow** Scope, definitions and basic relationship, review of flow density speed studies, hydrodynamic analogies, Application of hydrodynamic analogy, Car-following theory and its application to traffic engineering, probabilistic description of traffic flow, an introduction to queuing theory as applied to traffic flow problems for study state conditions, simulation studies.
4	**Transport Economics** Economic evaluation of highway schemes, need for economic evaluation, cost and benefits of transportation projects, basic principles of economic evaluation, Net present value method, benefit/cost ratio method, internal rate of return method. Vehicle operating costs, Value of travel time saving, Accident costs.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. Electronics

&

Telecommunication Engineering

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI

I. SCHEME OF INSTRUCTIONS AND EXAMINATIONS

at

B.E. (Electronics and Telecommunication Engineering)

(R-2001)

(Revised Scheme Considering 60 Minutes' Period Instead of 45 Minutes' Period as per AICTE Guide – lines)

Semester – VII

Sr. No.	Subject	Scheme of Instruction			Duration of paper hours	Scheme of Examination				
		Lect/ Week	Pract/ Week	Tuto/ Week		Paper	Term work	Pract.	Oral	Total
1	*Digital Communication	3	2	-	3	100	25	-	25	150
2	Mobile Communication System	4	-	1	3	100	25	-		125
3	Microwave Devices and circuits	4	2	-	3	100	25	-	25	150
4	Discrete Time Signal Processing	4	2	-	3	100	25	-	25	150
5	Elective I	4	2.	-	3	100	25	-	25	150
6	Project – A	-	-	4			25	-		25
	Total	19	8	5		500	150		100	750

* Subject common with Electronics Engineering branche.

Elective -I (Any one)

1) Image Processing (Pr)
2) Data compression and encryption (Pr)
3) Radar Engineering (Tut)
4) Microwave Integrated Circuits (Tut)
5) Simulation of communication systems (Tut)

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Semester – VIII

Sr. No.	Subject	Scheme of Instruction			Duration of paper hours	Scheme of Examination				
		Lect/ Week	Pract/ Week	Tuto/ Week		Paper	Term work	Pract.	Oral	Total
1	Satellite Communication	4		2	3	100	25		25	150
2	Optical Fiber Communication	4	2	-	3	100	25		25	150
3	Computer Communication Networks	4	2	-	3	100	25		25	150
4	Elective II	4	-	2	3	100	25		25	150
5	Project – B	-	8	-	-		50		50	100
	Total	**16**	**12**	**4**		**400**	**150**		**150**	**700**

Elective II (Any one)

1) Wireless network (Tut)
2) Digital Voice Communication (Tut)
3) Telecommunication network management (Tut)
4) Microwave amplifier and oscillator design (Tut)
5) Optical networks (Tut)
6) Internet communication engineering (Tut)

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II. Elective list in VII and VIII semesters

Semester VII

Elective – I

1. Image Processing (Pr)
2. Data compression and encryption (Pr)
3. Radar Engineering (Tut)
4. Microwave Integrated Circuits (Tut)
5. Simulation of communication systems (Tut)

Semester VIII

Elective – II

1. Wireless network (Tut)
2. Digital Voice Communication (Tut)
3. Telecommunication network management (Tut)
4. Microwave amplifier and oscillator design (Tut)
5. Optical networks (Tut)
6. Internet communication engineering (Tut)

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UNIVERSITY OF MUMBAI
(R – 2001)

III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Digital Communication			
Periods per week 1 Period of 60 min.	Lecture	3	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25

Detailed Syllabus

1. **Information theory:**
Entropy, Shannon Theorem, Shannon Hartley theorem

2. **Baseband Transmission:**

Discrete PAM Signals, power spectra of discrete PAM signals, intersymbol interference, Nyquist's criterion for distorrtionless baseband transmission, Pulse shaping, line codes, correlative coding, eye diagram, equalization.

3. **Digital Modulation:**

Representation of bandpass modulated signal, vector space representation, Gram, Schmidt procedure, signal energy and correlation, ASK, FSK, PSK, DPSK, M-ary PSK, M-ary FSK, QPSK, OQPSK, MSK, QAM- Introduction, Modulation, demodulation, signal space diagram, spectrum, bandwidth efficiency, power efficiency, probability of error, applications, carrier and timing recovery circuits.

4. **Baseband Detection:**

Detection of binary signals – Matched filters, decision threshold in matched filters, error probability, maximum likelihood receiver structure, correlation realization of matched filter.

5. **Error Control Systems:**

Overview, power and bandlimited channels, optimum decoding, decoded error rate.

6. **Error Control Block Codes:**

Introduction, code rate and code distance, some algebraic concepts, generator matrix of a linear block code, systematic form of G, parity check matrix of a linear block code, decoding mechanism, hamming codes, extended hamming codes, shortened hamming codes, systematic form of H matrix, cyclic codes, generator matrix for cyclic codes, polynomial multiplication and division, systematic cyclic codes, practical systematic encoders, binary BCH codes, shortened cyclic codes, cyclic redundancy check (CRC)codes, interleaving, Non algebraic decoding of cyclic codes, Meggit decoding, decoding shortened cyclic codes, burst detection, burst correction (error trapping), application areas.

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7. **Convolutional codes:**

Introduction, generator polynomial and optimal codes, puncturing code trellis, free distance, Viterbi decoding, hard decision Viterbi decoding, decoding window, soft decision Viterbi decoding, code spectra, recursive systematic codes, code transfer function, application areas.

8. **Spread Spectrum Techniques:**
Basic techniques, direct sequence spread spectrum, frequency hop spread spectrum, spreading sequences- m-sequences, gold sequences, Walsh Hadamard sequences, variable-length orthogonal codes, correlation of sequences, PSD of DS spread spectrum, performance of DS/QPSK in tone interference, DS spread spectrum on frequency selective fading channels, error probability for DS CDMA on AWGN channels.

Review:

Mathematical definition and proof of sampling theorem for base band and band pass signals, flat top samples and their spectrum, signal distortion. PCM – Principles, bandwidth, channel capacity, DPCM – Principles, Quantizer design, predictor design, coding gain, Adaptive DPCM – Principle, Delta Modulation (DM).

List of Experiments:

1. Measurement of bit error rate
2. Measurement of coding gain
3. Study of generation of cyclic codes
4. Measurement of bandwidth efficiency of QAM
5. Study of equalizer's performance parameters
6. Study of eye diagram using oscilloscope.
7. Study of QPSK waveform using digital oscilloscope
8. Measurement of Bandwidth efficiency of QPSK
9. Study of MSK generation and detection.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on experiments (at least eight from the list of suggested experiments) and assignments along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on experiments – 15 marks.
Written Test – 10 marks.

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V. **Text Books:**

1. Digital Communications – Simon Haykin,
   John Wiley & Sons publication
2. Coding Techniques: An Introduction to Compression and Error Control – Graham wade,
   Palgrave
3. Principles of Mobile communications 2nd Edition – Gordon Stuber
   Kluwer Academic publication

VI. **Reference Books:**

1. Digital Communications 2nd Edition – Bernard Sklar
   Pearson Education Asia publication
2. Communication Systems – B. P. Lathi,
   BS Publications (Hyderabad)

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Mobile Communication System			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	1	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	-
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

   Introduction to wireless communication systems

2. **The cellular concept:**

   Frequency reuse handoff, interference, trunking and grade of service, improving the capacity of cellular systems

3. **Mobile radio propagation:**

   Large scale path loss, reflection, ground reflection, model (2 ray model), diffraction, practical link budget design using path loss models, small scale fading and multi-path, small-scale multi-path propagation, parameter of multi-path channels, types of small scale fading, Raleigh and ricean distribution, diversity.

4. **Analog cellular mobile system:**

   AMPS and ETACS system (overview call handling, air interface, N-AMPS)

5. **Digital cellular mobile system:**
   GSM-services, features, system architecture, radio subsystem, channel types, frame structure, signal processing security aspects, network operations.

6. **Low power wireless communication systems:**

   Cordless telephone, CT2, DECT, PHS, PACS

7. **CDMA digital cellular standard (IS-95):**

   Frequency and channel specifications, forward and reverse CDMA channel

8. **Mobile terminals:**
   Over view, types, radiated power, functional architecture, encryption, subscriber identity module,

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9. **Global mobile satellite system:**
Introduction to iridium system, global star system, ICO system, telederic system

10. **Third generation mobile communication:**
System IMT-2000, Introduction, radio aspects, network aspects.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments covering all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Wireless Communications – Theodore S. Rappaport
Prentice Hall of India, PTR publication

2. Wireless Personal Communications Systems – David J. Goodman
Addison Wesley publication

3. GSM Cellular Radio – Joachim Tesal
John Wiley publication

VI. **Reference Books:**

1. Mobile and personal communication systems and services – Raj Pandya
Prentice Hall of India publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Microwave Devices and Circuits			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

Microwave bands, microwave characteristics, microwave system, traditional, industrial and biomedical applications, microwave hazards.

2. **Transmission line theory:**

Circuit representation of transmission line, transmission line equations, sinusoidal excitation of transmission line, impedance and its transformation, Simth Chart and its applications, impedance matching techniques.

3. **Microwave Transmission lines:**

Co-axial line, rectangular and circular wave guides, introduction to strip lines, microstrip lines and co-planar wave-guides.

4. **Wave guide components:**

Transmission line resonators, Rectangular and circular cavity resonators, introduction of s-parameters,
Hybrid junctions, Directional couplers, circulators, isolators, wave-guide terminations, Attenuators, Phase-shifter

5. **Microwave tubes:**

Reflex klystrons, Multi cavity klystron, Helix TWT, Coupled cavity TWT, Backward wave oscillator, magnetron, Forward wave cross field Amplifiers.

6. **Microwave semiconductor devices:**

Point contact diodes, Schottky barrier diodes, PIN diodes, varactor diodes, tunnel diodes, Gunn devices, IMPATT diode, parametric devices, Detectors and Mixers.

7. **Microwave measurements:**

VSWR, Frequency, Power, Noise, Q Factor, Impedance, Attenuation, Dielectric Constant, antenna Gain.

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LIST OF EXPERIMENTS:

1. Measurement of power using Bolo meters
2. Measurement of attenuation by substitution method
3. Measurement of impendence using slotted wave guide
4. Measurement of scattering parameters
5. Measurement of noise
6. Measurement of frequency using slotted wave guide .
7. Measurement of impedance using reflectometer
8. Measurement of wavelength using reflectometer
9. Measurement of gain of horn antenna form radiation pattern

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on experiments (at least eight from the list of suggested experiments) along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on experiments – 15 marks.
Written Test – 10 marks.

V. Text Books:

1. Microwave engineering passive circuits - Peter A. Rizzi
   PHI Publication
2. Microwave Devices and circuits - Samuel Liao
   PHI Publication
3. Microwave Engineering - David Pozar
   John Wiley and Sons publication
4. Microwave Engineering and Applications - O.P. Gandhi
   Pargamon Press publication

VI. Reference Books:

1. Basic Microwave Techniques and laboratory manual - M. L. Sisodia, G. S. Raghuvanshi
   Wiley eastern Limited publication
2. Electromagnetic Field theory fundamentals - Guru & Hisiroglu
   Thomson Learning publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Discrete Time Signal Processing			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Transform analysis of LTI systems:**

Frequency response of LTI systems, phase distortion and delay, all pass systems, minimum, maximum mixed phase systems, linear phase filters, causal generalized linear phase system (pole zero plots) symmetric anti-symmetric filters low pass, high pass, band pass filters, digital resonator, comb filters, notch filters, all pass filters, digital sinusoidal oscillator.

2. **Discrete fourier transform:**

DFT and its properties, linear filtering based on DFT, frequency analysis of signal using DFT, long data filtering overlap and save, overlap and add method.

3. **Discrete cosine transform (DCT):**

Definition of DCT, DCT-1 and DCT-2, relationship between DFT and DCT-1 and DCT-2, energy compaction property of DCT-2, applications of DCT

4. **Computation of DFT:**

Fast fourier transform radix 2, radix 4, application of FFT algorithm, efficient computation of DFT of 2N point real sequences, linear filtering, correlation, Goertzel algorithm, chirp Z transform,
DIT-FFT, DIF, FFT, IFFT split radix FFT degradation from finite word length, effects of quantization, round off noise in FFT and IFFT

5. **Design of filters:**

Design of FIR filters – windowing method frequency sampling method, optimum equiripple linear phase FIR, FIR differentiator, optimum approximation of FIR filters, Hilbert transformers, relationship between no. of coeff and filters, characteristic raised cosine transition filter, Design of IIR filters – Impulse invariance, bilinear transformation, butter worth, chebyshev filter I, chebyshev II, frequency transformation low pass to high pass, band pass, band reject filters. Design of digital filter based on least square method (FIR,IIR).

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6. **Structures for discrete time systems:**

FIR structures (direct form, cascade form, frequency sampling and lattice), structures for linear phase filters, structures for IIR systems, direct form (cascade, parallel, lattice and lattice ladder),basic structure of phase shifters, effect of coefficient quantization in IIR and FIR systems, effect of round off noise in digital filters analysis of the direct form IIR structures, and scaling in fixed point implementation of IIR systems, analysis of a cascade IIR structures, and FIR structures.

7. **Digital ladder filters:**

Properties of two port circuits, simulated ladder filters, switched capacitor filters, wave filters, lattice filters, comparison elements

8. **Introduction to programmable digital signal processors:**

Multiplier and multiplier accumulator modified bus structures and memory access scheme in P-DSPs, multiple access memory, multi-ported memory, VLIW architecture, pipelining, special addressing modes, in P-DSPs, on chip peripherals.

List of Experiments:

1. Magnitude and phase response of a system.
2. Pole zero diagram and phase response of a linear phase filter.
3. Computation of DFT and at least one application.
4. Discrete cosine transform and its application
5. Design of Butterworth IIR filter.
6. Design of chebyshev IIR filter.
7. Design of FIR filter.
8. Design of digital filter using least square method.
9. Real time signals and its processing using digital signal processors.
10. Implementation of multi-rate signal processing.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on experiments (at least eight from the list of suggested experiments) along with a graded answer paper shall be submitted as term work.

The distribution of term work will be as follows:

Report on experiments – 15 marks
Written Test – 10 marks

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V. **Text Books:**

1. Digital Signal Processing – John Proakis
   Prentice Hall of India Publication

2. Discrete time signal processing – Alan V. Oppenheim & Ronald W. Scheuffer
   Prentice Hall of India Publication

3. Digital Signal Processors – B. Venkatramani, M. Bhaskar
   Tata Mc-Graw Hill Publication.

VI. **Reference books:**

1. Digital Processing of signals – Maurice Bellanger
   John wiley Publication

2. Digital Filters – Analysis and Design – A. Antonion
   Tata Mc-Graw Hill Publication

3. Digital Signal Processing – Iffecho R.
   Pearson Education Assia Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (1): Image Processing			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

Digital image representation, steps in image processing, elements of digital image processing systems.

2. **Digital Image Fundamentals:**

Elements of visual perception, simple image model, sampling and quantisation, basic relationships between pixels, basic transformations

3. **Image Transforms:**

Review of DFT, two-dimensional DFT and its properties, walsh transform, Hadamard transform, discrete cosine transform, the Harr transform, the slant transform, the hotelling transform.

4. **Image Enhancement:**

Spatial domain methods, frequency domain methods, enhancement by point processing, spatial filtering, enhancement in the frequency domain, generation of spatial masks from frequency domain specification, colour image processing.

5 **Image Compression:**

Fundamentals, image compression models, using information theory for image compression, error free compression, lossy compression, image compression standard.

6. **Image segmentation:**

Detection of discontinuities, edge linking and boundary detection, thresholding, region oriented segmentation, the use of motion in segmentation

7. **Image Representation and description:**

Representation schemes, boundary descriptors, regional descriptors, morphology, relational descriptors

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List of Experiments:

1. Read on input image and manipulate its resolution in the spatial and gray domains.
2. Arithmetic and logical operations on images.
3. Image rotation, scaling, translation
4. Image Transforms –I For a 4X4 image, determine its forward and inverse transforms and compare the inverse transforms with the original image data.
5. Image Transforms -II
6. Histogram and Histogram equalization of an image.
7. Smoothening filters
8. Sharpening filters
9. Compression codes
10. Image differentiation
11. Thresholding
12. Functions to determine boundary descriptors like boundary length, curvature
13. Functions to determine regional descriptors like area, perimeter, compactness, Eular number
14. Functions to compute texture descriptors in an image.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on experiments (at least eight from the list of suggested experiments) along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on experiments – 15 marks.
Written Test – 10 marks.

V. Reference Books:

1. Digital Image Processing – Ganzalez R. C,
   Pearson Education Asia Publication
2. Image processing, Analysis, and Machine vision – Milan Sonka, Vaclav Hlvac, Roger Boyle
   Thomson Learning publication
3. Fundamentals of Image Processing - Anil K. Jain
   Prentice Hall of India Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (2): Data Compression and Encryption			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Data Compression and Encryption:**

Need for Data Compression, Lossy / loss less compression, symmetrical compression and compression ratio, run length encoding (RLE) for text and image compression, relative encoding and its applications in facsimile data compression and telemetry, scalar quantization.

2. **Statistical Methods:**

Statistical modeling of ingormation source, coding redundancy, variable size codes prefix codes, Shannon-Fano coding, Huffman coding, adaptive Huffman coding, arithmetic coding and adaptive arithmetic coding, text compression using PPM method.

3. **Dictionary Methods:**

String compression, sliding window compression, LZ77, LZ78 and LZW algorithms and applications in text compression, Zip and Gzip, ARC and
Redundancy code.

4. **Image compression:**

Loss less techniques of image compression, gray codes, two dimensional image transforms, discrete cosine transform and its application in lossy image compression, quantization, zig-zag coding sequences, JPEG and JPEG-LS compression standards, pulse code modulation and differential pulse code modulation methods of image compression, video compression and MPEG industry standard.

5. **Audio Compression:**

Digital Audio, Lossy sound compression, M-law and A-law compounding, DPCM and ADPCM audio compression, MPEG audio standard, frequency domain coding, format of compressed data.

6. **Conventional Encryption:**

Security of information, security attacks, classical techniques, Caesar cipher, block ciper principles, data encryption standard, key generation for DES, block cipher principle, design and modes of operation, S-box design, triple DES with two three keys, introduction to international data encryption algorithm, key distribution.

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7. **Number Theory and public encryption:**

Modular arithmetic, Fermat's and Euler's theorems, Chinese remainder theorem, discrete logarithm, principles of public key cryptosystems, RSA algorithm, key management, Diffie-Hellman key exchange, elliptic curve cryptography.

8. **Message Authentication:**

Authentication requirements and functions, message authentication codes (MAC), hash functions and their security, hash and MAC algorithms, digital signatures and authentication protocols, digital signature standard and algorithms.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on experiments (at least eight) and assignments along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on experiments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Data Compression - David Salomon,
   Springer Verlag Publication

2. Cryptography and Network Security – William Stalliings
   Pearson Education Asia Publication

3. Introduction to Data Compression – Khalid Sayood
   Morgan Kaufmann Publication

VI **Reference Books:**

1. The Data Compression book – Mark Nelson
   BPB Publication

2. Applied Cryptography – Bruce Schnecer
   John Wiley & Sons Inc. Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (3): Radar Engineering			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

   Rader set, radar frequencies and radar applications.

2. **Radar Equation:**

   Range performance, minimum detectable signal, receiver noise, transmitter power, pulse repetition frequency, pulse duration, system losses, and propagation effects.

3. **Radar Targets:**

   Radar cross-section, black scatter cross section, complex target cross section fluctuations, frequency agility effects on target detection and tracking.

4. **CW, MTI & Pulse Radars:**

   CW radars, FMCW radar, MFCW radar, MTI radar, Pulse Doppler radar – principles, operation performance, limitations and applications

5. **Radar Clutters:**

   Surface clutter radar equations, sea clutter, land clutter, effects of weather on radar angles echoes.

6. **Tracking radars:**

   Sequential lobing, conical scan tracking mono-pulse tracking.

7. **Navigational & Remote Sensing Radars;**

   Airport radars, meterological radars, airborne radars, Doppler navigation, remote sensing radars, pattern synthesis, phased array

8. **Landing Systems & Hyperbolic Navigation:**

   Instrument landing systems, ground controlled approach, radio altimeter, microwave landing system, loran – A, measurement delay, loran-C, DECCA.

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IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Introduction to Radar System – M. I. Skolnik
Mc-Graw Hill publication

2. Radar Systems and Radio Aids to Navigation – A. K. Sen & A. B. Bhattacharya
Khanna publication.

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (4): Microwave Integrated Circuits			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Hybrid MICs :**

   Definition, characteristics, comparison with conventional circuits, fields of application and limitations and criteria for the choice of substrate material, thin film hybrid circuits, thick film hybrid circuits, artwork, mask making, photolithography, resistor stabilization, sawing, brazing process, wire bonding.

2. **Monolithic MICs:**

   Definition, substrate structure, doping by ion implantation ohmic contact, metal resistive layers, gate metal, dielectric second level metal, dielectric and air bridge vias, substrate vias, final wafer process steps.

3. **Micro strip Lines:**

   Planar wave guides, non-TEM propagation, line impedance definitions, quasi-static approximations, quasi-static line parameters, micro strip open circuits and gaps, micro strip corners, step changes in width, dispersion analysis, micro strip characteristic impedance, symmetric T junction, full wave analysis of micro strip propagation, LSE and LSM potentials, spectral domain analysis, dispersion relation for open micro strip, spectral domain impedance analysis, dispersion relation for open micro strip, spectral domain impedance analysis, Green's functions, millimeter wave modeling of micro strip lines.

4. **Coupled Line Propagation:**

   Wave equations for coupled lines, propagation models, coupled line parameters, coupled line parameter variations with frequency, directional couplings, Lange coupler coupled line pair treated as a four port, coupled line pair operated as a two port assuming 0e = 0o, low pass filter design assuming 0e =0o, coupled line pair analysed to a two port 0e not equal to 0o, narrow band filter using coupled resonator, narrow band coupled line filters, suspended substrate strip lined filters, suspended substrate strip line filter design using method 1 and method 2.

5. **Slot Lines :**

   Analysis, design consideration, transitions and applications.

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6. **Coplanar Waveguide:**

   Analysis, design considerations and coplanar line circuits.

7. **Devices :**

   GaAs FET, HEMT, gunn diode, varactor diodes, PIN diodes, YIC resonators, dielectric resonators & their application in oscillator mixer and amplifiers.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as term work.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Text Books:

1. Microstrip Circuit Analysis – David H. Schrader , Prentice Hall PTR, New Jersey 07458.
2. Microstrip Lines and Slot Lines- K.C. Gupta, R. Garg and I.J. Bahl , Artech House.
3. MIIC Design : GaAs FETs and HEMTs- Peter Ladbrooke , Artech House.
4. Foundations for Microstrip Circuit Design -T.C. Edwards, John Wiley and Sons

VI. Reference Books:

1. MIC and MMIC Amplifier and Oscillator Circuit Design- Allen Sweet, Artech House.
2. Handbook of Microwave Integrated Circuits- Reinmut K. Hoffman , Artech House.

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Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (5): Simulation of Communication Systems			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Basics of Simulation Modeling :**

System model and Simulation, Physical and Mathematical models. Analytical solutions and simulation output. Continuous and Discrete simulation models.
Discrete event simulation: Components and organization of discrete event scheduling and time advance approaches
a) Simulation of a single server queuing systems
b) Simulation of an Inventory system
Problem statement, program organization and logic, simulation program, simulation output and Analysis of result

2. **Complex system Simulation :**

Steps in simulation study, combined discrete continuous simulation, Monte Carlo Simulation. List processing in Simulation, storing list, linked storage allocation, simple C based Simulation language Simlib. Single server queueing Simulation, Simlib program steps and Simulation output

3 **Simulation software :**

Classification of Simulation software general purpose vs Application oriented Simulation packages. Modeling approaches, common modeling elements, entities attributes, resources and queries. Validation of Simulation model.
Features of Simulation software, animation and dynamic graphics, statistical capabilities, documentation, output reports and graphics, general purpose Simulation package: Arena, Object Oriented Simulation: Modsim III.

4 **Random process:**

Random variables, probability density functions and probability distribution functions. Random members and their properties, Randomness in message arrival time, type and length etc Review of sampling theorem for band limited signal and its representation using MATLAB, generation of random variables for specified probability density function. Gaussian process in communication system, generation of a multivariable gaussian process and its Simulation using MATLAB, Low and Band pass process Simulation.

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5 **Analog modulation :**

Amplitude modulation (double sided, single sided and vestigial side band type) of band limited message signal and its modulation, frequency analysis of AM signals. MATLAB Simulation of AM signals Angle modulation (Phase and Frequency) MATLAB Simulation of frequency modulation showing the spectra of message and modulation signals, comparison of demodulated output signals with the original message signal

6 **Digital signal transmission (Base band and band limited) :**

Additive white Guassian noise optimal receiver of AWGN channel, Probability of error. MATLAB Simulation of the above. Monte Carlo Simulation of binary communication system employing correlators of matched filters.
Transmission through band limited channels, power spectrum of pulse amplitude modulation, channel distribution, MATLAB Simulation of band limited channel, modeling as a linear filters (FIR or IIR), characterization of Inter symbolic interface based on transmitter and receiver filters, Communication system design for low ISI, Linear equalization and their design, equalizer design using MATLAB.

7 **Digital Transmission via Carrier Modulation :**

carrier amplitude modulation (ASK), Carrier Phase Modulation (PSK), Differential phase modulation (DPSK) and demodulation, Quadrature, amplitude modulation and demodulation, Carrier frequency modulation (FSK) and demodulation, MATLAB Simulation of above methods

8 **Source coding and channel coding:**

Source coding : Huffman coding, Quantization, pulse code modulation, MATLAB scripts for the above.
Channel coding : Linear block codes, cyclic block codes, Implementation of the above using MATLAB

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Text Books :

1 Simulation Modelling and Analysis – Averill M. Law & W. David Kelton
McGraw Hill International services

2 Contemporary Communication systems using MATLAB – John G. Proakis & Masoud Salehi
Brooks Cole Thomson Learning Publishers

VI. Reference Books :

1 Discrete Event System Simulation – Jerry Banks
Pearson Education International Series Publishers
2. Simulation of Communication Systems – Jeruelaim Philips Balaban
AT & T Bell Lab publ.
3. Simulation Modeling & Analysis – Aberilla David Eltron

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Satellite Communications			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

   General background, frequency allocations for satellite services, basic satellite system, system design considerations, applications.

2. **Satellite Orbits:**

   Introduction, laws governing satellite motion, orbital parameters, orbital perturbations, Doppler effects, geostationary orbit, antenna look angles, antenna mount, limits of visibility, Earth eclipse of satellite, sun transit outage, inclined orbits, sun-synchronous orbit, launching of geostationary satellites.

3. **Wave Propagation and Polarization:**

   Introduction, atmospheric losses, ionospheric effects, rain attenuation, other impairments, antenna polarization, polarization of satellite signals, cross polarization discrimination, ionospheric depolarization, rain depolarization, ice depolarization.

4. **Satellite Antenna:**

   Antenna basics, aperture antennas, parabolic reflectors, offset feed, double relflector antennas, shaped reflector systems.

5. **Link Design:**

   Introduction, transmission losses, link power budget equation, system noise, carrier to noise ratio for uplink and downlink, combined uplink and downlink carrier to noise ratio, inter modulation noise

6. **Communication Satellites:**

   Introduction, design considerations, lifetime and reliability, spacecraft sub systems, spacecraft mass and power estimations, space segment cost estimates.

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7. **Earth Stations:**

Introduction, design considerations, general configuration and characteristics.

8. **Multiple Access Techniques:**

Introduction, FDMA, TDMA, FDMA/TDMA, operation in a multiple beam environment, CDMA, multiple access examples

9. **Non Geostationary Orbit Satellite Systems:**

Introduction, reasons, design considerations, case study, example of systems.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Text Books:

1. Satellite Communications – Dennis Roddy – 3rd edition, Mc-Graw Hill publication

2. Satellite Communications systems – M. Richharia – 2nd edition Mc Millan publication.

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Optical Fiber Communication			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Overview Of Optical Fiber Communications:**

   Communication system applications in the electromagnetic spectrum, elements of on optical fiber transmission link, advantages of optical fiber communication

2. **Light Propagation in Optical Fiber:**

   Fiber types, rays and modes, ray theory transmission, electromagnetic mode theory for optical propagation, single mode and multimode fibers, linearly polarized models.

3. **Fiber Optics Technology:**

   Fiber materials, fiber fabrication, fiber optic cables, couplers, splices, connectors

4. **Signal Degradation in Optical Fibers:**

   Alternation, dispersion, bit rate and bandwidths, mode coupling.

5. **Optical Sources and Detectors:**

   Related semiconductor physics, leight emitting diodes, laser diodes, their characteristics, modulation circuits, optical detection principles, quantum efficiency, responsively, response time photo detector noise, PIN and Avalanche photodiodes.

6. **Optical Receiver Operation:**

   Noise, Receiver capacitance, receiver structures, pre-amplifiers

7. **Optical Fiber Systems:**

   Link power budget, rise time budget, analog systems, digital systems, coherent systems – homodyne and heterodyne detection, multiplexing.

8. **Optical Fiber Measurements:**

   Measurement of attenuation, dispersion, refractive index profile, numerical aperture, fiber diameter, OTDR

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List of Experiments:

1. Analog fiber optic system
2. Digital fiber optic system
3. Measurement of numerical aperture
4. Measurement of attenuation
5. Measurement of pulse spreading
6. Multiplexing in fiber optic system
7. Light source characteristics
8. Measurements using OTDR

IV. Term Work:

Each student has to appear for at least two written test during the term. Report on experiments (at least six from the list of suggested experiments) along with a graded answer paper shall be submitted as term work.

The distribution of term work will be as follows:

Report on experiments – 15 marks
Written Test – 10 marks

V. Text Books:

1. Optical Fiber Communication – John Senion
   Prentice Hall of India Publication
2. Optical Fiber Communication – Gred Keiser
   Mc- Graw Hill Publication

VI. Reference Books:

1. Fiber Optic Communication – Djafar K. Mynbarv, Lowell L. Scheiner
2. Optical Fiber Communication – Selvarajan, Subartkar, T. Srinivas
   Tata Mc-Graw Hill Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Computer Communication Networks			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Communication networks and services:**

Network functions and network topology, basics of message switching, packet switching, circuit switching and cell switching.

2. **Application and layered architectures:**

Layering architecture, the OSI reference model, unified view of layers, protocols and services, overview of TCP/IP architecture, TCP/IP protocol.

3. **Telephone Network:**

Frequency division and time division multiplexing, synchronous optical network (SONET) and SONET multiplexing, space division and time division circuit switches, Telephone Network, integrated services digital network, network channel signaling and routing control.

4. **Peer to peer protocols:**

Peer to peer protocols and service models, service models, end to end requirements and adaptation functions, end to end versus hop by hop. ARO protocols, stop and wait ARQ, go-back-N ARQ, selective repeat ARQ, transmission efficiency of ARQ protocols, sliding windows flow control, timing recovery for synchronous services, reliable stream service, data link controls, HDLC data link control, point to point protocol, statistical multiplexing.

5. **Local area networks:**

Multiple access communications, local area networks (LAN) structure, the medium access control sub layer, the logical link control layer, random access, ALOHA, slotted ALOHA, CSMA, CSMA/CD, scheduling approaches to medium access control, reservation systems, polling, token passing rings, comparison of random access and scheduling medium access controls, IEEE 802.3 standards for 10Mbps and 1000 Mbps LANs, repeaters and hubs, LAN bridges, transparent bridges, source routing bridges, mixes media bridges, LAN switches, spanning tree algorithm.

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6. **Packet switching networks:**

Network services and internal network operation, packet network topology, connectionless packet switching, virtual circuit packet switching, routing in packet networks, routing algorithm classification, routing tables, hierarchical routing, link state versus distance vector routing, shortest path algorithms, the Bellman-ford algorithm, Dijkstra's algorithm, other routing approaches.

7. **Frame relay and asynchronous mode (ATM):**

Frame relay protocol architecture, frame relay call control, user data transfer network function, congestion control, ATM architecture, logical connection, ATM cells, transmission of ATM cells, ATM adaptation layers, ATM traffic management and Qos, FIFO and priority queues, fair queuing, congestion control, open loop control, closed loop control.

8. **TCP/IP:**

The Internet Protocol (IP), IP packet, IP addressing, subnet mask, classless interdomain routing (CIDR), address resolution, reverse address resolution, IP fragmentation and reassembly, ICMP, User Date gram Protocol (UDP), Transmission Control Protocol (TCP), TCP Reliable stream service, TCP operation, TCP protocol, Dynamic Host Configuration Protocol (DHCP), mobile IP IPv6, internet routing protocols, routing information protocols, open shortest path first protocol, border gateway protocol, multicast routing, reverse path broadcasting, internet group management protocol, reverse path multicasting, distance vector multicast routing protocol.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on six experiments along with a graded answer paper shall be submitted as term work.

The distribution of term work will be as follows:

Report on experiments – 15 marks
Written Test – 10 marks

V. Text Book:

1. Communication Networks – Leon Garcia, Indra Widjaja
   Tata Mc-Graw Hill publication

2. Data and Computer Communication – William Stallings
   Pearson Education publication

3. Computer Network – Larry L. Peterson
   Morgan Kaufmann

VI. Reference Books:

1. Data Communication and Networks – Forouzan,
   Tata Mc-Graw Hill publication

2. Telecommunication Networks - Scwartz
   Addison Wesley publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (1) Wireless Networks			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **An overview of 2nd and 3rd generation air interfaces:**

   Introduction, PCS Standardization, major attributes of CDMA systems, 3 G systems

2. **CDMA IS – 95 Call Processing:**
   Introduction, CDMA call processing state, CDMA registration, authentication.

3. **Soft handoff and power control in CDMA:**

   Introduction, types of handoff, Pilot sets, search windows, handoff parameters, handoff messages, handoff processing setup and end of soft handoff, pilot set maintenance

4. **Reverse and Forward link Capacity of a CDMA system:**

   Introduction, Reverse parameters in CDMA, multi-cell networks, inter-cell interference, reverse link capacity, cell loading, cell radius, Erlange capacity of a single cell, forward link capacity, CDMA cell size, Forward and reverse link balance, forward link budget.

5. **CDMA 2000 System:**

   Introduction, layering structure, logical channels used by PLICF, physical layer, forward link physical channels, forward link features, reverse physical channels, media access control and LAC sub-layer data services, mapping of logical channels to physical channels, evolution of CDMA one to CDMA 2000 systems.

6. **Wireless Local Loop:**

   Introduction, user requirement for a WLL system, WLL systems, WLL architecture, capacity of a CDMA WLL, W-CDMA WLL, Air-loop WLL system

7. **Wireless Application protocol, Bluetooth**

   Introduction, Wireless Application protocol, goals of WAP, WAP programming model, WAP architecture, Bluetooth, Blutooth protocol stack, Bluetooth link types, Bluetooth security, network connection establishment in Bluetooth, error connection in Bluetooth, network topology on Bluetooth, Bluetooth usage models, application of WAP and Bluetooth.

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IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

- Report on assignments – 15 marks.
  Written Test – 10 marks.

V. Text Book:

1. Wireless Network Evolution 2 G to 3 G - Vijay K. Garg
   Prentice Hall PTR publication

2. Mobile and Personal Communication Systems and Services – Raj Pandya
   Prentice Hall of India Publication

3. Mobile Communications – Schiller
   Addison Wesly Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (2): Digital Voice Communication			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Telephony Background:**

Analogue networks, switching systems, transmission systems, modulation, multiplexing, signaling, subscriber loop design, calculating resistance Limit, calculating loss limit, voice digitization, pulse code modulation (PCM), time division multiplexing, high order PCM multiplex systems, traffic analysis, traffic characterization, arrival and holding time, loss systems, lost calls, network blocking probabilities, delay systems, measurement of traffic congestion, lost calls and grade of service, availability. Handling of calls, infinite and finite traffic sources, probability distribution curves, erlange and Poisson traffic formulas.

2. **Digital switching and networks:**

Space division switching, time division switching, time space time (TST) switch, space time space (STS) switch, comparison of TST and STS switches, network synchronization, control and management, timing, timing inaccuracies, network synchronization, network control, network management.

3. **Integrated service digital network (ISDN):**

ISDN overview, conceptual network, ISDN protocol structure and standards, ISDN interfaces and functions, transmission structure, user network interface, ISDN protocol architecture, ISDN connection, addressing, internetworking, ISDN physical layer: basic rate user network interface, primary rate user network interface, U interface, ISDN data link layer: LPAD protocol, terminal adaptation, bearer channel data link control, ISDN network layer: basic call control, control of supplementary services, signaling system no. 7 (SS7): signaling date link level, signaling link level, network level , ISDN signaling connection control part, ISDN user port, broadband ISDN(B – ISDN): (B – ISDNS) standards, architecture protocol reference model , B-ISDN, physical layer.

4. **Access Technologies:**
High-speed digital subscriber loops (DSL), ADSL, HDSL, VDSI, wireless local loop (WLL).

5. **Voice over IP:**

TCP/IP protocol family, internet protocol (IP) header, IP addressing, internet control manage message protocol (ICMP), transport protocol, quality of service on IP, Ethernet frame, LAN queing, resource reservation protocol (RSVP), multi protocol label switching, real time protocol

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(RTP), session initiation protocol (SIP). H. 323 standard media gateway control protocol, voice over IP gateway case studies, voice coding, properties of speech, waveform coding, vocoding, hybrid coding, telephony, signaling call set up, local loop. PBX interfaces.

6. **Voice over other packet networks:**

Voice over frame relay (VoFR), frame relay frame format, frame length handling, fragmentation, frame prioritization, frame loss handling, echo cancellation, silence suppression telephony signaling, VoFR standard, voice over ATM, ATM cell format, ATM protocol stack, ATM adaptation layer, IP over ATM, frame relay over ATM.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Digital Telephony – John C. Bellamy
2. ISDN and Broadband ISDN with Frame Relay and ATM – William Stalling.
   4th Edition, Pearson education Asia publication
3. Voice & Data Interworking – Gil Held
   Tata McGraw Hill publication.

VI. **Reference Books:**

1. IP Telephony – Oliver Hersent, David Gurle & Jean – Pierre Petit.
   Edition: 2001, Pearson Education Asia publication
2. Voice over packet networks – David J. Wright.
   John Wiley Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (3): Telecommunication Network Management			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Foundations:**

Network management standards, network management model, organization model, information model abstract syntax notation 1 (ASN.1), encoding structure, macros, functional model.

2. **Network management application functional requirements:**

Configuration management, fault management, performance management, Error correlatio technology, security management, accounting management, common management, report management, polity based management, service level management, management service, community definitions, capturing the requirements, simple and formal approaches, semi formal and formal notations.

3. **Telecommunication management network (TMN) architecture:**

Terminology, functional architecture, information architecture, physical architecture, TNN cube, TMN and OSI

4. **Common management information service element (CMISE):**

CMISE model, service definitions, errors, scooping and filtering features, synchronization, functional units, association services, common management information protocol (CMIP) specification.

5. **Information Modeling for TMN:**

Rationale for information modeling, management information model, object oriented modeling paradigm, structure of management information, managed object class definition, management information base (MIB)

6. **Simple network management protocol (SNMP):**

SNMPv1: managed networks, SNMPmodels, organization model, information model, SNMPv2: communication model, functional model, major changes in SNMPv2, structure of management information (SMI), MIB, SNMPv2 protocol, compatibility with SNMPv1, SNMPv3, architecture, applications, MIB security, remote monitoring (RMON) SMI and MIB, RMON1 and RMON2.

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7. **Network management examples:**

ATM integrated local management interface, ATM MIB. M1, M2, M3, M4, interfaces, ATM digital exchange interface management, digital subscriber loop (DSL) and asymmetric DSL (ADSL) technologies, ADSL configuration management, performance management.

8. **Network management tools:**

Network statistics management, network management system, management platform case studies: OPENVIEW, ALMAP.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Text Books:

1. Network Management: Principles and Practice – Mani Subramanian, Addison Wesley, Pearson Education Asia publication.
2. Fundamentals of Telecommunication Network Management – Lakshmi Raman IEEE Communication Society, Prentice Hall of India Edition 1999
3. Telecommunication Network Management: Technologies and Implementations – Airdarous Salah, Plevyak Thomas. Prentice Hall of India

VI. Reference Books:

1. Telecommunication Network Management – Haojin Wang Mc- Graw Hill Professional Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (4): Microwave Amplifier and Oscillator Design			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **S – Parameters:**

   Definition and use with amplifiers

2. **Noise in linear 2 port:**

3. **Microwave transistor s- parameters and tuning elements:**

   Microwave bipolar transistor, DC Biasing, impedance matching, example of transistor s-parameters and noise parameters.

4. **Amplifier Design:**

   One stage

5. **High Power Amplifier Design:**

   Device modeling and characterization, optimum loading, single stage design, multistage design.

6. **Oscillator Design:**

   Compressed Smith chart, series and parallel resonance, resonator, 2-port oscillator design, Negative resistance from transistor model oscillator, Q and output power, noise in oscillators, analytical approach to optimum oscillator design using S-parameters, non linear oscillator model, oscillator design using non linear CAD tools.

7. **Microwave Mixer Design:**

   Diode Mixer theory, single diode mixer, balanced mixer, FET mixer theory, balanced FET mixers

8. **Microwave Control Circuit Design:**

9. **Microwave Rectifier and detector design:**

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IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Reference Books:

1. Microwave Circuit Design – George D. Vendelin, Anthony M. Pavio & Ulrich L. Rehde John Wiley & Sons publication

2. Radio Frequency and Microwave Electronics – Matthew M. Radmanesh Pearson Education Asia publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (5): Optical Networks			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Optical Amplifiers:**

   Stimulated emission, Spontaneous emission, erbium- doped fiber amplifiers, praseodymium doped fiber amplifiers, semiconductor optical amplifiers, noise accumulation and network size restriction.

2. **Optical Filters:**

   Overview, Silica waveguide type filters, bulk type filters, another filters.

3. **Photonic Switches:**

   Time Division Switching (TDS), Wave Division Switching (WDS), fast – packet switching, multi dimensional switching system, OTDM, broadcast OTDM networks

4. **First Generation Optical networks:**

   SONET/SDH, computer interconnects, metropolitan area networks, layered architecture, high speed local area networks (LAN), single and multi-hop optical FDM local area networks, WDM and DWDM.

5. **Broadcast and select networks:**

   Topologies, Media Access Control (MAC), protocols, testbeds

6. **Wavelength Routing Networks:**

   Optical layer, mode designs, network design and operation, optical layer cost trade offs, routing and wavelength assignment.

7. **Virtual Topology Design (VTD):**

   Virtual Topology design problems, combined SONET / WDM problem, integer linear programming formulation, regular virtual topologies, implementation in broadcast and select networks.

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8. **Access networks:**

Network architecture overview, access networks – HFC & FTTC, Optical access network architecture.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Reference Books:**

1. Optical Networks – Rajiv Ramaswami, Kumar N. Sivarajan
Hartcourt Asia PTE Limited publication.

2. Optical FDM Network technologies – Kiyoshi Nasu
Artech House Inc. publication.

3. Photonics in switching , Vol II – Edited by John E. Midwinter,
Academic Press publication

4. Optical Networking & WDM – Walter Goralski
Tat Mc-Graw Hill publication.

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (6): Internet Communication Engineering			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction to TCP / IP:**

TCP/IP networking model, layer functions, TCP/IP protocols, services, sockets and ports, encapsulations, differences between ISO and internet layering.

2. **Internetworking layer:**

Internet protocol (IP) datagram header fields and their functions, Internet control message protocol, IP address classes, brodadcast, multicast and special addresses, network space and host space, subnets and supernets, private IP addresses, classless inter domain routing (CIDR), CIDR subnet addressing, variable length in CIDR subnet addressing.

3. **Transport layer:**

User datagram protocol (UDP) header fields and their functions, pseudo header, transmission control protocol (TCP), need for stream delivery, properties of reliable stream delivery, TCP header fields, ports, connections, end points, passive and active open, segment, stream and sequence numbers, variable window size and flow control, out of band data, checksum, acknowledgement and retransmission, round trip samples, Karn's algorithm, timer back off, response to delay variation and congestion, TCP state machine, connection establishment.

4. **Domain name system (DNS):**

Internet domain name, mapping domain name and address, domain name resolution, efficient translation, caching, DNS server message format, compresed name format, abbreviation of name, inverse mapping, pointer queries.

5. **Dynamic host configuration protocol (DHCP):**

IP address management with DHCP, standard address discovery process, address renewal process, address release process, DHCP packet structure.

6. **IP Routing:**

Table driven routing, next hop routing, default routing, the IP routing algorithm, distance vector protocol, link state protocol, routing characteristics, convergence, split horizon, poison reverse, time to line, areas, autonomous system, border routers, routing information protocol (RIP), open shortest path first (OSPF), border gateway protocol (BGP), internet control message protocol

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(ICMP), ping, echo request and reply message format, congestion and datagram flow control, source quelch, route discovery.

7. **TCP / IP Security:**

IP security (IPSec.), authentication header (AH), encapsulating security payload (ESP), mutable header fields, tunneling, firewalls and internet access, firewall implementation, packet filtering, proxy access through firewall, network address translation (NAT), port mapped NAT.

8. **IP Version6 (IPv6):**

IPv6 address format and types, routing considerations, packet header fields and their functions, auto configuration, quality of service, security, mobile users.

9. **Voice and Video over Internet:**

Voice digitization standards for voice over IP, code excited linear predictive coders (CELP), G.729, G.723.1 and G.728 standards, telephony and internet approaches for voice over IP, digital video, MPEG-2, MPEG-4, MPEG-6, H.323 architecture, H.323 protocol stack, gatekeeper, admission and status operations, internet multimedia protocols, RTP, Real time control protocol, RSVP, IP multicast, MBONE.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Internetworking with TCP / IP, Vol. I – Douglas Comer
Prentice Hall of India publication

2. IP Telephony – Oliver Hersent, David Gurle & Jean Pierre Petit. Edition - 2001
Pearson Education Asia publication

VI. **Reference Books:**

1. Advanced Internet Technologies – Uyless Black
Prentice Hall of India publication

2. Guide to TCP /IP – Laura A. Chappell, Ed. Tittel
Thomson Learning publication

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Construction Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTIONS AND EXAMINATION
(R-2001)

SECOND YEAR ENGINEERING: (Construction Engineering)

Semester III

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Applied Mathematics III (Construction)*	4	-	-	3	100	-	-	-	100
2	Surveying I*	3	3	-	3	100	25	-	-	125
3	Strength of Materials*	5	2	-	3	100	25	-	-	125
4	Building Construction*	3	-	2	3	100	25	-	-	125
5	Construction Materials & Testing*	3	2	-	3	100	25	-	-	125
6	Fluid Mechanics*	4	2	-	3	100	25	-	-	125
	Total	**22**	**9**	**2**	**-**	**600**	**125**	**-**	**-**	**725**

* Common with Civil Engineering

Semester IV

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Applied Statistics & Numerical Methods*	4	-	-	3	100	-	-	-	100
2	Surveying II*	3	3	-	3	100	25	-	25	150
3	Structural Analysis I*	5	-	2	3	100	25	-	25	150
4	Engineering Geology*	5	2	-	3	100	25	-	25	150
5	Building Design & Drawing I*	1	3	-	4	100	25	-	25	150
6	Applied Hydraulics	4	2	-	3	100	25	-	25	150
	Total	**22**	**10**	**2**	**-**	**600**	**125**	**-**	**125**	**850**

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UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTIONS AND EXAMINATION
(R-2001)

THIRD YEAR ENGINEERING: (Construction Engineering)

Semester V

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Presentation & Communication Techniques $	1.5	-	1.5	-	-	25	-	25	50
2	Structural Analysis II*	4	-	2	3	100	25	-	-	125
3	Soil Mechanics*	3	2	-	3	100	25	-	-	125
4	Building Design & Drawing II*	1	3	-	4	100	25	-	-	125
5	Building Services	3	-	2	3	100	25	-	-	125
6	Transportation Engineering I*	3	-	-	3	100	25	-	-	125
7	Construction Techniques	4	-	2	3	100	25	-	-	125
	Total	**19.5**	**5**	**7.5**	**-**	**600**	**175**	**-**	**25**	**800**

* Common with Civil Engineering
$ Common to all branches

Semester VI

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Foundation Engineering*	3	2	-	3	100	25	-	25	150
2	Design & Fabrication of Steel Structures	4	-	3	4	100	25	-	25	150
3	Environmental Engineering	5	2	-	3	100	25	-	25	150
4	Transportation Engineering II*	4	2	-	3	100	25	-	25	150
5	Engineering Economics and Accounting in Construction	4	-	-	3	100	25	-	25	150
6	Concrete Technology & Formwork Design	3	2	-	-	-	25	-	25	50
	Total	**23**	**8**	**3**	**-**	**500**	**150**	**-**	**150**	**800**

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UNIVERSITY OF MUMBAI
SCHEME OF TEACHING AND EXAMINATION
(R-2001)

FOURTH YEAR ENGINEERING: (Construction Engineering)

Semester VII

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Theory of Concrete Structures	5	-	2	3	100	25	-	-	125
2	Construction Project Management I	4	-	2	3	100	25	-		125
3	Irrigation Engineering*	4	-	2	3	100	25	-	-	125
4	Administration of Construction Contracts	4	-	2	3	100	25	-	25	150
5	Elective I	4	-	2	3	100	25	-	25	150
6	Project – A	-	-	2	-	-	25	-	-	25
	Total	**21**	**-**	**12**	**-**	**500**	**150**	**-**	**50**	**700**

Elective I: i. Advanced Engineering Geology*, ii. Advanced Surveying*, iii. Management Decision Making*, iv. Value Engineering*

Semester VIII #

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Design & Detailing of Reinforced Concrete Structures	5	-	2	4	100	50	-	25	175
2	Quantity Survey and Estimation	5	-	2	3	100	50	-	25	175
3	Construction Project Management II	4	-	2	3	100	25	-	25	150
4	Elective II	4	-	2	3	100	25	-	25	150
5	Project – B	-	-	6	-	-	50	-	50	100
6	Field Training #	-	-	-	-	-	50	-	50	100
	Total	**18**	**-**	**14**	**-**	**400**	**250**	**-**	**200**	**850**

Elective II: i. Productivity in Construction, ii. Quality Management in Construction, iii. Advanced Environmental Engineering , iv: Advanced Construction Techniques

* Common to Civil Engineering# The Semester VIII shall have two parts. First part shall consists of Field Training of Six weeks duration.
The second part shall consist of theory subjects with at least Ten weeks of instructions.

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Theory of Concrete Structures

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - 5 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - Total: 125

Detailed syllabus	
1	Reinforced Concrete Fundamentals (working Stress Method) : Concept of reinforced concrete, stress strain characteristics of concrete and steel reinforcement , elastic theory, singly reinforced , balanced section, under reinforced section and over reinforced section, analysis and design of singly reinforced doubly reinforced rectangular and T-sections, design of one way and two way slab as per IS-456(latest), shear and bond stresses and design for shear and bond, design of axially loaded columns, analysis of sections subjected to bending and axial forces(tension or compression)
2	Fundamentals of ultimate strength theory: curved stress distribution, compressive stress block, simplified rectangular stress block as per Whitney's approach, ultimate moment of resistance of singly reinforced section
3	Limit state method of design as per IS 456 (latest edition): concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to limit states of collapse in flexure, direct compression, shear and limit states of serviceability in deflection and cracking, design of singly and doubly reinforced rectangular and T sections for flexure, design of members in shear and bond, design of axially loaded columns, design of one-way and two-way slabs, design of beam subjected to bending and torsion.
4	Pre-stressed Concrete Basic principles of pre-stressed concrete: materials used and their properties, methods and systems of pre-stressing, losses in pre-stress, analysis of various types of sections subjected to pre-stress and external loads General design principles: concepts of center of compression, kern of a section, efficiency of the section, pressure line and safe cable zone, principal tension in pre-stressed concrete members
	Term Work: Each student is to appear for at least one written test during the term. Solution of at least 20 problems with neat sketches wherever necessary and the graded answer paper of the test shall be submitted as term work.

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Text books:

1. Plain and Reinforced Concrete, Vol. I, Jain & Jaikrishna, Nemchand Brothers.
2. Design of Reinforced Concrete Structures, Dayaratnam P, Oxford & IBH.
3. Design of Pre-stressed Concrete Structures, Lin T Y & Ned Burns John Wiley.
4. Prestressed Concrete, Krishna Raju, Tata McGraw Hill.
5. Ultimate Strength Design for Structural Concrete, Arthur P D & Ramkrishnan V ,Wheeler & Co.pvt ltd
6. Limit State Theory for Reinforced Concrete Design, Huges B P, Pitman.
7. Limit State design - Reinforced Concrete. Jain A K,
8. Reinforced Concrete, Warner R F, Rangan B C & Hall A S ,Pitman.
9. Reinforced Concrete , H.J. Shah, Charotar Publisher.
10. Theory of Reinforced Concrete, Shina & Roy
11. Prestressed Concrete, Evans R H & Benett E W, Chapman & Hall.
12. Limit State Design - Reinforced Concrete, Shah & Karve,
13. Illustrated Reinforced Concrete Design, Dr. V.L. Shah & Dr. S.R. Karve, Structures

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Construction Project Management I

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - Total: 125

Detailed Syllabus	
1	Management: concept of management, objectives, emergence of management thought, brief description of contributions by Fredrick Taylor, Henry Fayol, Elton Mayo and Gilbreth, basic functions of management: planning, organising, staffing, directing, co-ordinating and control
2	Construction Project: what is a project – types and characteristics of a project, phases of a project, agencies involved and their roles, methods of execution
3	Construction project planning: Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Development of plan and schedules, work break-down structure, activity lists, assessment of work content, estimating durations. Networks: Basic terminology, types of precedence relationships: finish to start, start to start, finish to finish, start to finish, preparation of CPM networks: activity on link and activity on node representation, analysis of network for networks with single (finish to start) relationships, computation of float values, critical and semi-critical paths, calendering networks, preparation of networks with overlapping relationships
4	Construction project scheduling: Bar chart, line of balance technique, resource constraints and conflicts, resource aggregation, allocation, smoothening and leveling
5	PERT method of planning: assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion
	Term work: Each student is to appear for at least one written test during the term. At least 10 problems and 10 assignments and the graded answer paper for the term test shall be submitted as term work. Exposure to available Project Planning and Scheduling software is to be provided.
	Recommended books: 1. Koontz, Management, McGraw Hill, 2. Varma M, Construction Equipment and It's Planning and Application, Metropolitan Book 3. Barrie D S & Paulson B C, Professional Construction Management, McGraw Hill 4. Dharwadkar P P, Management in Construction Industry, Oxford & IBH 5. Banga & Sharma, Industrial Organization & Engineering Economics, Khanna Publishers 6. P K Joy, Handbook of Construction Management, MacMillan

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Irrigation Engineering

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): 100 Term Work: 25 Practical: - Oral: - Total: 125

Detailed Syllabus	
1	Introduction: irrigation, water resources in India, need of irrigation in India, development of irrigation in India, impact of irrigation on human environment, irrigation systems: minor and major, command area development
2	Hydrology: hydrologic cycle, rainfall - runoff process, factors affecting runoff, runoff hydrograph, runoff computations, flood discharge calculations, unit hydrograph method, S-hydrograph
3	Water requirement of crops: 3.1 Crops and crop seasons in India, cropping pattern, duty and delta 3.2 Quality of irrigation water 3.3 Soil-water relationships: soil characteristics significant from irrigation considerations, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation 3.4 Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation
4	Ground water and well hydrology 4.1 Ground water resources, occurrence of ground water, methods of ground water exploration, well irrigation 4.2 Well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests, design of water wells
5	Distribution system: 5.1 Canal systems, alignment of canals, canal losses, estimation of design discharge 5.2 Design of channels: rigid boundary channels carrying clear and sediment laden water, alluvial channels carrying clear and sediment laden water, Kennedy's and Lacey's theory of regime channels 5.3 Canal outlets: non-modular, semi-modular and modular outlets 5.4 Waterlogging: causes, effects and remedial measures 5.5 Lining of canals: economics of lining, types of lining 5.6 Drainage of irrigated lands: necessity, methods
6	Canal structures: 6.1 Surface and sub-surface flow considerations for design of canal structures: hydraulic jump, seepage forces, uplift forces 6.2 Canal falls, cross regulator, distributary head regulator, canal escapes: types, components and design considerations 6.3 Cross drainage works: need, types, design considerations
7	Canal headworks: 7.1 Weir and barrage, different units of headworks, types of weirs, sediment control in canals, river training for canal headworks 7.2 Theories of seepage for design of weirs: Bligh's creep theory, Lane's weighted creep theory, Khosala's method of independent variables

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8	Dams and spillways: 8.1 Embankment dams: Classification, selection of site for dam, design considerations, estimation and control of seepage, slope protection 8.2 Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile, structural joints, keys and water seals, galleries, outlets 8.3 Arch and buttress dams: types 8.4 Spillways: components of spillways, types, terminal structures, types of gates for spillway crests
9	Reservoirs: types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site, flood routing
	Term work: Each student is to appear for at least one written test during the term. At least 10 numerical problems and 10 descriptive assignments including sketches of relevant hydraulic structures and the graded answer paper for the term test shall be submitted as term work.
	Text books: 1. G L Asawa, Irrigation Engineering, Wiley eastern 2. S K Garg, Irrigation Engineering & Hydraulic Structures, Khanna Publishers 3. P N Modi, Irrigation Engineering & Hydraulic Structures, **Reference books:** 1. J D Zimmerman, Irrigation, John Wiley & Sons 2. Varshney, Gupta & Gupta, Theory and Design of Irrigation Structures, Nem Chand & Bros 3. Punmia B C & Pande B B lal, irrigation Engineering and Water Power Engineering, Laxmi Publications

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Administration of Construction Contracts

Class: B. E. (Construction Engineering)		Semester: VII	
Periods per week:		Evaluation System:	
Lectures:	- 4	Theory paper (3 Hours):	100
Practicals:	-	Term Work:	25
Tutorials:	-2	Practical:	-
		Oral:	25
		Total:	**150**

Detailed Syllabus	
1	Methods of executing construction projects: departmental method, contract method, piece work system, day-work system, comparative merits and demerits
2	Stages in contracting: Notice inviting tenders Tender documents: contents, general conditions of contract like, tender validity period earnest money deposit and security deposit, performance bond, etc. Prequalification and post-qualification: purpose and methods Prebid conference: purpose and procedure Award of contract: scrutiny and acceptance of tender, letter of intent, signing of contract
3	Construction contracts: Definition, valid, invalid and voidable contract Indian Contract Act, relevant sections, obligations, rights and responsibilities of parties to the contract Types of construction contracts: item rate, percent rate, cost plus, lumpsum, turnkey, BOT etc., suitability of type of contract for different types of works, role and responsibilities of client and contractor in each type of contract
4	Contract documents: Standard contract documents, general and special conditions of contract, conditions related to time of completion, maintenance period, extension of time, subletting, interim and final payments, advances and their recoveries, change orders, price variation , Breach of contract: reasons and remedies for breach, liquidated damage Termination of contract
5	Claims and disputes: Types of claims, settlement procedures Dispute resolution methods: mediation, arbitration, litigation Arbitration: Arbitration and conciliation Act, process of arbitration
6	Labour laws: historical developments in labour legislation, Purpose and general provisions of following acts: Industrial disputes act, Payment of wages act, Contract labour (regulation & abolition) act, Minimum wages act, Interstate migrant workmen (regulation of employment and conditions of services) act, The building and other construction workers (regulation of employment and conditions of service) act, The building and other construction workers welfare cess act

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	Term work: Each student is to appear for at least one written test during the term. At least 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Recommended books: 1. Reddy Narsinha B V, Engineers, Contractors and Arbitration, 2. Gajaria G T, Law Related to Building and engineering Contract in India, N M Tripathi P Ltd 3. Clough R H, Construction Contracting, Wiley 4. Fisk E R, Construction Project Administration, Wiley

Elective I :Advanced Engineering Geology

Class: **B. E. (Civil / Construction Engineering)**	Semester: **VII**
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: **150**

Detailed Syllabus	
1	Introduction Importance of geological studies in engineering investigations, precautions to avoid misleading conclusions likely to be drawn while interpreting drilling data with particular reference to RQD, case histories illustrating economies made possible by proper geological studies
2	Engineering geology of Deccan Trap basalts Factors affecting strength and water tightness, stability of cuts and ability to stand without support, significance of features like gas cavities, jointing, waeathering, hydrothermal alteration, volcanic bracias, techylytes, dykes, fractures, field structures of flows, stratigraphic sequence of flows etc. and their significance in civil engineering projects
3	Dams Strength and watertightness of Deccan trap rocks from foundation point of view, physical properties such as compressive strength, water absorption etc. of basalts, effect of weathering and hydrothermal alteration on engineering properties of rocks, deterioration of rock masses on exposure to atmosphere and suitable treatment for such rocks Investigations for determining the foundation treatment for adverse geological features, determination of foundation levels / cutoff levels for dams, groutability of rocks, correction of adverse feature by grouting, purpose of consolidated and curtain grouting, determining depth and zones of grouting, relation of zones of grouting with height of dams, foundation treatment for fractures having different manifestation, jointed racks, tachylytes and dykes Erosion of tail channel as a factor in selecting site for spllway, causes of rapid erosion from side spillways, geological conditions leading to erosion Case histories

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4	Tunneling Methodologies of investigations for different types of tunnels for different purposes, location, spacing, angles and depths of drill holes for different types of tunnels, difference in behaviour of basalts because of jointing as exemplified by compact basalts and amygdaloidal basalts. Difficulties introduced by tachylytes, volcanic breccias, tuffs, intertrappean beds, fractures, dykes, hydrothermal alteration, flow contacts and unfavourable field characters. Computing structural discontinuities in rock masses, RQD, joint frequency index, RMR values, Q system, standup time. Selection and provision of protective measures such as guniting, rock bolting, shotcreting, steel fibre shotcreting, permanent steel supports, lagging, concreting and contact grouting above steel supports depending on geological conditions. Suitability of TBM for tunneling. Case histories
5	Bridges Investigations for bridge foundations, computing SBC for bridge foundation based on nature and structure of rock, foundation settlements Case histories
6	Geology of soil formation Residual and transported soils. Rock weathering conditions favourable for decomposition and disintegration, influence of climate on residual and transported soils in the deccan trap area. Nature of alluvium of deccan trap rivers and its engineering character. Effect of deposition of calcium carbonate. Scarcity of sand in the rivers in deccan trap area
7	Geophysical investigations Seismic and electrical resistivity methods of explorations
8	Construction material Deccan trap basalts as construction material. Use of compact basalts and amygdaloidal basalts as rubble for masonry, metal for concrete making
	Practicals: • Logging of drill core, preparation of lithologs and interpreting drilling data, calculation of RQD and joint frequency index. Preparing geological cross-sections from drill hole data and using them for designing of civil engineering structures • Use of electrical resistivity method for determining depth of bed rock • Study of geological aspects of an engineering projects and writing a report based on studies carried out during visits to civil engineering projects
	Term Work: Each student is to appear for at least one written test during the term. Reports on experiments performed as detailed above and the graded answer paper for the term test shall be submitted as term work. A brief report on a visit to a project site with reference to geological conditions should also be included in the journal.
	Reference books: 1. PWD handbook, Engineering Geology, Government of Maharastra 2. Textbook of Engineering Geology, R E Gupte, PVG Prakashan 3. Geology of India, D H Wadia 4. Geology of India and Burma, M E Krishnan

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Elective I: Advanced Surveying

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus	
1	Modern Surveying Equipment Data and equipment needed for engineering projects, review of traditional surveying equipment. Changing scene in surveying and mapping, map substitutes, use and advantage of modern surveying equipment in project. Modern surveying electronic equipment, their principles, constructions, working and use – Electronic Theodolite, E.D.M. Instrumens – Geodimetor, Tellurometer, Distomat, total station. Application of lasers in distance and angular measurements, introduction of electronic navigation and position fixing – different systems and their characteristics
2	Global Positioning System Global positioning system – working principles and methods. Different approaches to is GPS and their accuracies, advantages of GPS in navigation, survey, planning and mapping
3	Geographic information system Geographic information system – data requirement and database creation. Use of field data, maps, aerial and satellite data. Advantages of GIS
4	Photogrammetry Definition of Photogrammetric terms, geometry of aerial and terrestrial photographs, aerial camera and photo – theodolite, scales of a photograph, tilt and height displacements, stereoscopic vision and stereoscopes, height determination from parallax measurements, flight planning, maps and map substitutes and their uses
5	Remote sensing Introduction and definition of remote sensing terms, remote sensing system, electromagnetic radiation and spectrum, special signature, atmospheric windows, different types of platforms, sensors and their characteristics, orbital parameters of a satellite, multi concept in remote sensing
6	Image interpretation Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantages of multidate and multiband images, digital image processing concept
7	Field astronomy Terms, co-ordinate systems, hour angle, right ascension, declination, altitude, azimuth: study of astronomical charts, determination of latitude and true bearing by observation on the sun and polestar, time, standard time, local time, universal time, equation of time

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	Practicals: • At least three practicals based on the above syllabus are to be conducted.
	Term Work Each student has to appear for at least one written test during the term. Report on the practicals conducted, at least five assignments and the graded test paper shall be submitted as the term work. **Reference Books:** 1. Campbell J.B., "Introduction to Remote Sensing", The Guilford Press, London, 1986 2. Curran P.J., "Principles of Remote Sensing", Longman, London, 1985. 3. Kennie T.J.M Petrie G., "Engineering Surveying Technology"/ Blackie & Sons Ltd, London,1990. 4. Wolf P.R., "Elements of Photogrammetry", Tata McGraw Hill Book Company, New Delhi, 1986.

Elective I: Management Decision Making

Class: **B. E. (Civil / Construction Engineering)**	Semester: **VII**
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: **150**

Detailed Syllabus	
1	Concept of systems approach: system, boundaries of system, goals and objectives, optimality, mathematical models, objective function and constraints, problem solving mechanism, types of problems, modeling / problem formulation, sub-optimization, solution techniques, sensitivity analysis
2	Decision theory: classification of decision situations, decision tables and decision tree, criteria for decision making under certain, uncertain and risk conditions, utility theory
3	Time series analysis: variations in time series, trend analysis: method of moving averages, method of least squares
4	Index numbers: basic requirements of index numbers, constructing index numbers: using relatives, using aggregates
5	Linear programming: general nature of problem, formulation of problems, graphical method of solution, simplex method, dual, sensitivity analysis
6	Distribution models: transportation and assignment problems and their solutions
7	Queuing models: various situations, queue discipline and customer behaviour, single server model
8	Basic functions of inventory and inventory decisions, Inventory control model – economic order quantity
9	Simulation: general approach, Monte Carlo simulation, simple problems using hand calculations
	Term work: Each student is to appear for at least one written test during the term. At least two assignments and 3 problems on each of the topic and the graded answer paper for the term test shall be submitted as term work.

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	Recommended Books: 1. Varma Mahesh, Construction Planning & Management through Systems Techniques, Metropolitan 2. Ossenbruggen P J, Systems Analysis for Civil Engineers 3. Shrivastava, Shenoy & Sharma, Quantitative Techniques for Managerial Decisions, Wiley Eastern

Elective I : Value Engineering

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: **150**

Detailed Syllabus	
1	**Introduction** Definitions: Value, value engineering, value analysis, value management, background & history of value engineering, habits, roadblocks & attitudes and their relation to value engineering
2	**Value Engineering Job Plan** Various versions of job plan, phases of job plan: information, creative, analytical, investigation , recommendation, implementation
3	**Function Analysis** Function & its role in achieving value, function in terms of its cost & worth, Graphical function analysis: function analysis system technique
4	**Creative thinking** Definition, creative people, creative processes, conducting creative session
5	**Life cycle costing** Definition, purpose & implications, economic principles for life cycle costing, types of life cycle costs.
6	**Energy** Energy resources & consumption, energy cost escalation, sources of energy supply, end use of energy, energy embodiment of construction materials, buildings, infrastructures facilities & energy systems, energy models, factors affecting energy consumption, impact of maintenance on energy saving.
7	Value engineering case studies
	Termwork Each student is to appear for at least one written test during the term. At least five assignments and at least one case study report following complete job plan and graded answer paper of the term test will be submitted as term work.
	Recommended Books: 1.Value Engineering – L.W. Zimmerman, G.D.Hart, CBS publishers & distributors 2.Proffessional Construction Management- Barrie & pualson, McGraw Hill 3. Value Engineering in the Construction Industry- Dell'Isola, A J, Construction Publication Company. 4. Value analysis in design & Construction, O'brien, J J, McGraw Hill

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Project – A

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - Practicals: - Tutorials: - 2	Evaluation System: Theory paper : Term Work: - 25 Practical: - Oral: - Total: **25**

The students are expected to take up a project on one of the Civil / Construction Engineering problems to be completed in Semester VII and Semester VIII.
This may include,

- experimental analysis / verification,
- development of design methods and verification,
- design and fabrication of a model for a civil engineering project,
- design of civil engineering structures and preparation of working drawings,
- developing a software for analysis and / or design or decision making in civil engineering and management practice
- technical and / or economic feasibility study

The students may be asked to work individually or in groups with not more than five students in each group.

Basic study through review of literature on the topic selected shall be completed. The scope of the project, identification of necessary data, sources of such data etc. shall be identified. The student / group of students has to prepare a brief report on the work done during the semester and is to be submitted. The report should at least include objective of the project, scope of the project and methodology.

Design and Detailing of Reinforced Concrete Structures

Class: B. E. (Construction Engineering)	Semester: VIII
Periods per week: Lectures: - 5 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (4 Hours): - 100 Term Work: - 50 Practical: - Oral: - 25 Total: **175**

Detailed Syllabus	
1	Design of Foundations (limit state method of design): Isolated square and rectangular footings subjected to axial load and moments, Design of combined foundations, Rectangular foundations and simple raft
2	Design of staircases (limit state method of design): Doglegged, Open well type
3	Complete design of residential, office or industrial building including staircase and foundations (limit state method of design)
4	Design of retaining walls (limit state method of design): Cantilever, Counterfort type
5	Design of water tanks (working stress method): Circular and rectangular, at ground level, underground and overhead - both by IS coefficient and approximate methods, supporting structure for overhead water tanks.

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	Term work: A design report and at least four A1 (imperial) size drawings sheets for three projects covering the above syllabus shall be submitted as term work. All drawing work is to be done in pencil only. Exposure to design by available software for design. Each student has to appear for at least one written test during the term. The term work mentioned as above and the graded test paper shall be submitted as the term work.
	Oral Examination: There shall be a sketching examination of 30 minutes duration followed by oral examination.
	Recommended Books: 1. Limit State Theory for Reinforced Concrete Design, Huges B. P., Pitman 2. Limit State Design – Reinforced Concrete, Jain A. K. 3. Reinforced Concrete, Warener R. F., Rangan B.C. & Hall A. S. 4. Illustrated Design G+3 Building, Shah & Karve, Structural Publishers 5. Reinforced Concrete, S. N. Sinha 6. Reinforced Concrete, H. J. Shah, Charotar Publisher 7. Relevant I.S. codes

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Quantity Survey & Estimation

Class: B. E. (Construction Engineering)	Semester: VIII
Periods per week: Lectures: - 5 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (4 Hours): - 100 Term Work: - 50 Practical: - Oral: - 25 Total: 175

Detailed Syllabus	
1	Estimates: Various types, their relative importance. factors to be considered, complete set of Estimate. Approximate estimates: importance, purpose, different methods. Use of CBRI Equations for the same. Methods of preparation of estimates for projects such as I) Building R.C.C., Load bearing ii) Road iii) Irrigation and iv) Water supply and sewerage: miscellaneous works like Manhole, water storage tank, septic tanks v) Trusses of steel
2	Measurements for various items: Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams
3	Material survey: Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials
4	Specifications: types, requirements and importance, detailed specifications for the buildings, roads, minor bridges and industrial structures
5	Rate analysis: purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment
6	Tender: preparation of tender documents, importance of inviting tenders, contract types, relative merits,. prequalification. general and special conditions, termination of contracts, extra work and items, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance , insurance, claims, price variation, etc.
7	Introduction to acts pertaining to : Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights
8	Valuation : different terms used, the role of a valuer, purpose and necessity of the same. Capitalised Value, Years purchase ,sinking fund, depreciation, types of values, Purpose of valuation, Different methods of valuation for open plots and open plots with existing residential buildings.
9	Use of computers in quantity surveying

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	Termwork The term work shall consist of the following: i. To find out the approximate estimate of a multistoried building by approximate method. ii. Detailed estimate of at least four of the following with the required material survey for the sam a. a ground plus three storied building (RCC) b. a bridge with minimum 2 spans c. a factory building d. a road work e. a cross drainage work f. a load bearing structure iii. Assignments on rate analysis, specifications and simple estimates. iv. Detailed estimate of minor structure v. Bar bending schedule Each student is to appear for at least one written test during the term. The term work detailed above and the graded answer paper for the term test shall be submitted as term work.
	Text Books: 1. M Chakravarty, Estimating, Costing Specifications & Valuation 2. Joy P K, Handbook of Construction Management, Macmillan 3. B.S. Patil , Building & Engineering Contracts **References:** 1. Relevant Indian Standard Specifications 2. World Bank approved contract documents 3. FIDIC contract conditions 4. Bare Acts related to Minimum wages, Workman's compensation, Contract, and Arbitration.

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Construction Project Management II

Class: B.E. (Construction Engineering)	Semester: VIII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): 100 Term Work: 25 Practical: - Oral: 25 Total: 150

Detailed Syllabus	
1	Organising: Organisation as a management function, principles of organisation, structure of organisation, line, line & staff, functional and matrix forms of organisation, selecting the project manager, Organising for site, mobilisation and winding up, site layout
2	Personnel management: importance and objectives, manpower estimation and planing for projects, recruitment methods, training of personnel, performance evaluation, importance and methods of motivation
3	Monitoring & control: supervision, record keeping, periodic progress reports, Updating of plans: purpose, frequency and methods of updating, Time cost tradeoff in construction projects, compression and decompression, common causes of time and cost overruns and corrective measures,
4	Communication Importance, elements of communication systems Types of communication: written & non-written, verbal & non-verbal, formal & informal, barriers to effective communication
5	Materials management: importance and objectives, estimation and planning of materials, ABC analysis, procurement procedures, vendor evaluation, stock and inventory control, concept of economic order quantity, reorder level and reorder quantity, storage of materials, record keeping for materials management
6	Equipment management: mechanization in construction, sources of construction equipment, selection of equipment, standardization, matching and balancing of equipment, location on site for optimum utilization, cost of equipment, maintenance policies, record keeping for equipment management
7	Quality control: Definition of quality, elements of quality, quality in various stages of project, use of manuals and checklists for quality control, role of inspection
8	Cost control: cost codification, tracking of costs, control budget, collection of data and reporting for cost control, time cost trade off, compression and decompression of project plans, cash flow analysis, variance analysis
9	Productivity in construction: Concept of productivity in construction projects, factors affecting construction productivity, work study techniques for improving productivity
10	Safety and health on project sites: accidents: their causes and effects, costs of accidents, occupational health problems in construction, organising for safety and health
11	Management information systems for construction projects

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	Term work: Each student is to appear for at least one written test during the term. At least 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Oral Examination: The oral examination will be held on syllabus of both Project Management I and Project Management II.
	Recommended books: 1. Koontz, Management, McGraw Hill, 2. Varma M, Construction Equipment and It's Planning and Application, Metropolitan Book 3. Barrie D S & Paulson B C, Professional Construction Management, McGraw Hill 4. Beneath J, Construction Project Management, Butterworths 5. Helpin D W & Woodhead R W, Construction Management, Wiley 6. Joy P K, Handbook of Construction Management, Macmillan

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Elective II. Productivity in Construction

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus	
1	Productivity 1.1 Definition and importance of productivity in construction 1.2 Measurement of productivity, productivity of construction resources; labour, materials and equipment, factors affecting productivity 1.3 Improvement of productivity: basic and added work content and related time contents of job, productivity improvement techniques
2	Work study 2.1 Definition and purpose, historical developments 2.2 Method study: definition and objectives of conducting method study 2.3 Steps in applying method study: select, record, critical examination, development, installation and maintenance, recording techniques: outline process charts, flow process charts, flow diagram, two handed process charts, multiactivity chart, travel chart, string diagram, layout maps. 2.4 Micromotion studies, sino-chart, cyclegraph and chrono cycle graph, photographic techniques, THERBLIGS 2.5 Work measurement: definition and objectives, various techniques of work measurement 2.6 Time study: Purpose of time study, time measuring devices, recording methods, steps in time study, rating of a worker, observed time, basic time, relaxation, allowances, standard time of an operation 2.7 Work sampling techniques: basis of work sampling, concept of accuracy and reliability 2.8 Analytic and synthetic time standards
3	Use of work study techniques in improving construction productivity.
	Term work: Each student is to appear for at least one written test during the term. At least 10 assignments and the graded answer paper for the term test shall be submitted as term work
	Recommended books: 1. Oglesby, Clarkson H et al, Productivity Improvement in Construction, McGraw Hill 2. Work Study, ILO 3. Alfed L E, Construction Productivity, McGraw Hill

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Elective II. Quality Management in Construction

Class: B. E. (Construction Engineering)	Semester: VIII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): 100 Term Work: 25 Practical: - Oral: 25 Total: **150**

Detailed Syllabus	
1	Basic concepts and definitions: quality, quality engineering, quality control, quality assurance, total quality management
2	Elements of quality: 2.1 Quality characteristics: tangible and intangible parameters of quality 2.2 Quality of design: role of various agencies involved and codes and specifications 2.3 Quality of conformance and quality of performance
3	Economics of quality: cost of quality; cost of conformance, cost of non-conformance and cost of lost opportunities
4	Organisation for quality: identifying tasks, responsibilities and procedures, quality systems, typical organisation structures, preparation of manuals, flow charts and checklists, role of inspection, stages in quality inspection
5	Statistical quality control: 5.1 Review of basic concepts of statistics: measures of central tendency, measures of dispersion, frequency curves, frequency distributions 5.2 Sampling: methods of sampling, sample size, acceptance sampling 5.3 Control charts: construction, interpolation and inferencing
6	Miscellaneous concepts and tools of quality management: kaizen concept, quality circles, fishbone diagram (Ishikawa diagram), Pareto diagram
	Term work: Each student is to appear for at least one written test during the term. At least 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Recommended books: 1. The essence of total quality management, John Bank, Prentice Hall of India, 1995 2. Inspection and Quality Control in Building Works, A C panchadhari, Mandakini Publishers 3. Quality Assurance in Construction, Dunkan, thorpe & Summer, Gower

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Elective II. Advanced Environmental Engineering

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: **150**

Detailed Syllabus	
1	Industrial water treatment Methods of treatment, adsorption, desorption, ion exchange, demineralization, removal of specific ions from water, reverse osmosis, electrolysis, multiple effect evaporations, recovery of water and byproduct, quality of water for various treatments
2	Municipal solid waste management Sources, types and composition of municipal waste, physical, chemical and biological properties of municipal solid waste, methods of segregation, collection and conveyance, factors affecting solid waste generation and collection, separation of waste materials such as screening, density separation, magnetic separation, densification Methods of disposal of solid wastes: land fill method, composition and characteristics, leachate control methods, composting, incineration, environmental aspects
3	Air Pollution Definitions, types and units of measurement for particulates and gaseous pollutants, sources of pollutants, particulate characteristics, effect of air pollution on human beings, global effects of air pollution, methods of sampling and measuring air pollutants, eminent air quality standards, control devices for air pollutants
4	Noise Pollution Effects of noise pollution on health, measurements, methods of control
	Term Work Each student is to prepare a report on one of the topics of the syllabus. The report shall contain literature review and a case study. Each student is to appear for at least one written test during the term. The report as mentioned above, at least 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Text Books and References: Industrial Water Treatment Practice, Hammer, Jackson, and Thurston, Butterworths. Water Conditioning for Industries, Powell Integrated Solid Waste Management, Tchbanoglus, Theisen and Vegil, McGraw Hill Environmental Engineering, Peavy, Rowe and Tchbanoglus, McGraw Hill Introduction to Environmental Engineering, Davis and Cornwel, McGraw Hill

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Elective II. Advanced Construction Techniques

Class: B. E. (Construction Engineering)	Semester: VIII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): 100 Term Work: 25 Practical: - Oral: 25 Total: 150

Detailed Syllabus:	
1	Soil stabilization Definitions and necessity: Methods of Soil stabilization: sand drains, use of lime, cements bitumens & columns.soil nailing, reinforced earth
2	Grouting Definition, types of grouts:- suspension grouts-grouting with soil, grouting with bentonite-cement mixes, grouting with asphalt emulsions Solution grouts- silicate derivatives, hignousulphate derivatives, water reactive grouts; phenoplasts, aminoplasts Grouting pressures, grouting materials and grouting equipments, guniting & shortcrete
3	Contsruction of foundations in deep water Pile foundations – types, suitability, construction methods Cofferdams and cassions – types, suitability, construction methods
4	Concrete construction Concreting under water, concreting in extreme weather conditions, transport, placing and compaction of concrete, use of ready mixed concrete, vacuum processing of concrete, joints of concrete, high density concrete, fibre reinforced concrete, light weight concrete, IS recommendations for hot and cold weather concrete
5	Foundation control techniques Non destructive testing including geophysics, seismic reflection, seismic refraction, electrical resistivity, magnetometry, ground – probing radar (GPR) Foundation instrumentation: load measurement, earth pressure measurement, deformation monitoring, pour water pressure measurement
6	Geotextiles (filter fabric) Introduction, geotextiles as separators, as reinforcement and in filteration and drainage Geotextiles in erosion control
7	Pile driving equipment: types, pile driving hammers – single and double acting, differential acting hammers, hydraulic and disel hammers, vibratory pile drivers
8	Miscellaneous Building construction systems – on site precasting, tilt-up, slip form, lift slab construction Ferrocement and its products Low cost housing systems
	Term work: Each student is to appear for at least one written test during the term. At least 10 sketches, and 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Text Books and References: 1. Construction and Geotechnical Methods in Foundation Engineering, R M Koerner, McGraw Hill 2. Construction Planning, Equipment and Methods, R L Peurifoy, McGraw Hill

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Project - B

Class: B. E. (Construction Engineering)		Semester: VIII	
Periods per week:		Evaluation System:	
Lectures:	-	Theory paper :	
Practicals:	-	Term Work:	- 50
Tutorials:	- 6	Practical:	-
		Oral :	- 50
		Total:	**100**

Details:	
	Further to Semester VII work, the student / group of the students shall collect all necessary information pertaining to the project and analyse it. The student / group of the students shall prepare and submit a report on the project. The report shall be typewritten on A4 size paper and hard-bound and prepared in an academic style. Broadly the report shall have four parts: Introduction, Literature review, Data collection and analysis, and Conclusions. Acquaintance with survey and research methods and their use in conducting a systematic invest use of data analysis tools, computational methods and style of report preparation and presentati form basis of evaluation.

Field Training

Class: B. E. (Construction Engineering)		Semester: VIII	
Periods per week:		Evaluation System:	
Lectures:	-	Theory paper :	
Practicals:	-	Term Work:	- 50
Tutorials:	-	Practical:	-
		Oral :	- 50
		Total:	**100**

Details:	
	Each student shall undergo a practical training for a period of at least six weeks before the beginning of the Semester VIII. The student is expected to spend the time of the training on study of various engineering and management aspects of construction like; construction methods, preparation of detailed working drawings, site layout, site organization, site records, progress monitoring, quality control techniques etc. The student shall prepare a detailed typewritten report on the training experience and submit it as term work. The report shall clearly bring out the learning that has taken place during the training period.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Construction Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTIONS AND EXAMINATION
(R-2001)

SECOND YEAR ENGINEERING: (Construction Engineering)

Semester III

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Applied Mathematics III (Construction)*	4	-	-	3	100	-	-	-	100
2	Surveying I*	3	3	-	3	100	25	-	-	125
3	Strength of Materials*	5	2	-	3	100	25	-	-	125
4	Building Construction*	3	-	2	3	100	25	-	-	125
5	Construction Materials & Testing*	3	2	-	3	100	25	-	-	125
6	Fluid Mechanics*	4	2	-	3	100	25	-	-	125
	Total	**22**	**9**	**2**	**-**	**600**	**125**	**-**	**-**	**725**

* Common with Civil Engineering

Semester IV

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Applied Statistics & Numerical Methods*	4	-	-	3	100	-	-	-	100
2	Surveying II*	3	3	-	3	100	25	-	25	150
3	Structural Analysis I*	5	-	2	3	100	25	-	25	150
4	Engineering Geology*	5	2	-	3	100	25	-	25	150
5	Building Design & Drawing I*	1	3	-	4	100	25	-	25	150
6	Applied Hydraulics	4	2	-	3	100	25	-	25	150
	Total	**22**	**10**	**2**	**-**	**600**	**125**	**-**	**125**	**850**

* Common with Civil Engineering

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UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTIONS AND EXAMINATION
(R-2001)

THIRD YEAR ENGINEERING: (Construction Engineering)

Semester V

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Presentation & Communication Techniques $	1.5	-	1.5	-	-	25	-	25	50
2	Structural Analysis II*	4	-	2	3	100	25	-	-	125
3	Soil Mechanics*	3	2	-	3	100	25	-	-	125
4	Building Design & Drawing II*	1	3	-	4	100	25	-	-	125
5	Building Services	3	-	2	3	100	25	-	-	125
6	Transportation Engineering I*	3	-	-	3	100	25	-	-	125
7	Construction Techniques	4	-	2	3	100	25	-	-	125
	Total	**19.5**	**5**	**7.5**	-	**600**	**175**	-	**25**	**800**

* Common with Civil Engineering
$ Common to all branches

Semester VI

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Foundation Engineering*	3	2	-	3	100	25	-	25	150
2	Design & Fabrication of Steel Structures	4	-	3	4	100	25	-	25	150
3	Environmental Engineering	5	2	-	3	100	25	-	25	150
4	Transportation Engineering II*	4	2	-	3	100	25	-	25	150
5	Engineering Economics and Accounting in Construction	4	-	-	3	100	25	-	25	150
6	Concrete Technology & Formwork Design	3	2	-	-	-	25	-	25	50
	Total	**23**	**8**	**3**	-	**500**	**150**	-	**150**	**800**

*** Common with Civil Engineering**

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UNIVERSITY OF MUMBAI
SCHEME OF TEACHING AND EXAMINATION
(R-2001)

FOURTH YEAR ENGINEERING: (Construction Engineering)

Semester VII

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Theory of Concrete Structures	5	-	2	3	100	25	-	-	125
2	Construction Project Management I	4	-	2	3	100	25	-		125
3	Irrigation Engineering*	4	-	2	3	100	25	-	-	125
4	Administration of Construction Contracts	4	-	2	3	100	25	-	25	150
5	Elective I	4	-	2	3	100	25	-	25	150
6	Project – A	-	-	2	-	-	25	-	-	25
	Total	**21**	**-**	**12**	**-**	**500**	**150**	**-**	**50**	**700**

Elective I: i. Advanced Engineering Geology*, ii. Advanced Surveying*, iii. Management Decision Making*, iv. Value Engineering*

Semester VIII #

	Subjects	No of periods per week (60 minutes each)			Duration of theory paper (hours)	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1	Design & Detailing of Reinforced Concrete Structures	5	-	2	4	100	50	-	25	175
2	Quantity Survey and Estimation	5	-	2	3	100	50	-	25	175
3	Construction Project Management II	4	-	2	3	100	25	-	25	150
4	Elective II	4	-	2	3	100	25	-	25	150
5	Project – B	-	-	6	-	-	50	-	50	100
6	Field Training #	-	-	-	-	-	50	-	50	100
	Total	**18**	**-**	**14**	**-**	**400**	**250**	**-**	**200**	**850**

Elective II: i. Productivity in Construction, ii. Quality Management in Construction, iii. Advanced Environmental Engineering , iv. Advanced Construction Techniques

* Common to Civil Engineering# The Semester VIII shall have two parts. First part shall consists of Field Training of Six weeks duration.
The second part shall consist of theory subjects with at least Ten weeks of instructions.

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Theory of Concrete Structures

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - 5 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - Total: 125

Detailed syllabus	
1	Reinforced Concrete Fundamentals (working Stress Method) : Concept of reinforced concrete, stress strain characteristics of concrete and steel reinforcement , elastic theory, singly reinforced , balanced section, under reinforced section and over reinforced section, analysis and design of singly reinforced doubly reinforced rectangular and T-sections, design of one way and two way slab as per IS-456(latest), shear and bond stresses and design for shear and bond, design of axially loaded columns, analysis of sections subjected to bending and axial forces(tension or compression)
2	Fundamentals of ultimate strength theory: curved stress distribution, compressive stress block, simplified rectangular stress block as per Whitney's approach, ultimate moment of resistance of singly reinforced section
3	Limit state method of design as per IS 456 (latest edition): concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to limit states of collapse in flexure, direct compression, shear and limit states of serviceability in deflection and cracking, design of singly and doubly reinforced rectangular and T sections for flexure, design of members in shear and bond, design of axially loaded columns, design of one-way and two-way slabs, design of beam subjected to bending and torsion.
4	Pre-stressed Concrete Basic principles of pre-stressed concrete: materials used and their properties, methods and systems of pre-stressing, losses in pre-stress, analysis of various types of sections subjected to pre-stress and external loads General design principles: concepts of center of compression, kern of a section, efficiency of the section, pressure line and safe cable zone, principal tension in pre-stressed concrete members
	Term Work: Each student is to appear for at least one written test during the term. Solution of at least 20 problems with neat sketches wherever necessary and the graded answer paper of the test shall be submitted as term work.

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Text books:

1. Plain and Reinforced Concrete, Vol. I, Jain & Jaikrishna, Nemchand Brothers.
2. Design of Reinforced Concrete Structures, Dayaratnam P, Oxford & IBH.
3. Design of Pre-stressed Concrete Structures, Lin T Y & Ned Burns John Wiley.
4. Prestressed Concrete, Krishna Raju, Tata McGraw Hill.
5. Ultimate Strength Design for Structural Concrete, Arthur P D & Ramkrishnan V ,Wheeler & Co.pvt ltd
6. Limit State Theory for Reinforced Concrete Design, Huges B P, Pitman.
7. Limit State design - Reinforced Concrete. Jain A K,
8. Reinforced Concrete, Warner R F, Rangan B C & Hall A S ,Pitman.
9. Reinforced Concrete , H.J. Shah, Charotar Publisher.
10. Theory of Reinforced Concrete, Shina & Roy
11. Prestressed Concrete, Evans R H & Benett E W, Chapman & Hall.
12. Limit State Design - Reinforced Concrete, Shah & Karve,
13. Illustrated Reinforced Concrete Design, Dr. V.L. Shah & Dr. S.R. Karve, Structures

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Construction Project Management I

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - Total: 125

Detailed Syllabus	
1	Management: concept of management, objectives, emergence of management thought, brief description of contributions by Fredrick Taylor, Henry Fayol, Elton Mayo and Gilbreth, basic functions of management: planning, organising, staffing, directing, co-ordinating and control
2	Construction Project: what is a project – types and characteristics of a project, phases of a project, agencies involved and their roles, methods of execution
3	Construction project planning: Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Development of plan and schedules, work break-down structure, activity lists, assessment of work content, estimating durations. Networks: Basic terminology, types of precedence relationships: finish to start, start to start, finish to finish, start to finish, preparation of CPM networks: activity on link and activity on node representation, analysis of network for networks with single (finish to start) relationships, computation of float values, critical and semi-critical paths, calendering networks, preparation of networks with overlapping relationships
4	Construction project scheduling: Bar chart, line of balance technique, resource constraints and conflicts, resource aggregation, allocation, smoothening and leveling
5	PERT method of planning: assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion
	Term work: Each student is to appear for at least one written test during the term. At least 10 problems and 10 assignments and the graded answer paper for the term test shall be submitted as term work. Exposure to available Project Planning and Scheduling software is to be provided.
	Recommended books: 1. Koontz, Management, McGraw Hill, 2. Varma M, Construction Equipment and It's Planning and Application, Metropolitan Book 3. Barrie D S & Paulson B C, Professional Construction Management, McGraw Hill 4. Dharwadkar P P, Management in Construction Industry, Oxford & IBH 5. Banga & Sharma, Industrial Organization & Engineering Economics, Khanna Publishers 6. P K Joy, Handbook of Construction Management, MacMillan

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Irrigation Engineering

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): 100 Term Work: 25 Practical: - Oral: - Total: 125

Detailed Syllabus	
1	Introduction: irrigation, water resources in India, need of irrigation in India, development of irrigation in India, impact of irrigation on human environment, irrigation systems: minor and major, command area development
2	Hydrology: hydrologic cycle, rainfall - runoff process, factors affecting runoff, runoff hydrograph, runoff computations, flood discharge calculations, unit hydrograph method, S-hydrograph
3	Water requirement of crops: 3.1 Crops and crop seasons in India, cropping pattern, duty and delta 3.2 Quality of irrigation water 3.3 Soil-water relationships: soil characteristics significant from irrigation considerations, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation 3.4 Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation
4	Ground water and well hydrology 4.1 Ground water resources, occurrence of ground water, methods of ground water exploration, well irrigation 4.2 Well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests, design of water wells
5	Distribution system: 5.1 Canal systems, alignment of canals, canal losses, estimation of design discharge 5.2 Design of channels: rigid boundary channels carrying clear and sediment laden water, alluvial channels carrying clear and sediment laden water, Kennedy's and Lacey's theory of regime channels 5.3 Canal outlets: non-modular, semi-modular and modular outlets 5.4 Waterlogging: causes, effects and remedial measures 5.5 Lining of canals: economics of lining, types of lining 5.6 Drainage of irrigated lands: necessity, methods
6	Canal structures: 6.1 Surface and sub-surface flow considerations for design of canal structures: hydraulic jump, seepage forces, uplift forces 6.2 Canal falls, cross regulator, distributary head regulator, canal escapes: types, components and design considerations 6.3 Cross drainage works: need, types, design considerations
7	Canal headworks: 7.1 Weir and barrage, different units of headworks, types of weirs, sediment control in canals, river training for canal headworks 7.2 Theories of seepage for design of weirs: Bligh's creep theory, Lane's weighted creep theory, Khosala's method of independent variables

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8	Dams and spillways: 8.1 Embankment dams: Classification, selection of site for dam, design considerations, estimation and control of seepage, slope protection 8.2 Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile, structural joints, keys and water seals, galleries, outlets 8.3 Arch and buttress dams: types 8.4 Spillways: components of spillways, types, terminal structures, types of gates for spillway crests
9	Reservoirs: types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site, flood routing
	Term work: Each student is to appear for at least one written test during the term. At least 10 numerical problems and 10 descriptive assignments including sketches of relevant hydraulic structures and the graded answer paper for the term test shall be submitted as term work.
	Text books: 1. G L Asawa, Irrigation Engineering, Wiley eastern 2. S K Garg, Irrigation Engineering & Hydraulic Structures, Khanna Publishers 3. P N Modi, Irrigation Engineering & Hydraulic Structures, **Reference books:** 1. J D Zimmerman, Irrigation, John Wiley & Sons 2. Varshney, Gupta & Gupta, Theory and Design of Irrigation Structures, Nem Chand & Bros 3. Punmia B C & Pande B B lal, irrigation Engineering and Water Power Engineering, Laxmi Publications

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Administration of Construction Contracts

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: -2	Evaluation System: Theory paper (3 Hours): 100 Term Work: 25 Practical: - Oral: 25 Total: **150**

Detailed Syllabus	
1	Methods of executing construction projects: departmental method, contract method, piece work system, day-work system, comparative merits and demerits
2	Stages in contracting: Notice inviting tenders Tender documents: contents, general conditions of contract like, tender validity period earnest money deposit and security deposit, performance bond, etc. Prequalification and post-qualification: purpose and methods Prebid conference: purpose and procedure Award of contract: scrutiny and acceptance of tender, letter of intent, signing of contract
3	Construction contracts: Definition, valid, invalid and voidable contract Indian Contract Act, relevant sections, obligations, rights and responsibilities of parties to the contract Types of construction contracts: item rate, percent rate, cost plus, lumpsum, turnkey, BOT etc., suitability of type of contract for different types of works, role and responsibilities of client and contractor in each type of contract
4	Contract documents: Standard contract documents, general and special conditions of contract, conditions related to time of completion, maintenance period, extension of time, subletting, interim and final payments, advances and their recoveries, change orders, price variation , Breach of contract: reasons and remedies for breach, liquidated damage Termination of contract
5	Claims and disputes: Types of claims, settlement procedures Dispute resolution methods: mediation, arbitration, litigation Arbitration: Arbitration and conciliation Act, process of arbitration
6	Labour laws: historical developments in labour legislation, Purpose and general provisions of following acts: Industrial disputes act, Payment of wages act, Contract labour (regulation & abolition) act, Minimum wages act, Interstate migrant workmen (regulation of employment and conditions of services) act, The building and other construction workers (regulation of employment and conditions of service) act, The building and other construction workers welfare cess act

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	Term work: Each student is to appear for at least one written test during the term. At least 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Recommended books: 1. Reddy Narsinha B V, Engineers, Contractors and Arbitration, 2. Gajaria G T, Law Related to Building and engineering Contract in India, N M Tripathi P Ltd 3. Clough R H, Construction Contracting, Wiley 4. Fisk E R, Construction Project Administration, Wiley

Elective I :Advanced Engineering Geology

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus	
1	Introduction Importance of geological studies in engineering investigations, precautions to avoid misleading conclusions likely to be drawn while interpreting drilling data with particular reference to RQD, case histories illustrating economies made possible by proper geological studies
2	Engineering geology of Deccan Trap basalts Factors affecting strength and water tightness, stability of cuts and ability to stand without support, significance of features like gas cavities, jointing, waeathering, hydrothermal alteration, volcanic bracias, techylytes, dykes, fractures, field structures of flows, stratigraphic sequence of flows etc. and their significance in civil engineering projects
3	Dams Strength and watertightness of Deccan trap rocks from foundation point of view, physical properties such as compressive strength, water absorption etc. of basalts, effect of weathering and hydrothermal alteration on engineering properties of rocks, deterioration of rock masses on exposure to atmosphere and suitable treatment for such rocks Investigations for determining the foundation treatment for adverse geological features, determination of foundation levels / cutoff levels for dams, groutability of rocks, correction of adverse feature by grouting, purpose of consolidated and curtain grouting, determining depth and zones of grouting, relation of zones of grouting with height of dams, foundation treatment for fractures having different manifestation, jointed racks, tachylytes and dykes Erosion of tail channel as a factor in selecting site for spllway, causes of rapid erosion from side spillways, geological conditions leading to erosion Case histories

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4	Tunneling Methodologies of investigations for different types of tunnels for different purposes, location, spacing, angles and depths of drill holes for different types of tunnels, difference in behaviour of basalts because of jointing as exemplified by compact basalts and amygdaloidal basalts. Difficulties introduced by tachylytes, volcanic breccias, tuffs, intertrappean beds, fractures, dykes, hydrothermal alteration, flow contacts and unfavourable field characters. Computing structural discontinuities in rock masses, RQD, joint frequency index, RMR values, Q system, standup time. Selection and provision of protective measures such as guniting, rock bolting, shotcreting, steel fibre shotcreting, permanent steel supports, lagging, concreting and contact grouting above steel supports depending on geological conditions. Suitability of TBM for tunneling. Case histories
5	Bridges Investigations for bridge foundations, computing SBC for bridge foundation based on nature and structure of rock, foundation settlements Case histories
6	Geology of soil formation Residual and transported soils. Rock weathering conditions favourable for decomposition and disintegration, influence of climate on residual and transported soils in the deccan trap area. Nature of alluvium of deccan trap rivers and its engineering character. Effect of deposition of calcium carbonate. Scarcity of sand in the rivers in deccan trap area
7	Geophysical investigations Seismic and electrical resistivity methods of explorations
8	Construction material Deccan trap basalts as construction material. Use of compact basalts and amygdaloidal basalts as rubble for masonry, metal for concrete making
	Practicals: • Logging of drill core, preparation of lithologs and interpreting drilling data, calculation of RQD and joint frequency index. Preparing geological cross-sections from drill hole data and using them for designing of civil engineering structures • Use of electrical resistivity method for determining depth of bed rock • Study of geological aspects of an engineering projects and writing a report based on studies carried out during visits to civil engineering projects
	Term Work: Each student is to appear for at least one written test during the term. Reports on experiments performed as detailed above and the graded answer paper for the term test shall be submitted as term work. A brief report on a visit to a project site with reference to geological conditions should also be included in the journal.
	Reference books: 1. PWD handbook, Engineering Geology, Government of Maharastra 2. Textbook of Engineering Geology, R E Gupte, PVG Prakashan 3. Geology of India, D H Wadia 4. Geology of India and Burma, M E Krishnan

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Elective I: Advanced Surveying

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus	
1	Modern Surveying Equipment Data and equipment needed for engineering projects, review of traditional surveying equipment. Changing scene in surveying and mapping, map substitutes, use and advantage of modern surveying equipment in project. Modern surveying electronic equipment, their principles, constructions, working and use – Electronic Theodolite, E.D.M. Instrumens – Geodimetor, Tellurometer, Distomat, total station. Application of lasers in distance and angular measurements, introduction of electronic navigation and position fixing – different systems and their characteristics
2	Global Positioning System Global positioning system – working principles and methods. Different approaches to is GPS and their accuracies, advantages of GPS in navigation, survey, planning and mapping
3	Geographic information system Geographic information system – data requirement and database creation. Use of field data, maps, aerial and satellite data. Advantages of GIS
4	Photogrammetry Definition of Photogrammetric terms, geometry of aerial and terrestrial photographs, aerial camera and photo – theodolite, scales of a photograph, tilt and height displacements, stereoscopic vision and stereoscopes, height determination from parallax measurements, flight planning, maps and map substitutes and their uses
5	Remote sensing Introduction and definition of remote sensing terms, remote sensing system, electromagnetic radiation and spectrum, special signature, atmospheric windows, different types of platforms, sensors and their characteristics, orbital parameters of a satellite, multi concept in remote sensing
6	Image interpretation Principles of interpretation of aerial and satellite images, equipments and aids required for interpretation, ground truth – collection and verification, advantages of multidate and multiband images, digital image processing concept
7	Field astronomy Terms, co-ordinate systems, hour angle, right ascension, declination, altitude, azimuth: study of astronomical charts, determination of latitude and true bearing by observation on the sun and polestar, time, standard time, local time, universal time, equation of time

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	Practicals: • At least three practicals based on the above syllabus are to be conducted.
	Term Work Each student has to appear for at least one written test during the term. Report on the practicals conducted, at least five assignments and the graded test paper shall be submitted as the term work. **Reference Books:** 1. Campbell J.B., "Introduction to Remote Sensing", The Guilford Press, London, 1986 2. Curran P.J., "Principles of Remote Sensing", Longman, London, 1985. 3. Kennie T.J.M Petrie G., "Engineering Surveying Technology"/ Blackie & Sons Ltd, London,1990. 4. Wolf P.R., "Elements of Photogrammetry", Tata McGraw Hill Book Company, New Delhi, 1986.

Elective I: Management Decision Making

Class: **B. E. (Civil / Construction Engineering)**	Semester: **VII**
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: **150**

Detailed Syllabus	
1	Concept of systems approach: system, boundaries of system, goals and objectives, optimality, mathematical models, objective function and constraints, problem solving mechanism, types of problems, modeling / problem formulation, sub-optimization, solution techniques, sensitivity analysis
2	Decision theory: classification of decision situations, decision tables and decision tree, criteria for decision making under certain, uncertain and risk conditions, utility theory
3	Time series analysis: variations in time series, trend analysis: method of moving averages, method of least squares
4	Index numbers: basic requirements of index numbers, constructing index numbers: using relatives, using aggregates
5	Linear programming: general nature of problem, formulation of problems, graphical method of solution, simplex method, dual, sensitivity analysis
6	Distribution models: transportation and assignment problems and their solutions
7	Queuing models: various situations, queue discipline and customer behaviour, single server model
8	Basic functions of inventory and inventory decisions, Inventory control model – economic order quantity
9	Simulation: general approach, Monte Carlo simulation, simple problems using hand calculations
	Term work: Each student is to appear for at least one written test during the term. At least two assignments and 3 problems on each of the topic and the graded answer paper for the term test shall be submitted as term work.

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	Recommended Books: 1. Varma Mahesh, Construction Planning & Management through Systems Techniques, Metropolitan 2. Ossenbruggen P J, Systems Analysis for Civil Engineers 3. Shrivastava, Shenoy & Sharma, Quantitative Techniques for Managerial Decisions, Wiley Eastern

Elective I : Value Engineering

Class: B. E. (Civil / Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus	
1	**Introduction** Definitions: Value, value engineering, value analysis, value management, background & history of value engineering, habits, roadblocks & attitudes and their relation to value engineering
2	**Value Engineering Job Plan** Various versions of job plan, phases of job plan: information, creative, analytical, investigation , recommendation, implementation
3	**Function Analysis** Function & its role in achieving value, function in terms of its cost & worth, Graphical function analysis: function analysis system technique
4	**Creative thinking** Definition, creative people, creative processes, conducting creative session
5	**Life cycle costing** Definition, purpose & implications, economic principles for life cycle costing, types of life cycle costs.
6	**Energy** Energy resources & consumption, energy cost escalation, sources of energy supply, end use of energy, energy embodiment of construction materials, buildings, infrastructures facilities & energy systems, energy models, factors affecting energy consumption, impact of maintenance on energy saving.
7	Value engineering case studies
	Termwork Each student is to appear for at least one written test during the term. At least five assignments and at least one case study report following complete job plan and graded answer paper of the term test will be submitted as term work.
	Recommended Books: 1.Value Engineering – L.W. Zimmerman, G.D.Hart, CBS publishers & distributors 2.Proffessional Construction Management- Barrie & pualson, McGraw Hill 3. Value Engineering in the Construction Industry- Dell'Isola, A J, Construction Publication Company. 4. Value analysis in design & Construction, O'brien, J J, McGraw Hill

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Project – A

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - Practicals: - Tutorials: - 2	Evaluation System: Theory paper : Term Work: - 25 Practical: - Oral: - Total: 25

The students are expected to take up a project on one of the Civil / Construction Engineering problems to be completed in Semester VII and Semester VIII.
This may include,

- experimental analysis / verification,
- development of design methods and verification,
- design and fabrication of a model for a civil engineering project,
- design of civil engineering structures and preparation of working drawings,
- developing a software for analysis and / or design or decision making in civil engineering and management practice
- technical and / or economic feasibility study

The students may be asked to work individually or in groups with not more than five students in each group.

Basic study through review of literature on the topic selected shall be completed. The scope of the project, identification of necessary data, sources of such data etc. shall be identified. The student / group of students has to prepare a brief report on the work done during the semester and is to be submitted. The report should at least include objective of the project, scope of the project and methodology.

Design and Detailing of Reinforced Concrete Structures

Class: B. E. (Construction Engineering)	Semester: VIII
Periods per week: Lectures: - 5 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (4 Hours): - 100 Term Work: - 50 Practical: - Oral: - 25 Total: **175**

Detailed Syllabus	
1	Design of Foundations (limit state method of design): Isolated square and rectangular footings subjected to axial load and moments, Design of combined foundations, Rectangular foundations and simple raft
2	Design of staircases (limit state method of design): Doglegged, Open well type
3	Complete design of residential, office or industrial building including staircase and foundations (limit state method of design)
4	Design of retaining walls (limit state method of design): Cantilever, Counterfort type
5	Design of water tanks (working stress method): Circular and rectangular, at ground level, underground and overhead - both by IS coefficient and approximate methods, supporting structure for overhead water tanks.

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	Term work: A design report and at least four A1 (imperial) size drawings sheets for three projects covering the above syllabus shall be submitted as term work. All drawing work is to be done in pencil only. Exposure to design by available software for design. Each student has to appear for at least one written test during the term. The term work mentioned as above and the graded test paper shall be submitted as the term work.
	Oral Examination: There shall be a sketching examination of 30 minutes duration followed by oral examination.
	Recommended Books: 1. Limit State Theory for Reinforced Concrete Design, Huges B. P., Pitman 2. Limit State Design – Reinforced Concrete, Jain A. K. 3. Reinforced Concrete, Warener R. F., Rangan B.C. & Hall A. S. 4. Illustrated Design G+3 Building, Shah & Karve, Structural Publishers 5. Reinforced Concrete, S. N. Sinha 6. Reinforced Concrete, H. J. Shah, Charotar Publisher 7. Relevant I.S. codes

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Quantity Survey & Estimation

Class: B. E. (Construction Engineering)	Semester: VIII
Periods per week: Lectures: - 5 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (4 Hours): - 100 Term Work: - 50 Practical: - Oral: - 25 Total: 175

Detailed Syllabus	
1	Estimates: Various types, their relative importance. factors to be considered, complete set of Estimate. Approximate estimates: importance, purpose, different methods. Use of CBRI Equations for the same. Methods of preparation of estimates for projects such as I) Building R.C.C., Load bearing ii) Road iii) Irrigation and iv) Water supply and sewerage: miscellaneous works like Manhole, water storage tank, septic tanks v) Trusses of steel
2	Measurements for various items: Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams
3	Material survey: Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials
4	Specifications: types, requirements and importance, detailed specifications for the buildings, roads, minor bridges and industrial structures
5	Rate analysis: purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment
6	Tender: preparation of tender documents, importance of inviting tenders, contract types, relative merits,. prequalification. general and special conditions, termination of contracts, extra work and items, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance , insurance, claims, price variation, etc.
7	Introduction to acts pertaining to : Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights
8	Valuation : different terms used, the role of a valuer, purpose and necessity of the same. Capitalised Value, Years purchase ,sinking fund, depreciation, types of values, Purpose of valuation, Different methods of valuation for open plots and open plots with existing residential buildings.
9	Use of computers in quantity surveying

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	Termwork The term work shall consist of the following: i. To find out the approximate estimate of a multistoried building by approximate method. ii. Detailed estimate of at least four of the following with the required material survey for the sam a. a ground plus three storied building (RCC) b. a bridge with minimum 2 spans c. a factory building d. a road work e. a cross drainage work f. a load bearing structure iii. Assignments on rate analysis, specifications and simple estimates. iv. Detailed estimate of minor structure v. Bar bending schedule Each student is to appear for at least one written test during the term. The term work detailed above and the graded answer paper for the term test shall be submitted as term work.
	Text Books: 1. M Chakravarty, Estimating, Costing Specifications & Valuation 2. Joy P K, Handbook of Construction Management, Macmillan 3. B.S. Patil , Building & Engineering Contracts **References:** 1. Relevant Indian Standard Specifications 2. World Bank approved contract documents 3. FIDIC contract conditions 4. Bare Acts related to Minimum wages, Workman's compensation, Contract, and Arbitration.

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Construction Project Management II

Class: B.E. (Construction Engineering)	Semester: VIII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): 100 Term Work: 25 Practical: - Oral: 25 Total: 150

Detailed Syllabus	
1	Organising: Organisation as a management function, principles of organisation, structure of organisation, line, line & staff, functional and matrix forms of organisation, selecting the project manager, Organising for site, mobilisation and winding up, site layout
2	Personnel management: importance and objectives, manpower estimation and planing for projects, recruitment methods, training of personnel, performance evaluation, importance and methods of motivation
3	Monitoring & control: supervision, record keeping, periodic progress reports, Updating of plans: purpose, frequency and methods of updating, Time cost tradeoff in construction projects, compression and decompression, common causes of time and cost overruns and corrective measures,
4	Communication Importance, elements of communication systems Types of communication: written & non-written, verbal & non-verbal, formal & informal, barriers to effective communication
5	Materials management: importance and objectives, estimation and planning of materials, ABC analysis, procurement procedures, vendor evaluation, stock and inventory control, concept of economic order quantity, reorder level and reorder quantity, storage of materials, record keeping for materials management
6	Equipment management: mechanization in construction, sources of construction equipment, selection of equipment, standardization, matching and balancing of equipment, location on site for optimum utilization, cost of equipment, maintenance policies, record keeping for equipment management
7	Quality control: Definition of quality, elements of quality, quality in various stages of project, use of manuals and checklists for quality control, role of inspection
8	Cost control: cost codification, tracking of costs, control budget, collection of data and reporting for cost control, time cost trade off, compression and decompression of project plans, cash flow analysis, variance analysis
9	Productivity in construction: Concept of productivity in construction projects, factors affecting construction productivity, work study techniques for improving productivity
10	Safety and health on project sites: accidents: their causes and effects, costs of accidents, occupational health problems in construction, organising for safety and health
11	Management information systems for construction projects

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	Term work: Each student is to appear for at least one written test during the term. At least 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Oral Examination: The oral examination will be held on syllabus of both Project Management I and Project Management II.
	Recommended books: 1. Koontz, Management, McGraw Hill, 2. Varma M, Construction Equipment and It's Planning and Application, Metropolitan Book 3. Barrie D S & Paulson B C, Professional Construction Management, McGraw Hill 4. Beneath J, Construction Project Management, Butterworths 5. Helpin D W & Woodhead R W, Construction Management, Wiley 6. Joy P K, Handbook of Construction Management, Macmillan

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Elective II. Productivity in Construction

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus	
1	Productivity 1.1 Definition and importance of productivity in construction 1.2 Measurement of productivity, productivity of construction resources; labour, materials and equipment, factors affecting productivity 1.3 Improvement of productivity: basic and added work content and related time contents of job, productivity improvement techniques
2	Work study 2.1 Definition and purpose, historical developments 2.2 Method study: definition and objectives of conducting method study 2.3 Steps in applying method study: select, record, critical examination, development, installation and maintenance, recording techniques: outline process charts, flow process charts, flow diagram, two handed process charts, multiactivity chart, travel chart, string diagram, layout maps. 2.4 Micromotion studies, sino-chart, cyclegraph and chrono cycle graph, photographic techniques, THERBLIGS 2.5 Work measurement: definition and objectives, various techniques of work measurement 2.6 Time study: Purpose of time study, time measuring devices, recording methods, steps in time study, rating of a worker, observed time, basic time, relaxation, allowances, standard time of an operation 2.7 Work sampling techniques: basis of work sampling, concept of accuracy and reliability 2.8 Analytic and synthetic time standards
3	Use of work study techniques in improving construction productivity.
	Term work: Each student is to appear for at least one written test during the term. At least 10 assignments and the graded answer paper for the term test shall be submitted as term work
	Recommended books: 1. Oglesby, Clarkson H et al, Productivity Improvement in Construction, McGraw Hill 2. Work Study, ILO 3. Alfed L E, Construction Productivity, McGraw Hill

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Elective II. Quality Management in Construction

Class: B. E. (Construction Engineering)		Semester: VIII	
Periods per week:		Evaluation System:	
Lectures:	- 4	Theory paper (3 Hours):	100
Practicals:	-	Term Work:	25
Tutorials:	- 2	Practical:	-
		Oral:	25
		Total:	150

Detailed Syllabus	
1	Basic concepts and definitions: quality, quality engineering, quality control, quality assurance, total quality management
2	Elements of quality: 2.1 Quality characteristics: tangible and intangible parameters of quality 2.2 Quality of design: role of various agencies involved and codes and specifications 2.3 Quality of conformance and quality of performance
3	Economics of quality: cost of quality; cost of conformance, cost of non-conformance and cost of lost opportunities
4	Organisation for quality: identifying tasks, responsibilities and procedures, quality systems, typical organisation structures, preparation of manuals, flow charts and checklists, role of inspection, stages in quality inspection
5	Statistical quality control: 5.1 Review of basic concepts of statistics: measures of central tendency, measures of dispersion, frequency curves, frequency distributions 5.2 Sampling: methods of sampling, sample size, acceptance sampling 5.3 Control charts: construction, interpolation and inferencing
6	Miscellaneous concepts and tools of quality management: kaizen concept, quality circles, fishbone diagram (Ishikawa diagram), Pareto diagram
	Term work: Each student is to appear for at least one written test during the term. At least 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Recommended books: 1. The essence of total quality management, John Bank, Prentice Hall of India, 1995 2. Inspection and Quality Control in Building Works, A C panchadhari, Mandakini Publishers 3. Quality Assurance in Construction, Dunkan, thorpe & Summer, Gower

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Elective II. Advanced Environmental Engineering

Class: B. E. (Construction Engineering)	Semester: VII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): - 100 Term Work: - 25 Practical: - Oral: - 25 Total: 150

Detailed Syllabus	
1	Industrial water treatment Methods of treatment, adsorption, desorption, ion exchange, demineralization, removal of specific ions from water, reverse osmosis, electrolysis, multiple effect evaporations, recovery of water and byproduct, quality of water for various treatments
2	Municipal solid waste management Sources, types and composition of municipal waste, physical, chemical and biological properties of municipal solid waste, methods of segregation, collection and conveyance, factors affecting solid waste generation and collection, separation of waste materials such as screening, density separation, magnetic separation, densification Methods of disposal of solid wastes: land fill method, composition and characteristics, leachate control methods, composting, incineration, environmental aspects
3	Air Pollution Definitions, types and units of measurement for particulates and gaseous pollutants, sources of pollutants, particulate characteristics, effect of air pollution on human beings, global effects of air pollution, methods of sampling and measuring air pollutants, eminent air quality standards, control devices for air pollutants
4	Noise Pollution Effects of noise pollution on health, measurements, methods of control
	Term Work Each student is to prepare a report on one of the topics of the syllabus. The report shall contain literature review and a case study. Each student is to appear for at least one written test during the term. The report as mentioned above, at least 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Text Books and References: Industrial Water Treatment Practice, Hammer, Jackson, and Thurston, Butterworths. Water Conditioning for Industries, Powell Integrated Solid Waste Management, Tchbanoglus, Theisen and Vegil, McGraw Hill Environmental Engineering, Peavy, Rowe and Tchbanoglus, McGraw Hill Introduction to Environmental Engineering, Davis and Cornwel, McGraw Hill

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Elective II. Advanced Construction Techniques

Class: B. E. (Construction Engineering)	Semester: VIII
Periods per week: Lectures: - 4 Practicals: - Tutorials: - 2	Evaluation System: Theory paper (3 Hours): 100 Term Work: 25 Practical: - Oral: 25 Total: 150

Detailed Syllabus:	
1	Soil stabilization Definitions and necessity: Methods of Soil stabilization: sand drains, use of lime, cements bitumens & columns.soil nailing, reinforced earth
2	Grouting Definition, types of grouts:- suspension grouts-grouting with soil, grouting with bentonite-cement mixes, grouting with asphalt emulsions Solution grouts- silicate derivatives, hignousulphate derivatives, water reactive grouts; phenoplasts, aminoplasts Grouting pressures, grouting materials and grouting equipments, guniting & shortcrete
3	Contsruction of foundations in deep water Pile foundations – types, suitability, construction methods Cofferdams and cassions – types, suitability, construction methods
4	Concrete construction Concreting under water, concreting in extreme weather conditions, transport, placing and compaction of concrete, use of ready mixed concrete, vacuum processing of concrete, joints of concrete, high density concrete, fibre reinforced concrete, light weight concrete, IS recommendations for hot and cold weather concrete
5	Foundation control techniques Non destructive testing including geophysics, seismic reflection, seismic refraction, electrical resistivity, magnetometry, ground – probing radar (GPR) Foundation instrumentation: load measurement, earth pressure measurement, deformation monitoring, pour water pressure measurement
6	Geotextiles (filter fabric) Introduction, geotextiles as separators, as reinforcement and in filteration and drainage Geotextiles in erosion control
7	Pile driving equipment: types, pile driving hammers – single and double acting, differential acting hammers, hydraulic and disel hammers, vibratory pile drivers
8	Miscellaneous Building construction systems – on site precasting, tilt-up, slip form, lift slab construction Ferrocement and its products Low cost housing systems
	Term work: Each student is to appear for at least one written test during the term. At least 10 sketches, and 10 assignments and the graded answer paper for the term test shall be submitted as term work.
	Text Books and References: 1. Construction and Geotechnical Methods in Foundation Engineering, R M Koerner, McGraw Hill 2. Construction Planning, Equipment and Methods, R L Peurifoy, McGraw Hill

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Project - B

Class: B. E. (Construction Engineering)		Semester: VIII	
Periods per week:		Evaluation System:	
Lectures:	-	Theory paper :	
Practicals:	-	Term Work:	- 50
Tutorials:	- 6	Practical:	-
		Oral :	- 50
		Total:	100

Details:	
	Further to Semester VII work, the student / group of the students shall collect all necessary information pertaining to the project and analyse it. The student / group of the students shall prepare and submit a report on the project. The report shall be typewritten on A4 size paper and hard-bound and prepared in an academic style. Broadly the report shall have four parts: Introduction, Literature review, Data collection and analysis, and Conclusions. Acquaintance with survey and research methods and their use in conducting a systematic invest use of data analysis tools, computational methods and style of report preparation and presentati form basis of evaluation.

Field Training

Class: B. E. (Construction Engineering)		Semester: VIII	
Periods per week:		Evaluation System:	
Lectures:	-	Theory paper :	
Practicals:	-	Term Work:	- 50
Tutorials:	-	Practical:	-
		Oral :	- 50
		Total:	100

Details:	
	Each student shall undergo a practical training for a period of at least six weeks before the beginning of the Semester VIII. The student is expected to spend the time of the training on study of various engineering and management aspects of construction like; construction methods, preparation of detailed working drawings, site layout, site organization, site records, progress monitoring, quality control techniques etc. The student shall prepare a detailed typewritten report on the training experience and submit it as term work. The report shall clearly bring out the learning that has taken place during the training period.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Mechanical Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTION AND EVALUATION (R-2001)

COURSE B.E. (MECHANICAL)
Semester VII

Sr. No.	Subject	L	P	Theory (hours)	Theory Marks	TW	P	O	Total
1	Design of Machine Elements II	4	3	4	100	50	--	25	175
2	CAD/CAM & Finite* Element Analysis	4	2	4	100	50	--	25	175
3	Manufacturing Planning and Control	4	2	3	100	50	--	--	150
4	E-commerce and Industrial Financing*	4	2	3	100	50	--	--	150
5	Elective I	4	2	3	100	25	--	25	150
6	Project	--	4	-	--	50	--	-	50
	TOTAL	20	15	--	500	275	--	75	850

COURSE B.E. (MECHANICAL)
Semester VIII

Sr. No.	Subject	L	P	Theory (hours)	Theory Marks	TW	P	O	Total
1	Design of Mechanical Systems	4	3	4	100	50	--	25	175
2	Refrigeration and Air-conditioning	4	2	3	100	25	--	25	150
3	Industrial Engineering & Enterprise Resource Planning*	4	2	3	100	25		25	150
4	Elective II	4	2	3	100	25	--	25	150
5	Project	--	8	--		75	--	50	125
	TOTAL	16	17	--	400	200	--	150	750

- Common with Automobile Engineering

Group	Elective I	Elective II
I	Industrial Robotics**	Artificial and Machine Intelligence*
II	Concurrent Design of Products and Processes*	Software Engineering
III	Automobile Engineering I	Automobile Engineering II
IV	Cryogenic Engineering	Non Conventional Energy sources
V	Business Process Reengineering*	Supply Chain Management*
VI	Computer Integrated Manufacturing*	Optimization*
VII	Advanced FEA*	Dynamic System Analysis*
VIII	Non Destructive Testing	Welding Engineering
IX	Enterprise Networking and Internet	Java Technologies

**Common with Automobile and Production Engineering branches

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Semester VII

CLASS: B.E. (Mechanical)		Semester - VII	
Design of Machine Elements II			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	3	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	50
Detailed Syllabus			

1. Design of spur, helical, bevels and worm gears. Gear box design including housing
2. Design of flat and vee belt and chain drives.
3. Design of single and multiple plate and cone clutches
4. Design of brakes. External and internal shoe type and disk type.
5. Design of hydrodynamically lubricated bearings.
6. Design of hydro Static bearings
7. Selection of Mechanical Seals
8. Selection of rolling contact bearings.
9. Design of cam and follower mechanisms.
10. Design of flywheels.

TERM WORK:

Exercise on the above topics in the from of design calculations with sketches and or drawings.

Atleast four A-2 size drawing sheets shall be submitted as term work and at least eight exercises covering the above topics.

TEXT BOOKS:

1. Design of Machine Elements – V.M. Faires.
2. Design of Machine Elements – Spotts.

REFERENCE BOOKS:

1. Design Data Books – P.S.G.
2. Design Data Books – Mahadevan.
3. Machine Tool Design Handbook – Cmti.

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CLASS: B.E. (Mechanical / Automobile)		Semester - VII	
CAD/CAM & Finite Element Analysis			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	50
Detailed Syllabus			

CAD/ CAM -Computer Aided Design and Manufacturing

1. INTRODUCTION

The design process, The role of modeling and communication, Modeling using CAD, Product life cycle & CAD /CAM, Concurrent engineering, Computer for design process, CAD System Architecture

2. ELEMENTS OF INTERACTIVE COMPUTER GRAPHICS

The design workstation & its functions, Operator input devices (Mouse, Keyboard, tracker ball and Joy stick etc.), Output devices (Printers & Plotters), two dimensional computer graphics, vector generation, The windowing transformation, Three dimensional Computer graphics, viewing transformation, Homogeneous coordinates, Perspective projection, Visual realism, Hidden line removal and hidden surface removal algorithm, light and shade ray tracing

3. TECHNIQUES FOR GEOMETRIC MODELING

Graphic standards, The parametric representation of geometry, Bezier curves, Cubic spline curves, B-Spline curves, Parametric representation of line, circle, ellipse & parabola, constructive solid geometry, Feature Based modeling, Feature recognition, Design by feature

4. TRANSFORMATION, MANIPULATION AND DATA STORAGE

2D & 3D Transformations (Translation, Rotation, and Scaling & Magnification), Concatenations, Matrix representation, Problems and object oriented programming on Transformations. Object transformation, mirror transformation, Data Structures for interactive modeling, Bill of materials from attribute data, The use of Object Orientation and associativity, Engineering data management system, Relational data base for design, Object Oriented Database, Structured Query language, Design Information Systems. Artificial Intelligence in Design, Representation of Knowledge, Knowledge base Engineering

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CAM (COMPUTER AIDED MANUFACTURING

1. NC TECHNOLOGY

Introduction, basic components of NC system, NC procedure, NC Coordinate systems, and NC motion control systems, Applications, Advantages and disadvantages of NC machines.

2. NC PART PROGRAMMING

Introduction, the punched tape in NC, Tape coding and format, Manual part programming.

3. COMPUTER AIDED NC PART PROGRAMMING

Introduction, Part programmers job, Functions of a post processor, NC part programming languages, Elements of a APT language, The MACRO statement in APT, NC programming with interactive graphics.

4. CNC

Problems with conventional NC, CNC functions and advantages, DNC, Adaptive control, CNC programming concepts, Trends and new developments in NC including FMS.

5. FINITE ELEMENT ANALYSIS

Introductory Concepts : Introduction to FEM. Brief History. General FEM procedure. Applications of FEM in various fields. Advantages and disadvantages of FEM.

Differential Equations in different fields : Types of Differential Equations. Primary and Secondary Variables and types of Boundary Conditions.

Matrix Algebra : Matrix operations, Gauss Elimination Method to get inverse of a Matrix. Partitioning of Matrix.

FEM Procedure : Definitions of various terms used in FEM like element, order of the element, internal and external node/s, degree of freedom, primary and secondary variables, essential boundary conditions, natural boundary conditions, homogeneous and non-homogeneous boundary conditions, discretization, band-width, aspect ratio, coarse and fine meshing, etc.

Pre-processing, Processing and Post-processing – Topology.

Direct Application of Element Matrix Equations : Analysis and solution of problems in various fields like Structural Mechanics, Thermal, Nuclear, Fluid etc. (Stepped and Taper Bars, Fins, Fluid Network, Spring-Cart systems, Plane Trusses, Beams) using direct element matrix equations to obtain global matrix equation. Method of Elimination. Penalty Approach method. Sources of error.

TERM WORK :

- Assignments at least one on each topic (both CAD/CAM and FEA)
- Assignments using I-DEAs Master series or ANSYS or -at least one-which shall cover tasks like Model-prepeartion, Mesh generation, Simulation,Postprocessing etc.
- One in-semester test

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TEXT BOOKS :

1. CAD/CAM by Ibrahim Zeid.
2. CAD/CAM/CIM by P. Radhakrishnan.
3. Introduction to Finite Elements Methods by Desai and Abel, CBS Publication.
4. FEM in Structural and Continuum Mechanics by Zienkiewiez O.C.Vol.I & II.
5. Textbook of FEAnalysis, P.Seshu, Prentice Hall

REFERENCE BOOKS :

1. Computer Graphics by Hearn & Baker.
2. Introduction to Finite Elements in Engineering by Tirupati R. Chandrupatla Ashok D.Belegundu.
3. Applied Finite Elements Analysis by Larry J. Segerlind.
4. Finite Elements Hand Book by H. Kardestuneer.
5. Concepts & Applications of Finite Element Analysis by R.D.Cook.
6. Finite Element Method, Reddy J. N., McGRAW-HILL
7. Introduction to FE in Engg., Chandrupatla, Belugundu, Prentice Hall.
8. FEM in Engg, Rao S. S., Pergamon Press
9. Applied FEA, Segerlind, John Wiley
10. FEM, Fagan
11. FEA for undergraduates, Akin J. Ed, Academic Press

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CLASS: B.E. (Mechanical)		Semester - VII	
Manufacturing, Planning and Control			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	--
	Term Work	--	50
Detailed Syllabus			

1. MANUFACTURING PLANNING & CONTROL:

MPC System: Framework, Objectives, Functions, Stages, Functional Relationship, Input/Output, Payoffs, Customer Expectations, Manufacturing Improvement Plans. Production / Logistics Process: Material Flow, Management Problems. Decision making Techniques and Supporting Database. Matching the MPC system with the needs of Firm. Requirements of Effective MPC Systems. Performance Indices. Computerization.

2. MATERIAL REQUIREMENTS PLANNING :

MRP : Requirements, Aims, Structure, Inputs, Linkage with other MPC functions. MRP & MRP II. Record Processing : The Basic MRP Record. Linking the MRP Records. Technical Issues: Lot Sizing. Safety Stock & Safety Lead Time. Low Level Coding. Pegging. Firm Planned Order Releases. Using the MRP System: The MRP Planner. Bottom-Up Re-planning. An MRP Output. The MRP DataBase.

3. MASTER PRODUCTION SCHEDULING:

Basic concepts, Purpose, Manufacturing Environment, Techniques, Process of setting up and running MPS, Managing Demand, Time Fencing, Stability, Rough Cut Planning, MPS- Format and Logic, Managing MPS.

4. CAPACITY PLANNING:

The Roll of Capacity Planning in MPC System : Hierarchy of Capacity Planning Decisions. Links to Other Systems Modules. Capacity Planning & Control Techniques : Capacity Planning using Overall Factors (CPOF). Capacity Requirements Planning (CRP). Input/ Output Control. Capacity Management. Capacity Planning in MPC System. Choosing the Measure of Capacity. Data Base Requirements.

5. SHOP-FLOOR CONTROL:

A Framework for Shop-floor Control: MPC System Linkages. The Company Environment Shop Floor Control Techniques. Basic Shop-Floor Control Concepts. Priority Sequencing Rules. Finite Loading. Using the Shop-Floor Control System:

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Matching the SFC System to the Company. Performance Measurement Lead Time Management.

6. PURCHASING:

Purchasing in Manufacturing Planning and Control: Breadth of the Purchasing Function. The MPC Focus. Vendor Relationship: Quantity Planning. Price Planning. Vendor Scheduling. Uncertainty Protection. Quality Improvement Programs. Purchasing Systems and Data Base. The Procurement Functions. The Data Base. Vendor Performance. Electronic Data Interchange(EDI). Organizational Change.

7. JUST-IN-TIME:

JIT in Manufacturing Planning and Control: Major Elements of Just-In-Time. The impact of JIT on Manufacturing Planning and Control. The Hidden Factory. JIT Cornerstones and the Linkage to MPC. A JIT Example: Leveling the Production. Pull System Introduction. Product Design. Process Design. Bill of Material Implications. JIT Applications.

8. PRODUCTION PLANNING:

Production Planning in Firm: Production Planning and Management. Production Planning and MPC Systems. Payoffs. The Production-Planning Process: Routinizing Production and Game Planning. The Basic Trade-Offs. Evaluating Alternatives. Top-Management Role. Functional Roles. Integrating Strategic Planning. Controlling the Production Plan. Operating Production-Planning System.

9. DEMAND MANAGEMENT:

Demand Management in Manufacturing Planning and Control Systems: Demand Management and Production Planning. Demand Management and Master Production Scheduling. Outbound Product Flow: Data Capture. Dealing with Day-to-Day Customer Orders. Demand Management Techniques. Aggregating and Disaggregating Forecasts. Make-to-Stock Demand Management. Assemble-to-Order Demand Management. Managing Demand. Organizing for Demand Management. Managing Service Levels.

10. ADVANCE CONCEPTS IN MATERIAL REQUIREMENTS PLANNING:

Determination of Manufacturing Order Quantities: Economic Order Quantities (EOQ). Periodic Order Quantities (POQ). Part Period Balancing (PPB). Determination of Purchase Order Quantities: The Purchasing Discount Problem. Look Ahead Feature. Performance Comparisons. Buffering Concepts: Concept of Uncertainty, Safety Stock and Safety Lead Performance Comparisons. Nervousness: Sources of MRP System Nervousness. Reducing System Nervousness.

11. ADVANCE CONCEPTS IN SCHEDULING:

A Scheduling Framework. Performance Criteria. Shop Structure. Product Structure. Work Centre Capacities. Basic Scheduling Research: Static Scheduling Approaches. Dynamic Scheduling Approaches. Johnson's Rule: The One Machine Case. The Two Machine Case. Assignment Models. Queuing Model Approaches. Sequencing. Priority Rules.

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12. ADVANCED CONCEPTS IN PRODUCTION PLANNING:
Mathematical Programming Approaches: Linear Programming Simplex Method. Sensitivity Analysis. Duality. Aggregate Planning: Decision Rules. Disaggration. Hierarchical Planning. Simulation.

13. FORECASTING:
Types, Steps, Techniques, Approaches – Moving Averages, Weighted Averages, Regression Analysis, Exponential Smoothening Models, Trend Projection, Casual, Role of Computers in Forecasting.

14. PROJECT SCHEDULING:
Network Design. Gantt Charts. Framework of PERT and CPM. Project Planning; Scheduling and Monitoring through Network Control. Probability Aspects; Cost Analysis and Crashing.

TERM WORK :

The Term work shall comprise of at least Ten class assignments (Problems or Case Studies) covering different topics of the syllabus, One Seminar Presentation Report and One Test.

TEXT BOOKS:

1. Manufacturing Planning & Control Systems by Thomas E. Vollman. William L. Berry and others. Galgotia Publications
2. Production and Operations Mnagement by S. N. Chary - T. M. H. Publishing Company.
3. Modernization of Materials Management by L. C. Jhamb - Everest Publishing House.

REFERENCE BOOKS:

1. Production and Operations Management Strategies and Tacties by Jay Heizer & Barry Render. Prentice Hall.
2. Material Requirement Planning by Orlicky J. McGraw Hill
3. Operations Management Problems & Models by E. S. Buffa. John Wiley
4. Introduction to Materials Management by J. R Tony and others. Pearson Education
5. Production – Inventory Systems: Planning & Control by Buffa E. S. and J. G. Miller.
6. Operations Research by Hamdy H. Taha.
7. Quantitative Techniques for Managerial Decisions by L. C. Jhamb Everest Publishing House

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CLASS: B.E (Mechanical / Automobile)		Semester - VII	
E-Commerce and Industrial Finance			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	-
	Term Work	--	50
Detailed Syllabus			

I E-COMMERCE

1. INTRODUCTION :

Understanding E-Commerce , Emergence of the internet. Emergence of the worldwide web. Advantage and disadvantages of E- Commerce, E-Commerce in action, Reality and myth.

2. ENABLING TECHNOLOGIES OF E- COMMERCE :

Internet client/server application, Networks and internets, Software agents, Internet standards and specifications, Internet service providers, Staffing for E-Commerce.

3. E-COMMERCE BUSINESS SOLUTIONS :

E- Marketing , Online marketing, advantages of online marketing, E- advertising : various means , Efficiency of E- Advertising , E- branding , Marketing strategies , E Security , Security on Net , E- business
Risk management issues
E-Payment systems , Online payment categories , Digital token based E-Payment systems , Risk and E- Payment systems
Designing E- Payment Systems.
E- Customer relationship management , E- CRM solutions, E-CRM toolkit , CRM capabilities and the customer life cycle.
E-Supply Chain Management.
Strategic advantages and benefits , Components and architectures , Major trends in E-SCM, E- strategy server dimensions, value chain and E- strategy, Planning the E-Commerce project , Brand management strategies.

4. TRANSITION TO E-COMMERCE IN INDIA :

E-transition challenges to Indian corporate, The information technology Act 2000 , Positive aspects for corporate sector, Some Indian case studies , E- Commerce best practices , Modern trends in E- Business.

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5. THE SCOPE OF Industrial FINANCE :

Introduction , Finance defined , Microfinance v/s Macrofinance , Corporate finance and other disciplines , The financial manager , The goal of corporate finance , profit maximization and traditional goal , Improving open tradition through value maximization.

FINANCIAL MARKETS

The other form of organization Capital, cas h money and Govt. securities, Financial market overview , How new securities are issued , Public issue : General cash offer, Public issue : Rights offering , Private placement.

Types of financial markets

The common stock market , the bond market , The money market , International financial market , Efficiency of financial market, interest rates , the term structure of interest rates , The risk structures of interest rates.

6. AN OVERVIEW OF INVESTMENT APPRAISAL METHODS :

Time value of money, The accounting rate of return method , The net present value method , The internal rate of return method , a comparison of NPV and RR method, Discounted payback method, Annual capital charge.

7. SOURCES OF LONG TERM FINANCE :

Equity finance , The new issues market , Right issues , Script issues , Preference shares , DEBT finance , Hybrid finance , Sources of intermediate term finance, term lones and leases , Short term financial markets , Managing corporate liquidity , The concept of circulating resources , The impact on risk and return , Managing current assets , Manage financial structure.

8. WORKING CAPITAL MANAGEMENT :

Objectives , Working capital policies , Working capital and cash conversion cycle , Overtrading , The management of stock , Management of costs.

9. MERGERS AND TAKEOVERS :

Terminology , Justification for acquisition , Trends in takeover activities , Valuation of the target company , The financing of acquisition , Strategies and tactical issues.

10. INTERNATIONAL FINANCIAL MANAGEMENT :

Exchange rates , Fixed verses floating exchange rates , Spot rates , forward rates , Future rates, Factor affecting exchange rates , Foreign exchange exposure managing foreign exchange , Exposure Recent trends.

TERM WORK :

1. Class test
2. At least ten assignments / problems on concepts, Case studies and analysis based on the topics mentioned above.

TEXT BOOKS :

1. E- Commerce A management perspective
   P.T.Joseph , Prentive Hall of India Pvt. Ltd.

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2. E- Commerce strategies
   Charles Trepper , Prentive Hall of India Pvt. Ltd.
3. E- Business and ERP , Transforminf the Enterprise
   Grant Norris , James R. Hurley, John Willey & Sons. Inc.
4. Fundamentals of financial management
   Prasanna Chandra , 3rd Edition , Tata Mcgraw Hill Publishing Company Ltd.
5. Introduction to Corporate finance
   Terry's Maness , Mc Graw Hill series in Finance

REFERENCE BOOKS :

1. Corporate Finance Principles And Practises, Denzil Watson & Tong Heads , Financial Time Pitman Publisher
2. handbook Of Corporate Finance, Edward I. Altmass , Willy Professional Banking & Finance Services
3. Introduction to Financial Management, Bidil Dickerson , Eudere F. B. , The Dryden Press

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CLASS: B.E. (Mechanical)		Semester - VII	
Industrial Robotics Elective I, Group I			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25
Detailed Syllabus			

1. INTRODUCTION:
Automation & robotics, Robotic System & Anatomy Classification, Future Prospects

2. DRIVES:
Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position & Velocity Sensors, Actuators, Power Transmission Systems.

3. ROBOT & ITS PERIPHERALS :
End Effecters – types, Mechanical & other grippers, Tool as end effecter

4. SENSORS :
Sensors in Robotics, Tactile Sensors, Proximity & Range Sensors, Sensor Based Systems, Uses Vision Systems – Equipment

5. MACHINE VISION :
Introduction, Low level & High level vision, Sensing & Digitising, Image processing & analysis, Segmentation, Edge detection, Object description & recognition, Interpretation, Applications

6. PROGRAMMING FOR ROBOTS :
Methods, Robot programme as a path in space, Motion interpolation, level & task level languages, Robot languages, Programming in suitable languages Characteristics of robot.

7. ROBOT KINEMATICS:
Forward, Reverse & Homogeneous Transformations, Manipulator Path Control, Robot Dynamics.

8. ROOT INTELLIGENCE & TASK PLANNING:
Introduction, State space search, Problem reduction, Use of predictive logic, Means – Ends Analysis, Problem solving, Robot learning, Robot task planning.

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9. ROBOTIC APPLICATION IN MANUFACTURING:
Material transfer, Machine loading & unloading, Processing operations, Assembly & Inspectors, Robotic Cell Design & Control.

10. SOCIAL ISSUES & ECONOMICS OF ROBOTICS :

TERM WORK:

1. At least one class test.
2. Minimum SIX exercises based on above topics including programming of robots.

REFERENCE BOOKS:

1 Robotics for Engineers - Yorem Koren
2 Robotics in Practice - J. F. Engelberger
3 Computer Integrated Manufacturing Technology and Systems - Ulrich rembolds, Christial Blume
4 Computer Aided Design in Mechanical Engineering - Ramamurthy
5 Robot Dynamics
6 Robotics - John Craig
7 Robot manipulators : mathematics, Programming and Control - Paul r p
8 Industrial Robotics - Groover and Simmers
9 Measurement systems - Ernest deoblin
10 Mechanical Measurements - Beckwith and Lewisbuck
11 Modern control Engineering - K. Ogata
12 Automatic Control Systems - Benjamin Kus
13 Robotic Engineering An Integrated approach - Richard D. Klafter and et. al.
14 Intelligent Robotic Systems - Spyros G. Tzafestas

CLASS: B.E. (Mechanical)		Semester - VII	
Concurrent Design of Products and Processes- Elective I, Group II			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25
Detailed Syllabus			

1. CUNCURRENT ENGINEERING CONCEPTS :

2. NEW APPROACHES TO MANUFACTURING :
Goals of Product and System design
Drivers of change in Manufacturing
Concurrent Design of Products and Processes
Product Design

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Fabrication and assembly System Design
Designing Production systems for Robustness and Structure

3. HISTORY AND MACRO ECONOMICS OF MANUFACTURING :
Generic problems in High Volume Manufacturing
Generic problems in low Volume Manufacturing
Ecnomic and demographics of Manufacturing in India

4. EXAMPLES OF RECENT ADVANCED PRODUCTION SYSTEMS :
Large scale Productio
Small scale Batch Production

5. BASIC PROCESS ISSUES :
Process Models, Why Process Models are important
Types of Process Models
Relation between Models and Specifications
Relation between Specifications and Technology
Relation between Models control, Automation and Process improvement
Fabrication Processes
Assembly Processes, Assembly Processe Models
Models of test and Inspection tasks
Models of Manufacturing systems

6. STRATEGIC APPROACH TO PRODUCT DESIGN :
Steps in Strategic approach to Product design
Comparison to other Product Design Methods

7. TECHNICAL ASPECTS OF PRODUCT DESIGN :
Assembly sequence generation
Choosing a good assembly sequence
Tolerences and their relation to assembly
Design for material handling and part mating
Creation and evaluation of Testing strategies

8. BASIC ISSUES IN MANUFACTURING SYSTEM DESIGN :
System Design Procedure
Design factors
Intangibles
Assembly resourse alternatives
Task assignment
Tools and Tool changing
Part feeding alternatives
Material handling alternatives
Floor layout and system architecture alternatives
System design and Economic analysis

9. ASSEMBLY WORKSTATION DESIGN :
Strategic issues
Technical Issues
Economic analysis

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10. ECONOMIC ANALYSIS OF SYSTEMS :
Types of manufacturing Cost
Pro-Forma cash flow
Determining allowable investment
How are alternative investments evaluated
Sensitivity analysis
Effect of recycling and rework
Alternative system justification

11. ECONOMIC - TECHNICAL SYNTHESIS OF ASSEMBLY SYSTEMS :
Unit Cost equation
Annualized Cost factor
Preliminary System estimation
Assembly system synthesis

12. SYSTEM SIMULATION :
Simulation as an alternative to analysis
Discrete Event simulation tools
An example simulation

13. CASE STUDIES :

TERM WORK :
Term work should contain atleast 6 assignments in the above listed topics. Two seminars and one in Semester Test should be conducted.

REFERENCE BOOKS :
Concurrent Design of Products and Processes - James L. Nevins et al. MGH
Engineering Productivity through CAD/CAM - Dimitris N. Chorafas Butterworths
Automatic assembly - Boothroyd G. et. al. - Marcel Dekker NY

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CLASS: B.E (Mechanical)		Semester – VII	
AUTOMOBILE SYSTEMS – I, Elective I, Group III			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

Detailed Syllabus

1. AUTOMOBILE POWER PLANT :
Constructional features of different types of engines used in automobiles, Their characteristics, Study of various engine components and their materials.

2. VEHICLE PERFORMANCE :
Tractive force, Tractive force Vs vehicle speed, Resistance to motion of the vehicle – Rolling and gradient resistance, Power requirement for acceleration and gradeability, maximum acceleration for front wheel driven – Rear wheel driven – Four wheel driven vehicles, Selection of suitable rear axle and gear ratios.

3. CLUTCHES :
Details, Requirements of clutches, Types of clutches and clutch materials, Design of clutch, Fluid coupling and maintenance aspects.

4. GEAR BOX :
Necessity of Gear box, Sliding mesh, Constant mesh, Synchromesh and epicyclic gear boxes, Overdrives and hydrodynamic torque converter, Maintenance aspects.

5. PROPELLER SHAFTS AND UNIVERSAL JOINTS :
types and construction of propeller shaft, different types of universal joints and constant velocity joints.

6. LIVE AXLE AND DIFFERENTIAL :
Final drive, spiral, Bevel, Hypoid and worm drives. Types of live axles, Semi, Three quarter and full floating axles. Necessity of differential, Conventional and non-slip differential, Maintenance aspects.

7. ELECTRICAL SYSTEM :
Battery: Types of battery, Lead-Acid, Alkaline, ZEBRA, Sodium Sulphur and Swing. Ratings, Charging, Maintenance and testing of Lead-Acid battery.

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Electronic Ignition system: Capacitor Discharge Ignition System, Distributor less ignition system, Direct ignition system. Hall effect pulse generator, Inductive pulse generator, Constant dwell system, Constant energy system.
Charging system:
Dynamo: Principle of operation, Construction, working. Regulators, combined current and voltage regulator, etc.
Alternator: Principle of operation, construction, working. Rectification from AC to DC.
Starting system: Requirements, Various torque terms used, Starter motor drives; Bendix, Flow through Barrel, Rubber compression, Compression Spring, Friction Clutch, Overrunning Clutch, Dyer. Starter motor solenoids and switches, Glow plugs.

8. LIGHTING :

Types of lamps, Energy demand of lighting systems.
Head lamps: Construction and types, Setting and control. Reflectors: Parabolic, Bifocal, Homifocal, Poly-ellipsoidal. Fog lamp, Side lamp, Tail lamp, Parking lamp, Brake warning light, Trafficators, Blinkers, Flashers, Electronic flasher circuit, instrument panel lights, Body interior illumination. Gauges: Fuel, Temperature, Oil pressure etc.
Accessories: Electric horn, Wipers, Fuel pump, Power operated windows, etc.

7. WHEELS AND TYRES :

Requirements of wheels and tyres, Constructional features, Types of tyres, Inflation pressure and its importance, Application to ride and stability, Maintenance aspects.

8. VEHICLE MAINTENANCE AND SERVICING :

Importance of vehicle maintenance, Preventive maintenance, Break-down maintenance, Corrective maintenance, Overhaul major and minor, Unit replacement system – Retrieval – various aspect of retrieval, Purchasing Vs Retrieval, Engine and chassis lubrication, Types of lubricant.

TERM WORK:

Class assignments and laboratory experiments of

1. Study of engine components
2. Study of clutches
3. Study of gear boxes
4. Study of rear axle and differential
5. Study of ignition and charging systems
6. Study of starting systems, lighting systems and battery
7. Study of wheels and tyres
8. Study of vehicle maintenance

One class test

TEXT BOOKS:

1. Automotive Mechanics by Williams Crouse
2. Automotive Mechanics by Joseph Heitner
3. The Automobile by Harbans Singh REyat
4. The Automobile Engineering by T.R. Banga & Nathu Singh
5. Automobile Engineering by Kirpal Singh Vol I & II
6. Automobile Electrical and Electronics by Tom Denton
7. Automobile Mechanics by N.K. Giri

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REFERENCE BOOKS:

1. Automotive transmissions and Power trains by William Crouse
2. Automotive Service Technology by Clifford M. Tempest
3. Automobile Electrical Equipments – Young & Griffiths.
4. Motor vehicles by Newton & Steeds

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CRYOGENIC ENGINEERING, Elective I, Group IV				
Class: B.E. (Mechanical)			Semester: VII	
Periods per week: (60 minutes duration)	Lectures	:	4	
	Tutorials	:	-	
	Practicals	:	2	
			Hours	Marks
Evaluation System:	Theory Examination	:	3	100
	Practical	:	-	-
	Oral Examination	:	-	25
	Term Work/Assignment	:	-	25
Detailed Syllabus:				

1. Introduction to cryogenic systems – development and present state of affairs of cryogenic engineering.
2. Low temperature properties of engineering materials, thermal engineering and magnetic properties of cryogenic fluids.
3. Gas liquefaction systems: system performance parameters, Thermodynamically ideal systems- Joule-Thomson effect- adiabatic expansion- critical components of liquefaction systems.
4. Gas separation and purification systems- cryogenic refrigeration systems, expansion engines refrigeration systems.
5. Phillips refrigerators, importance of refrigerator effectiveness, Vuilleumier refrigerator, Solvay refrigerator, Gifford-McMahon refrigerator, refrigerators using solids as working media.
6. Measurements systems for low temperatures, temperature, pressure flow rate, and liquid level measurements.
7. Cryogenic fluid storage and transfer, system insulations. Importance of vacuum technology in cryogenics. Application of cryogenic systems, super conducting devices, space technology, cryogenic in biology and medicine.

TERM WORK:

This will consist of write up of laboratory experiments based on syllabus and project assignments and one class test.

TEXT BOOKS:

1. Cryogenics Systems – R. Barron Oxford University Press
2. Cryo-Cooler, Fundamentals Part-I – G.Walker Plenum Press New York
3. Cryo-Cooler, Fundamentals Part-II – G.Walker Plenum Press New York

REFERENCE BOOKS :

1. Sterling cycle design manual – Martini W. NASA Report, 1978

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Business Process Reengineering (BPR), Elective I, Group V				
Class: B.E. (Mechanical)			Semester: VII	
Periods per week: (60 minutes duration)	Lectures	:	4	
	Tutorials	:	-	
	Practicals	:	2	
			Hours	Marks
Evaluation System:	Theory Examination	:	3	100
	Practical	:	-	-
	Oral Examination	:	-	25
	Term Work/Assignment	:	-	25
Detailed Syllabus:				

1) What is BPR
2) Considerations in BPR
3) TQM
4) SW available for BPR
5) How to Plan Your Project, Select the Right Team, and Choose Your Approach
6) Articulate the business issues driving the project
7) Clearly define your project's objectives
8) Gain buy-in from key business leaders
9) Define the project scope
10) Create a powerful team
11) Choose your reengineering steps
12) Select and work with consultants
13) Prepare a project budget
14) Project Planning Template and Guidelines
15) Reengineering Team Selection Criteria and Approach
16) Methodology Selection
17) Consultant Selection
18) Project Readiness Assessment

REFERENCE BOOKS :

Reengineering the Corporation - A Manifesto for Business Revolution by Michael Hammer and James Champy.

Reengineering for Results: Keys To Success From Government Experience, Dr. Sharon L. Caudle; National Academy of Public Administration; Aug 94; on line text

Business Process Improvement
The Breakthrough Strategy For Total Quality, Productivity, And Competitiveness, H. James Harrington

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The Change Management Toolkit for Reengineering
For companies and individuals involved in reengineering and represents a practical approach to the management of change in any organization - from Holland and Davis, WorthingBrighton Press.

Competing for the Future, Gary Hamel and C.K. Prahalad; book review and ordering info.

Deming Management Method, TheMary Walton; Perigee Books, Book review

Best Practices In Reengineering, McGraw-Hill, New York, NY, 1995 by David K. Carr and Henry J. Johansson, Coopers and Lybrand

Managing the Change Process: A Field Book for Change Agents, Team, Leaders and Reengineering Managers; David K. Carr,Kelvin J. Hard,William J. Trahant

New Tools For New Times: The Workflow Paradigm, Second Edition, WARIA **Book** Review on line, http://www.waria.com/waria/fischer.html

Process Innovation: Reengineering Work Through Information Technology, Thomas Davenport; Harvard Business School Press

Reengineering Revolution, A Handbook (The) HarperCollins Publishers, Inc. , New York, 1995, Michael Hammer and Steven A. Stanton; Book Review Only

The Wisdom of Teams : Creating the High-Performance Organization, Jon R. Katzenbach Douglas K. Smith

Winning With Quality: Applying Quality Principles In Product Development, John W. Wesner, Jeffrey M. Hiatt, and David C. Trimble

TERM WORK :
Case Study : Present a report of 10 – 15 pages on any topic from syllabus.

Assignments
Should contain 5 assignments covering the entire syllabus

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Computer Integrated Manufacturing, (CIM), Elective I, Group VI				
Class: B.E. (Mechanical)			Semester: VII	
Periods per week: (60 minutes duration)	Lectures	:	4	
	Tutorials	:	-	
	Practicals	:	2	
			Hours	Marks
Evaluation System:	Theory Examination	:	3	100
	Practical	:	-	-
	Oral Examination	:	-	25
	Term Work/Assignment	:	-	25
Detailed Syllabus:				

1. FUNDAMENTALS OF MANUFACTURING AND AUTOMATION :

1 Production operations and automation strategies
2 Production Economics

2. HIGH VOLUME PRODUCTION SYSTEMS :

1 Detroit Type automation
2 Analysis of Automated Flow lines
3 Assembly systems and line Balancing
4 Automated Assembly systems

3. NUMERICAL CONTROL PRODUCTION SYSTEMS :

1 Numerical control
2 Part Programming
3 Flexible Manufacturing systems

4. QUALITY CONTROL AND AUTOMATED INSPECTION :

1 Automated Inspection and Testing

5. CONTROL SYSTEMS :

1 Linear Feedback Control systems
2 Optimal Control
3 Sequence Control and Programmable Controllers
4 Computer process Control

6. COMPUTER INTEGRATED MANUFACTURING :

1 Fundamentals of CAD/CAM
2 Computerized Manufacturing Planning systems
3 Shop Floor Control and automatic Identification techniques
4 Computer Networks for Manufacturing
5 Future automated factory

TERMWORK :

Assignments on the Use of I-DEAS Master Series or any other similar
Assignments on the use of NCPACK, Assignments on the use of CAMAND or any other similar

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Term work should contain atleast 6 assignments in the use of the above softwares and 6 assignments in the use of the above listed topics. Two seminars and one in Semester Test should be conducted.

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REFERENCES :

1 Automation, Production Systems, and Computer integrated Manufacturing - Mikell P. Groover
2 CAD/CAM/CIM - P. Radhakrishnan
3 Computer Aided Mechanical Design and analysis - V. Ramamurthy
4 CAD/CAM - Mikell P. Groover and Emory. W. Zimmer
5 Fundamentals of CIM Technology - Oavid I. Goetsch
6 Computer Integrated Manufacturing Techniques and Applications - Michael Hardeski

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Advanced Finite Element Methods, Elective I, Group VII				
Class: B.E. (Mechanical)			Semester: VII	
Periods per week: (60 minutes duration)	Lectures	:	4	
	Tutorials	:	-	
	Practicals	:	2	
			Hours	Marks
Evaluation System:	Theory Examination	:	3	100
	Practical	:	-	-
	Oral Examination	:	-	25
	Term Work/Assignment	:	-	25
Detailed Syllabus:				

1. INTRODUCTORY CONCEPTS :
Introduction to FEM. Brief History. General FEM procedure. Applications of FEM in various fields. Advantages and disadvantages of FEM.

2 A. DIFFERENTIAL EQUATIONS IN DIFFERENT FIELDS :
Types of Differential Equations. Primary and Secondary Variables and types of Boundary Conditions. Methods of solving Differential Equations – Exact Method, Finite Difference Method.

2 B. MATRIX ALGEBRA :
Guass Elimination Method to get inverse of a Matrix. Partitioning of Matrix.

2 C. NUMERICAL INTEGRATION :
Newton-Cotes Method, Guass Quadrature Method.

3. FEM PROCEDURE :
Definitions of various terms used in FEM like element, order of the element, internal and external node/s, degree of freedom, primary and secondary variables, essential BCs, natural BCs, homogeneous and non-homogeneous BCS, discretisation, shape function and interpolation function, band-width, aspect ratio, coarse and fine meshing, etc.

Derivation of Lagranges Interpolation Functions in Cartesian (Local and Global) and actural co-ordinate systems.

Pre-processing, Processing and Post-processing – Detail study Topology.

4. FEM WEIGHTED RESIDUE APPROACH :

A. Non-weak form type Methods : Approximate Solution, Residue, weighted integral equation. Weight functions. Methods to generate Matrix Equations from Governing Differential equations: Collocation Method, Sub-domain Method, Method of Least Squares, Galerkin Method, Petrov-Galerkin Method.

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B. Weak-form type Method : Rayleigh-Ritz Method : To generate Element Matrix equation in Local Co-ordinate System, using interpolation functions including Lagrange's family of Interpolation functions, trigonometrical functions etc . in the fields like Thermal, Nuclear, Fluid Structural etc.
C. Assembly and Solution : To generate Global Matrix equation. Substitution of Global BCs. Solution. Method of Elimination, Penalty-approach Method.

5. DIRECT APPLICATION OF ELEMENT MATRIX EQUATIONS :
Analysis and solution of problems in various fields like Thermal, Structural Mechanics, Nuclear, Fluid etc. (Stepped and Taper Bars, Fins, Fluid Network, Spring-cart Systems, Plane Trusses, Beams).

6. ERROR ANALYSIS :
Various sources of errors. Convergence criteria

7. Introduction to Time-dependent problems in 1-D .

8. TWO DIMENSIONAL PROBLEMS- INTRODUCTORY APPROACH:
Derivation of Interpolation function for triangular and rectangular elements. Topology. Assembly. Solution.

TERM WORK :

- Assignments at least one on each topic
- Assignments using I-DEAs Master series or other similar-at least 1- which shall cover tasks like Model-prepeartion, Mesh generation, Simulation,Postprocessing etc.
- Assignments using ANSYS, ADAMS or other similar- at least 1- which shall cover tasks like Model-prepeartion, Mesh generation, Simulation,Postprocessing etc.
- Minimum one seminar
- One in semester test

REFERENCES BOOKS :

Sr. no.	Title	Author	Publisher
1	Finite Element Method	Reddy J. N.	McGRAW-HILL
2	Introduction to FE in Engg.	Chandrupatla, Belugundu	Prentice Hall
3	FE Procedures	Bathe	Prentice Hall
4	FEM in Engg.	Rao S. S.	Pergamon Press
5	Applied FEA	Segerlind	John Wiley
6	FEM	Fagan	
7	Concepts and Applications of FEA	Cook, Malkus, Plesha	John Wiley
8	FEA for undergraduates	Akin J. Ed	Academic Press
9	Theory, problems of FEA Schaum's series	George R. Buchanan	McGRAW-HILL
10	FEM	Norrie, Vries	Academic Press
11	FEA in Engg. Design	S Rajsekaran	Wheelar
12	Boundary and FEs, Theory, Problem	J Ramchandran	Narosa
13	Textbook of FEAnalysis	P.Seshu	Prentice Hall

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NON DESTRUCTIVE TESTING, Elective I, Group VIII				
Class: B.E.(Mechanical)			Semester: VII	
Periods per week: (60 minutes duration)	Lectures	:	4	
	Tutorials	:	-	
	Practicals	:	2	
			Hours	Marks
Evaluation System:	Theory Examination	:	3	100
	Practical	:	-	-
	Oral Examination	:	-	25
	Term Work/Assignment	:	-	25
Detailed Syllabus:				

1. INTRODUCTION :

What is NDT, comparison between destructive and NDT, importance of NDT, scope of NDT, methods and problems, difficulties of NDT, comparison and selection of NDT methods, future progress in NDT, economics aspects of NDT,

2. ULTRASONIC TESTING:

Principle, wave propagations, Types of waves, frequency, velocity, wavelength, reflection, divergence, attenuation, mode conversion etc. in ultrasonic, UT testing methods, contact testing, and Immersion testing, normal beam and straight beam testing, angle beam testing, dual crystal probe testing, ultrasonic testing techniques. Resonance testing, through transmission testing technique, pulse echo testing technique, instruments used in UT, accessories such as transducers, types, various types, frequencies and sizes commonly used, cables, reference blocks with artificially created defects, calibration of equipment, testing of materials such as products like plates and roundbars, weld joints, castings, forgings, UT of nonmetals, advantages, limitations of UT, defects in various products.

3. RADIOGRAPHY TESTING :

Basic principle, Electromagnetic radiation sources: X-ray source, production of X-rays, high energy X-ray source, gamma ray source. Properties of x-rays and gamma rays. Inspection techniques like SWSI, DWSI, DWDI, panoramic exposure, real time radiography, films used in industrial radiography, types of films, speed of films, qualities of films, screens used in radiography, quality of a good radiograph, film processing, interpretation, evaluation of test results, safety aspects required in radiography, advantage and limitations, standards.

4. EDDY CURRENT TESTING :

principle of ECT, physics aspects of ECT like conductivity, permeability, resistivity, inductance, inductive reactance, impedance etc, field factor and lift of effect, edge effect, end effect, impedance plane diagram in brief, depth of penetration of ECT, relation between frequency and depth of penetration in ECT. Equipments and accessories, various application of ECT such as conductivity measurement, hardness measurement, defect detection, coating thickness measurement, coating of materials etc., advantages and limitation of ECT.

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4. **MAGNETIC PARTICLE TESTING :**
Principles of MPI, basic physics of magnetism, permeability, flux density, cohersive force, magnetizing force, rentivity, residual magnetism etc., methods of magnetization, magnetization techniques such as head shot technique, cold shot technique, central conductor testing, magnetization using products using yokes, direct method of magnetism, indirect method of magnetization.

continuous testing of MPI, residual technique of MPI, system sensitivity, checking devices in MPI, interpretation of MPI, indications, advantage and limitation of MPI.

5. **DYE PENETRANT TESTING :** Principles of DPT, properties required in a good penetrant and development which are used as consumable in dye penetrant testing, qualification of penetrant testing consumable, types of penetrants, types of developers, use of various types of penetrants and developers for various application, DPT technique, or test procedure, interpretation and evaluation of penetrant test indication such as relevant indications, non relevant indications, false indication, safety precaution required in penetration testing.

- Atleast 10 Assignments and practicals based on above topics.
- Report based on Industrial Visit.

TEXT BOOKS:

1. NDT — Krant Krammer
2. Ultrasonic Testing — Krant Krammer (Narosa Publishing House)
3. Techniques of NDT — Hogarth & Blitz (Butterworth & Co. Pub.)
4. Practical NDT — Baldev Raj & Jaya Kumar, (Narosa Publishing House)
5. Principles and Practice of NDT, J.H. Lamble (Heywood & Company Ltd)

REFERENCES BOOKS:

- Handbook of NDT — Robert C. Mc Master Vol.-I and Vol.-II (ASTM)

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CLASS: B.E (Automobile / Mechanical)		Semester – VII	
Enterprise Networking and Internet , Elective I, Group IX			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25
Detailed Syllabus			

Introduction
Growth of Computer Networking, Complexity in Network Systems, Mastering the Complexity, Resource Sharing, Growth of the Internet, Probing the Internet, Interpreting A Ping Response

PART I DATA TRANSMISSION

Transmission Media
Copper Wires, Glass Fibers, Radio, Satellites, Geosynchronous Satellites, Low Earth Orbit Satellites, Low Earth Orbit Satellite Arrays, Microwave, Infrared, Light Form a Laser

Local Asynchronous Communication
The Need for Asynchronous Communication, Using Electric Current to Send Bits, Standards for Communication, Baud Rate, Framing, and Errors, Full Duplex Asynchronous Communication, Limitations of Real Hardware, Hardware Bandwidth and the Transmission of Bits, The Effect of Noise On Communication, Significance for Data Networking

Long-Distance Communication (Carriers, Modulation and Modems)
Sending Signals across Long Distances, Modem Hardware Used for Modulation and Demodulation, Leased Analog Data Circuits, Optical, Radio Frequency, And Dialup Modems, Carrier Frequencies and Multiplexing, Base band And Broadband Technologies
Wave Division Multiplexing, Spread Spectrum, Time Division Multiplexing

PART II PACKET TRANSMISSION

Packets, Frames and Error Detection
The Concept of Packets, Packets and Time-Division Multiplexing, Packets and Hardware Frames, Byte Stuffing, Transmission Errors, Parity Bits and Parity Checking, Probability, Mathematics And Error Detection, Detecting Errors With Checksums,

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Detecting Errors With Cyclic Redundancy Checks, Combining Building Blocks, Burst Errors, Frame format And Error Detection Mechanisms

LAN Technologies and Network Topology
Direct Point-To-Point Communication, Shared Communication Channels, Significance of LANs and Locality of Reference, LAN Topologies, Bus Network: Ethernet Carrier Sense on Multi-Access Networks (CSMA), Collision Detection and Back off With CSMA/CD, Wireless LANs And CSMA/CA, Bus Network: Local Talk

Hardware Addressing and Frame Type Identification
Specifying a Recipient, How LAN Hardware Uses Addresses to Filter Packets Format of a Physical Address, Broadcasting, Multicasting, Multicast Addressing, Identifying Packet Contents, Frame Headers And Frame Format, Using Networks That Do Not Have Self-Identifying Frames, Network Analyzers

LAN Wiring, Physical Topology, and Interface Hardware
Speeds of LANs and Computers, Network Interface Hardware, the Connection between A NIC and A Network, Original Thick Ethernet Wiring, Connection Multiplexing, Thin Ethernet Wiring
Twisted Pair Ethernet, the Topology Paradox, Network Interface Cards and Wiring Schemes,

Extending LANs: Fiber Modems, Repeaters, Bridges and Switches
Distance Limitation and LAN Design, Fiber Optic Extensions, Repeaters, Bridges, Frame Filtering
Startup and Steady State Behavior of Bridged Networks, Planning a Bridged Network, Bridging Between Buildings, Bridging Across Longer Distances, A Cycle Of Bridges, Distributed Spanning Tree, Switching, Combining Switches And Hubs, Bridging And Switching With Other Technologies

Long-Distance Digital Connection Technologies
Digital Telephony, Synchronous Communication, Digital Circuits and DSU, Telephone Standards
DS Terminology and Data Rates, Lower Capacity Circuits, Intermediate Capacity Digital Circuits
Highest Capacity Circuits, Optical Carrier Standards, the C Suffix, Synchronous Optical Network (SONET), the Local Subscriber Loop, ISDN, Asymmetric Digital Subscriber Line Technology
Other DSL Technologies, Cable Modem Technology, Upstream Communication, Hybrid Fiber Coax

Wan Technologies and Routing
Large Networks and Wide Areas, Packet Switches, Forming A WAN, Store and Forward Physical Addressing In A WAN, Next-Hop Forwarding, Source Independence, Relationship of Hierarchical Addresses to Routing, Routing In A WAN, Use of Defaults Routes, Routing Table Computation, Shortest Path Computation in a Graph, Distributed Route Computation, Distance Vector Routing

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Network Ownership, Service Paradigm, and Performance
Network Ownership, Virtual Private Networks, Service Paradigm, Connection Duration and Persistence, Examples of Service Paradigms, Addresses and Connection Identifiers, Network Performance Characteristics

Protocols and Layering
The Need for Protocols, Protocol Suites, A Plan for Protocol Design, the Seven Layers, Stacks: Layered Software, How Layered Software Works, Multiple, Nested Headers, the Scientific Basis for Layering,

PART III INTERNETWORKING

Internetworking: Concepts, Architecture and Protocols
The Motivation for Internetworking, the Concept of Universal Service, Universal Service in a Heterogeneous World, Internetworking, Internet Architecture, Achieving Universal Service, A Virtual Network, Protocols for Internetworking, Significance of Internetworking and TCP/IP, Layering and TCP/IP Protocols, Host Computers, Routers And Protocol Layers

IP: Internet Protocol Addresses
Addresses for the Virtual Internet, The IP Addressing Scheme, The IP Addressing Hierarchy, Classes of IP Addresses, Computing the Class of an Address, Dotted Decimal Notation, Classes and Dotted , Decimal Notation, Division of the Address Space, Authority for Addresses, An Addressing Example
Special IP Addresses, Summary of Special IP Addresses, the Berkeley Broadcast Address Form
Routers and the IP Addressing Principle, Multi-Homed Hosts

The Following topics are meant for seminars and reading and should be omitted for examinations

NETWORK APPLICATIONS -
Client-Server Interaction
The Socket Interface
Example of a Client and a Server
Naming With the Domain Name System
Electronic Mail Representation and Transfer
File Transfer and Remote File Access
World Wide Web Pages and Browsing
Network Security
Initialization (Configuration)

TERM WORK
Term work should consist of at least 10 assignments from the aforementioned topics. A Seminar to be presented by each student as part of term works carrying 15 marks.

REFERENCE
Computer Network, Tuekeun, PHI
Networking Technology, Jaiswal, Galgotia.
Data Networking, Bertsekas, PHI

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CLASS: B.E (Automobile / Mechanical)		Semester – VII	
Project I			
Periods per week 1 Period of 60 min.	Lecture		
	Practical	4	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	--	--
	Practical	--	-
	Oral Examination	--	--
	Term Work	--	50
Detailed Syllabus			

Guidelines for submission of report of Project I

Body of Project

Introduction
Literature Survey
Objective
Methodology
Feasibility study

Appendix

This should contain Drawings, Graphs, coding used etc.

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Semester VIII

Design of Mechanical Systems				
Class: B.E.(Mechanical)			Semester: VIII	
Periods per week: (60 minutes duration)	Lectures	:	4	
	Tutorials	:	-	
	Practicals	:	3	
			Hours	Marks
Evaluation System:	Theory Examination	:	4	100
	Practical	:	-	-
	Oral Examination	:	-	25
	Term Work/Assignment	:	-	50
Detailed Syllabus:				

1. Methodology for mechanical system design

2. a) Layout of mechanisms (hoisting, trolley, traveling, bridge traveling, slewing, (buffing) used for the following types of cranes and applications of these cranes

   i) E. O. T. crane
   ii) Hand operated O.H.T. crane
   iii) Hand operated stationary ? crane
   iv) Stationary crane with turntable
   v) Truck mounted crane

   b) Design of –

   i) Hoisting mechanism for E.O.T. crane
   ii) Trolley structure and trolley traveling mechanism for E.O.T. crane
   iii) Bridge girder of E.O.T. crane

3. a) Layout of belt conveyor (2 views) showing all main components with their functions

   b) Design of – traction belt, pulleys, idlers with spindle

4. a) Construction, working and applications of

   i) Gear Pump
   ii) Centrifugal Pump

   b) Design of main components of gear pump –

   i) Motor selection
   ii) Gear design
   iii) Shaft design and bearing selection – design
   iv) Casing and bolt design
   v) Suctions and delivery pipe

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c) Design of main components of centrifugal pump –

i) Motor selection
ii) Suction and delivery pipe
iii) Impeller
iv) Impeller shaft
v) Volute casing
vi) Diffuser

5. a) Difference between petrol and diesel engine from the following points –

i) Working principle
ii) Material used and constructional features of cylinder; connecting rod; piston; crank shaft
iii) Application

b) Application of – two stroke and four stroke engines, single cylinder and multi-cylinder engines, petrol and diesel engines,

c) Power per cylinder and design of the following components of diesel engine – cylinder – header, liner; jacket, connecting rod, piston, crank shaft.

TERM WORK:

1. Report consisting sketches and design report covering all the above topics

2. Drawings –

i) Assembly and details of – Hook and Pulley block
ii) Complete assembly of EOT crane trolley with hoisting and trolley traveling mechanism
iii) Assembly and details of gear pump or centrifugal pump (Students need not prepare drawings of gear box and brake)

REFERENCES BOOKS:

1. Rudenko – Material handling equipments
2. Alexandrove – Material handling equipments
3. Spivakovsky and Dyachkov – Conveying machines
4. Orlov – Machine Design – Vol. I
5. Maleev – I. C. Engine Design
6. Sharma ? – Machine Design
7. PSG – Design Data Book
8. Khandave, Kale – Design data book for engine parts
9. Abdulla Sharif – Handbook, design data
10. IS : 807, 1976
11. IS : 3443 – 1980
12. IS : 3815 – 1969
13. IS : 3777 – 1965
14. IS : 3973 - 1967

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REFRIGERATION AND AIR-CONDITIONING				
Class: B.E. (Mechanical)			Semester: VIII	
Periods per week: (60 minutes duration)	Lectures	:	4	
	Tutorials	:	-	
	Practicals	:	2	
			Hours	Marks
Evaluation System:	Theory Examination	:	3	100
	Practical	:	-	-
	Oral Examination	:	-	25
	Term Work/Assignment	:	-	25
Detailed Syllabus:				

2.1 Refrigeration: Theory of refrigeration machines. Reversed carnot cycle. Cold air refrigeration machine. Co-eff. of performance. Applications of air cycles for cooling aircraft cabins. Vapour compression machines. Refrigeration effects per kg. of working substance-primary and secondary refrigerants. Multistage compression and expansion systems, with flash inter cooling. Cascade system of refrigeration. Vapour absorption machines. Commercial ice making plant. Household refrigerators, cryogenics. Liquefaction of gases, manufacturing of dry ice.

2.2 Air-Conditioning: Thermodynamic properties of air-water vapour mixtures. Psychorometry, use of psychorometric charts of various types, study of heating, cooling, humidification and dehumidification. Processes on air-water-vapour mixtures. Adiabatic mixing of air streams. Reheating and bypassing of air. Room apparatus dew point, coil apparatus dew point. Sensible heat factor, coil bypass factor, Inside and outside design, comfort air conditioning, comfort chart, comfort zone, effective temperature. Air conditioning load calculations.

2.3 Air distribution – high and low velocity ducts. Duct design, zoning, fans and blowers (applications only).

2.4 Cold Storages – load calculations, optimum insulation, design conditions for storage of various commodities, air circulation, types of evaporators, defrosting, controls in air conditioning plants, refrigerant feed control, safety controls, H.P. and L.P. switches, oil pressure failure switch, interlocking control, humidity and temperature measurement and control, air velocity measurement. Electric, pneumatic circuits for refrigeration plant used in air-conditioning.

2.5 Construction, layouts, operation and maintenance of air-conditioning plants. Noise and vibration control, fault location, causes and remedies, preventive maintenance.

2.6 Application of summer, winter and all weather air-conditioning plants. Testing of air-conditioning plants.

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TERM WORK:

This will consist of write up of laboratory experiments, based on the syllabus of project assignment.

TEXT BOOKS:

1. Refrigeration and Air-Conditioning - W.F. Stoecker and J.W. Jones, Tata McGraw Hill Pub.
2. Modern Air-Conditioning Practice - Norman C. Harris, Principles of Refrigeration - R.J. Dossat, Wiley Eastern Pub.
3. Refrigeration and Air-Conditioning - C.P. Arora, Tata McGraw Hill Pub.

REFERENCE BOOKS:

Refrigeration and Air-Conditioning - Manohar Prasad. New Age Int.(P) Ltd.

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
INDUSTRIAL ENGINEERING AND ENTERPRISE RESOURCE PLANNING			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25
Detailed Syllabus			

I INDUSTRIAL ENGINEERING

1.INTRODUCTION

System approach in manufacturing organization , Feature , Identification of different types of manufacturing systems (Mass, Batch , Job and Continuous)

2.ORGANISATION STRUCTURE AND BEHAVIOUR

Definition , Need , Types , Hierarchy , Functional matrix relationship , Responsibility , Authority delegation , Span of control , Recent developments (Lean , network , Virtual , SBU'S), Theories of motivation and leadership)

1. PRODUCTION MANAGEMENT

Production , Planning & control- Definations and Objectives, Inventory Control – Deterministic models , Statistical Quality Control – Control chart for variables - Concepts of variation, Control limit theorem. Why control charts work , Control chart techniques, -(Quality characteristics, trial control limits, revised control limits of mean, range and standard deviation chart, state of control, control chart for moving average and run charts) Control charts of attributes- Control chart for fraction defectives(p), Control chart for number of defectives(np), Control for number of defects (c), Control chart for number of defect per unit (u) . Total quality management – Policies and objectives , Organization for Quality , Cost of Quality , Designing for quality , Quality systems & Standards.

2. WORK STUDY , METHODS ENGINEERING & ERGONOMICS

Defination and Objectives , Work content – Basic work content, Total work content – in-effective time method of their reduction, Method study : Definition- Objectives and basic procedure- Different techniques used in method improvement- Process chart symbol- Process chart for operator or material process chart- Process chart for assembies, Flow diagram- analysis and critical examination of operations and development of improved methods, Man machine chart, Multiple activity chart, Use of micromotion and memotion study , Work measurements , Significance and procedures of work measurement , Techniques of time study: Steps in making a time study - Selection of operator, Break-up of an operation in to elements, Different timing method- Recording

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time study data- Form used ,Different rating practices , Normal time, Different types of allowances, Standard time. Maynard operation sequencing training (MOST) , Ergonomics , Safety , Safety devices , Occupational health and hazards , Design of Work Place.

Industrial psychology , Fatigue , Physical environment , Sound , Lighting, Ventilation.

3. FACILITIES PLANNING

Types of layout, Location of facilities, (Product, Process, Line Cellular/group)Techniques for layout design for process ad product layouts, Assembly line balancing – Numerical problems.

4. MODERN DEVELOPMENTS IN INDUSTRIAL ENGINEERING

MRP-I (Material requirement planning), MRP-II (manufacturing resources planning), JIT , KANBAN , Push and pull production systems , Theory of constraints , BPR (Business process Re engineering) , Lean manufacturing , Agile manufacturing, Supply chain management , Enterprise Resources planning –ERP.

II ERP (ENTERPRISE RESOURCE PLANNING)

5. INTRODUCTION :I

What is ERP? Why ERP system is required? Managing enterprise with ERP – The new paradigm , Evolution of ERP, Material requirement planning (MRP) , Manufacturing Resoueces Planning (MRP-II)

6. THE EMERGENCE OF ERP SYSTEMS :

Salient feature of of ERP systems , Different perspectives of ERP systems, Information systems perspective , Manufacturing perspective , ERP systems and management perspectives.

7. ERP & SUPPLY CHAIN MANAGEMENT (SCM) :

ERP & Business Process Reengineering (BPR)
ERP & Integrated Management Systems
ERP & Multiplant management
ERP & Enterprise Paperless Management

8. JUSTIFICATION OF ERP SYSTEMS :

Cost / Benefit analysis , Tangible and intangible benefits , Selection and implementation of ERP systems.

9. ERP SYSTEM IN INDIA :

ERP : Perspective of Indian Industries.
Recent trends in ERP

*-Topics 1,2 5 & 6 should be taught in elementary level covering basic concepts

TERM WORK.

Class test
At least five assignment on concepts , Case studies and analysis based on the topics mentioned above.

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TEXT BOOKS.

1. Management A Global Perspective , 10th Edition, Heinz Weihrich, Harold, Koontz, Tata McGraw Hill Publishing Company Ltd (international Edition).Production and Operation Management, Chase, Acquilano & Jacks, Tata McGraw Hill Publishing Company Ltd
2. Time and Motion Study, Ralph M. Barnes.
3. Total Quality management , J.S. Oakland
4. Work Study and Ergonomics, H.S. Sham , Dhanpatrao
5. ERP and beyond integrating your entire organization, Gang A. LangenWalter, The St. Lucas Press/ Apics Series on resources management

REFERENCE BOOKS.

1. E- Business & ERP Transforming the Enterprise
   Grant Norris , James R. Hurley , Kenneth M. Hurtley , John R. D. , John D. B.
2. Plant layout , Facilities planning By M. Apple
3. TQM (Total Quality management) By Besterfield
4. Business process reengineering Myths & Realities By Colen Coulsan , Thomson press
5. Business Process redesign A View From the inside By Ashley , Bragenza, Andrew Myers (International Thomson Business Press)

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
Artificial and Machine Intelligence, Elective II, Group I			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25
Detailed Syllabus			

1. AI AND INTERNAL REPRESENTATION :

Artificial Intelligence and the World, Representation in AI, Properties of Internal Representation, The Predicate Calculus, Predicates and Arguments, Connectives Variables and Quantification, How to Use the Predicate Calculus, Other Kinds of Inference Indexing, Pointers and Alternative Notations, Indexing, The Isa Hierarchy, Slot-Assertion Notation, Frame Notation

2. LISPS :

Lisps, Typing at Lisp, Defining Programs, Basic Flow of Control in Lisp, Lisp Style, Atoms and Lists, Basic Debugging, Building Up List Structure, More on Predicates, Properties, Pointers, Cell Notation and the Internals (Almost) of Lisp, Destructive Modification of Lists, The for Function ,Recursion, Scope of Variables, Input/Output, Macros

4. NEURAL NETWORKS AND FUZZY SYSTEMS :

Neural and fuzzy machine Intelligence, Fuzziness as Multivalence, The Dynamical Systems approach to Machine Intelligence, The brain as a dynamical system, Neural and fuzzy systems as function Estimators, Neural Networks as trainable Dynamical system, Fuzzy systems and applications, Intelligent Behavior as Adaptive Model free Estimation, Generalization and creativity, Learning as change, Symbol vs Numbers, Rules vs Principles, Expert system Knowledge as rule trees, Symbolic vs Numeric Processing, Fuzzy systems as Structured Numerical estimators, Generating Fuzzy rules with product space Clustering, Fuzzy Systems as Parallel associators, Fuzzy systems as Principle based Systems

1. NEURAL NETWORK THEORY :

Neuronal Dynamics: Activations and signals, Neurons as functions, signal monotonicity, Biological Activations and signals, Neuron Fields, Neuron Dynamical Systems, Common signal functions, Pulse-Coded Signal functions

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2. GENETIC ALGORITHMS :

A simple genetic algorithm, A simulation by hands, similarity templates(Schemata), Mathematical foundations, Schema Processing at work, The two- armed and k-armed Bandit Problem, The building block hypothesis, The minimal Deceptive Problem

Computer implementation of Genetic algorithm, Data Structures, Reproduction , Cross over and Mutation, Time to reproduce and time to Cross Mapping objective function to fitness form, Fitness scaling

Applications of genetic algorithm, De Jong and Function Optimization, Improvement in basic techniques, Introduction to Genetics based machine learning, applications of genetic based machine leaning

3. DATA MINING :

Introduction to Data Mining, Computer systems that can learn, Machine learning and methodology of science, Concept learning, Data ware house, designing decision support systems, Client server and data warehousing, Knowledge Discovery Process, Visualization Techniques, K- nearest neighbor, Decision trees, OLAP tools, Neural networks, Genetic algorithm, Setting up a KDD environment, Real life applications, Customer profiling, Discovering foreign key relationships

TERM WORK :

a. Software development in lisp and other languages and packages for practices and algorithm discussed in the syllabus.
b. written assignment on any four topics discussed above
c. One seminar by every student from the aforesaid area.
d. One class test

TEXT BOOK :

1. Introduction to Artificial Intelligence By Eugene Charniak, Drew McDermott- Addison Wesley
2. Neural Networks and fuzzy systems A dynamical systems approach to machine Intelligence by Bart Kosko- PHI
3. Genetic Algorithms in search, Optimization & Machine Learning by David E Goldberg-Addison wesley
4. Data Mining by Pieter Adriaans and Dolf Zantinge – Pearson Education Asia
5. Data Warehousing in the Real World by Sam Anahory and Dennis Murray, Addison -Wesley

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
Software Engineering, Elective II, Group II			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25
Detailed Syllabus			

Intoduction to Software Engineering
Scope of Software Engineering
Software production and its difficulties
Software Life-Cycle Models
Software Planning
Stepwise refinement: A Basic Software Engineering technique Testing
Phases of Life cycle
Specification methods
Modularity
Design methods
Implementation
Maintenance
Computer aided software Engineering
Portability and Reusability
ADA and software Engineering
Experimentation in Software Engineering
Automatic Programming

TW: 5 Case studies and their development covering the syllabus.

REFERENCE BOOKS :

Software Engineering by Stephen R. Schach
Analysis and Design of Information Systems - Senn James A
Analysis and Design and implementation of Information Systems -Lucas, Henry C. Jr
Systems methodology in practice - Checkland P Wiley
Applied general systems theory - Van Gich

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CLASS: B.E (Mechanical)		Semester - VIII	
AUTOMOBILE SYSTEMS – II, Elective II, Group III			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25
Detailed Syllabus			

1. DRIVES :
Hotchkiss drive, Torque tube drive and radius rods.

2. STEERING AND FRONT AXLES :
Steering geometry, Steering requirements, Steering linkages and steering gears, Over steer and under steer, Cornering power, Reversibility of steering gears, Steering trouble shooting. Types of front axles and their constructions.

3. BRAKES :
Requirement of brake, Classification of brakes, Mechanical, Hydraulic, Pneumatic, Electro and vacuum brakes. Disc brakes, Theory of shoe brakes, Shoe factor, Weight transfer and braking efficiency, Braking of vehicle front wheel, Rear wheel and four wheel brakes, Mean living pressure and heat generation during braking, Brake trouble shooting. Introduction to antilock braking system (ABS)

4. SUSPENSION :
Objects of suspension, Basic requirements, Springs- Leaf and Coil springs, Air suspension and its features, Independent suspension, Forces acting in independent suspension, Sprung and un-sprung mass, Pitching, Rolling and bouncing, Shock absorbers.

5. VEHICLE VIBRATION :
Types of vibration, Vibration control, Effect of vibration on human body, Driver's comfort and passengers comfort, Vehicle vibration with single degree of freedom.

6. VEHICLE BODY DESIGN :
Importance of body design, Material for body construction – Styling forms – Coach and bus body style, Layouts of passenger cars, Bus and truck bodies.
Aerodynamic drag – Aerodynamic lifts and pitching moments, Side force, Yawing moments and rolling moments.
Basic dimensions: Geometrical relations to drivers seat, Dimensions of foot and pedal control, Passenger seats, Vehicle dimensions and visibility.
Overall criteria for vehicle comparison
Chassis types and structure types: Open, Semi integral and integral bus structure.

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7. FRAMES :

Functions and types of frames, Loads on frames, Load distribution of structure, Location of power plant.

8. ELECTRONIC ENGINE CONTROLS :

Electronic Control Module (ECM), operating modes of ECM (closed loop and open loop) Inputs required and output signals from ECM, Electronic Spark Timing, Electronic Spark control, Air Management System, Idle speed control.
Multipoint Fuel injection system and single point fuel injection. Electronic fuel injectors. Principle of operation, Construction, Working & Application of Temperature sensors, Inductive sensors, Position sensors (rotary, linear), Pressure sensors, Knock sensors, Hot wire and thin film air flow sensors, Vortex flow/Turbine fluid flow sensors, Optical sensors, Oxygen sensors, Light sensors, Methanol sensor, and Rain sensor, New developments in the sensor technology.

TERM WORK:

Assignments and laboratory experiments 0f

1. Study of different drives
2. Study of steering systems
3. Study of brakes
4. Study of suspension systems
5. Study of basic dimension and vehicle layout
6. Study of computer control engine

Reports on factory visits
Seminars, and one class test

TEXT BOOKS:

1. The Automobile by Harbans Singh REyat
2. The Automobile Engineering by T.R. Banga & Nathu Singh
3. Automobile Engineering by Kirpal Singh Vol – I & II
4. Vehicle body engineering by J Powlowski
5. Principle of vehicle dynamics by steeds
6. Automobile mechanics by N. K. Giri
7. Auto Design by R.B.Gupta
8. Computerised Engine Control by Dick King

REFERENCE BOOKS:

1. Automotive Mechanics by Williams Crouse
2. Motor vehicles by Newton & Steeds
3. Automotive Mechanics by Joseph Heitner
4. Automobile Electrical and Electronics by Tom Denton

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NON-CONVENTIONAL ENERGY SOURCES, Elective II, Group IV				
Class: B.E.(Mechanical)			Semester: VIII	
Periods per week: (60 minutes duration)	Lectures	:	4	
	Tutorials	:	-	
	Practicals	:	2	
			Hours	Marks
Evaluation System:	Theory Examination	:	3	100
	Practical	:	-	-
	Oral Examination	:	-	25
	Term Work/Assignment	:	-	25
Detailed Syllabus:				

1. ENERGY REQUIREMENT – OF INDIA AND WORLD :

Present energy scenario, conventional energy sources- World's production and reserves, India's production and reserves: Global energy crises, shortcomings and limitations to the existing energy sources, need for alternative energy sources.

2. SOLAR ENERGY:

Solar radiation- Terrestrial and extra terrestrial, extra instruments. Energy potential of sun, simple flat plate collector, design of liquid flat plate collector, selective coatings, Application of LFPC performance, analysis of LFPC. Concentrating collectors, solar ponds, solar distillators, solar satellite power system, solar cooker, solar air heaters, solar driers, photovoltaic direct energy conversion, solar cells, solar thermal power system, solar energy storage.

3. HYDRO-POWER:

Principle of hydro-power- prospects of small hydropower, mini and micro power systems, hydropower conversion devices-Turbine, status in India.

4. WIND ENERGY:

History, principle of wind power, Betz model, wind mills- horizontal axis and vertical axis, horizontal axis wind turbines, their components. Operation, recent developments and their site characteristics. Vertical axis- Magnus effect, Madaras & Darrieus turbine. Application of wind energy.

5. GEOTHERMAL ENERGY:

History and future, origin and types of geothermal energy regions, dry rock and hot Acquifier analysis, vapour dominated and liquid nominated geothermal systems, operational and environmental problems.

6. OCEAN ENERGY:

Types of ocean energy sources, Ocean temperature difference, OTEC cycles-closed and open. Comparison with normal thermal power cycles.

Ocean waves-Wave motion, Energy power from waves, Wave energy conversion devices.

Tidal Power-Formation and causes of tides, power from tides, Tidal power devices.

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7. BIOMASS ENERGY:

Various forms of biomass as a potential energy source, energy plantation, Biofuel production processes, Biogas plants, Gassifiers, principle, construction and design of gassifiers, individual and community bio and gobar gas plants, Types of gobar gas plants.

8. CHEMICAL ENERGY SOURCES:

Fuel cells-principle, classification, advantage and disadvantage, application and recent development

TERM WORK:

The term work shall consists of at least 10 assignments on the topic based on the above syllabus.

TEXT BOOKS:

1. Renewable Energy Sources – John W. Twidell & Anthony D. Weir. ELBS Pub.
2. Non-Conventional energy sources – G.D. Rai

REFERENCE BOOKS:

Solar Energy – Principle of thermal collection and Storage – S.P. Sukhatme, Tata McGraw Hill

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
Supply Chain Management, Elective II, Group V			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25
Detailed Syllabus			

1. INTRODUCTION TO SUPPLY CHAIN MANAGEMENT:
Do we have the best suppliers at the lowest possible prices?
Are we getting and sending materials as quickly as possible?
Can the voices of our customers be heard in our processes?
Are customers satisfied with our products?

2. Creating outcome-driven tasks and processes :
Retooling the structure and business strategy of the organization
Setting up effective people/responsibility charts
Incorporating technology for maximum benefit
Creating performance-based rewards
Measuring results

3. Materials Management, Scope, importance, classification of materials, Procurement, Purchasing policies, vendor development and evaluation, Inventory control systems of stock replenishment, Cost elements, EOQ and its derivative models. Use of computers for materials function.

4. LOGISTICS AND COMPETITIVE STRATEGY, SYSTEM VIEW OF LOGISTICS :
Coordination and management of transportation, Inventory Order processing, Purchasing, warehousing materials handling, packaging and customer service standards

5. Supply Chain management, Distribution network design, channels of Distribution, Plant and warehouse location.

6. TRANSPORTATION SYSTEMS :
Individual Freight and passenger modes, intermodal transportation and third party transportation services, economic social, and political roles of transportation, demand, cost and service characteristics of different transport services, carrier selection and evaluation methods, contracting for transportation services, freight rate structure, Private fleet management, Claim management, International transportation, Ocean carrier management, port administration and regulation, costing and pricing issues of

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international transportation, logistics, cost transport mode choice, Dispatch decisions, routing decisions, routing Models, packaging to suit mode of Transport.

7. Total distribution Cost analaysis

8. Logistic Information Systems.

References

Materials Managemet and purchasing, Ammer DS Taraporewala
Logistics and Supply Chain Management, Martin Christopher, Richard Irwin

TERM WORK :

Case Study : Present a report of 10 – 15 pages on any topic from syllabus.
There should be a class test. The term work should also contain atleast 5 assignments covering the syllabus.

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
OPTIMIZATION, Elective II, Group VI			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25
Detailed Syllabus			

1. INTRODUCTION

Need for optimization and historical development classification and formulation of optimization problem, Classical optimization methods, Calculus based methods, Enumerative schemes, Random search algorithms, Evolutionary algorithms.

OPTIMUM DESIGN OF MECHANICAL ELEMENTS

Purpose and application of optimum design, Effects of manufacturing errors, Characteristics of mechanical systems, Selection of optimum configuration, Critical regions material and dimensions.

Formulation of Primary and Subsidiary design equations, Limit equations and Normal redundant and incompatible specification.

Exact and Interactive techniques. Optimal design of elements and systems, shafts, gears, bearings, High-speed machinery, cams etc.

Linear Programming model

Formulation, objective function, constraints, decision variables, canonical and standard forms, parameters and variables, classical problems such as crew scheduling, Knap sack, napkin/caterer, product mix etc.
Graphical method for two variable problems, simplex algorithm and tabular representation, types of solution such as feasible / non feasible, degenerate / non degenerate, optimal / sub optimal, unique / alternate / infinite optimal, bounded / unbounded value and solution and their interpretations from simplex table, cycling phenomena, mutual solution of problems involving upto three iterations.
Duality concept, dual problem formulation, dual simplex method, primal sub optimal - dual not feasible, and other primal - dual relations, interpretation of dual variables.
Duality Properties, sensitivity analysis for variation of parameter at a time.
Transportation, Transshipment and Assignment models.
As special cases of LP model, Problem formulation and optimality conditions in Vogel's penalty and Hungarian methods of solution. traveling salesman problem as a special case of assignment problem, sensitivity analysis manual solution of problems involving upto three iterations.

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Integer LP Models
Gomary's Cutting plane algorithms, branch and bound technique for integer programming

Simulation Models
Monte Carlo or experimenting method based on Probabilistic behavior data and random numbers, application in Probabilistic real life problems.

TERM WORK:
Atleast 10 assignments covering the total syllabus and one class test

TEXT BOOKS:
1. Optimization Theory and application by S..S Rao.

REFERENCE BOOKS:
1. Optimization for Engineering Design by Deb & Kalyanway.
2. Optimization Methods by Mital K.V
3. Operation Research - An Introduction by H.A. Taha.
4. Statistical Distribution in Engineering by Karl Bury.
5. Artificial Intelligence Through Simulated Evolution by Foged, Owence and Walsh.
6. Conference proceedings – Annual conference on Evolution programming.

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
Dynamic Systems Analysis, Elective II, Group VII			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25
Detailed Syllabus			

Introduction to Dynamic systems Analysis
Modeling of Mechanical Systems
Modeling of Hydraulic, Pneumatic, Electromagnetic, and Non-Engineering Systems
Fundamentals of Dynamic system analysis
Response of Dynamic Systems to Inputs
Linear Mechanical Vibrations
Linear Control Syatems
Numerical Methods for Dynamic System Analysis
Introduction to Nonlenear Dynamics

Assignments using ADAMS or any other similar

Term Work
Term work should contain 10 assignments in the above listed topics. Two seminars and one in Semester Test should be conducted.

References
Introduction to Dynamic Systems Analysis, Thomas D. Burton
Introduction to Physical Systems Dynamics, Ronald C. Rosenberg

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Welding Engineering, Elective II, Group VIII				
Class: B.E.(Mechanical)			Semester: VIII	
Periods per week: (60 minutes duration)	Lectures	:	4	
	Tutorials	:	-	
	Practicals	:	2	
			Hours	Marks
Evaluation System:	Theory Examination	:	3	100
	Practical	:	-	-
	Oral Examination	:	-	25
	Term Work/Assignment	:	-	25
Detailed Syllabus:				

1. Solders and solderings: Welding characteristics capillary attraction bond formation, metallurgy of solders, foreign materials in the solder alloy. Designing the solder joint. Soldering iron, special soldering technique, thermal free solder, low temperature soldering, high temperature soldering, expanding type solders.

2. Brazing: Metallurgical aspect of brazing. Design of the joint, brazing fluxes, method of heating –touch brazing, furnace brazing, induction brazing, Resistance brazing, diphasing, salt bath brazing, brazing solders, silver solders.

3. Special welding processes: Electron beam welding, plasma arc welding, laser welding, bronze welding, under water welding.

4. Weldability of steels: plain carbon steels-mild steel, medium carbon steel, High carbon steel, tool steels, low alloy and high alloy steels, stainless steels, Austenitic manganese steel.

5. Weldability of a aluminium and its alloys: Metallurgical behaviour during welding, choice of methods, welding rods, fixtures, methods of welding.

6. Weldability of cast iron and casting- gray cast iron, malleable cast iron, spheriodal graphite cast iron, selection of cast iron, electrodes and welding rods-methods of welding.

7. Weldability of copper and copper alloys: copper brasses, bronzes, phospher bronze, aluminium bronze, welding of dissimilar metal joints on copper and copper alloys, methods of welding.

8. Metallurgical concept of weldability- Temperature changes in welding concept of weldability carbon equivalent, cracking of welds, weldability testing, welding metallurgy of dissimilar metals, heat treatment of welds.

9. Hard facing – Types of wear, hard facing metallurgy, preparing for hard facing, basic hard facing procedure, spray hard facing, basic treatment weld.

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10. Design and fabrications: Designing for welding types of joints welds and stress distribution, layer sequences, deposition rates, expansion, contraction and residual stresses in welded structure.

11. Indian standards for welding electrodes, fluxes and properties, electrode selection.

Term work:

The term work shall consist of at least 10 assignments on above topics

Text Books:

1. Welding and Welding Technology, Richard L. Little, Tata McGraw Hill Pub.
2. Welding Design and Processes, Hilton and Richard Chapman & Hall Pub.
3. Welding Engineering, Gupta & Kaushish

Reference Books:

1. Welding Engineers Handbook, Oates J.A, George Newnes
2. Welding Handbook Vol-V, American Welding Society

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
Java Technologies , Elective II, Group IX			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25
Detailed Syllabus			

Java Programming

Object oriented programming revisited, JDK, Java Virtual machine-Platform independent-portability-scalability Operators and expressions-decision making ,branching, looping, Classes, Objects and methods, Arrays Strings and Vectors, Interfaces, Packages, Multi-Threading, managing errors and exceptions, Applet programming, Managing files and streams

Java Technology for Active Web Documents

An Early Form of Continuous Update, Active Documents and Server Overhead, Active Document Representation and Translation, Java Technology, the Java Run-Time Environment, The Java Library

A Graphics Toolkit, Using Java Graphics on a Particular Computer, Java Interpreters and Browsers

Compiling a Java Program, Invoking an Applet, Example of Interaction with a Browser

RPC and Middleware

Programming Clients and Servers, Remote Procedure Call Paradigm, RPC Paradigm, Communication Stubs, External Data Representation, Middleware and Object-Oriented Middleware

Network Management (SNMP)

Managing an Internet, The Danger of Hidden Features, Network Management Software, Clients, Servers, Managers and Agents, Simple Network Management Protocol, Fetch-Store Paradigm, The MIP and Object Names, The Variety of MIB Variables, MIB variables that correspond to arrays

Java technologies

Graphics, JFC-JAVA foundation classes, swing, images, java 2d graphics, internationalization, Communication and Networking, TCP Sockets, UDP Sockets, ***java.net,*** java security, Object serialization, Remote method serialization, JDBC: Java Data Base Connectivity, Java beans, Java interface to CORBA, JAVA- COM

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Integration, Java Media Framework, commerce and java wallet, Data structures and java utilities, JavaScript, Servelets

TERM WORK

Term work should consist of at least 06 assignments including debugged java source code for the applications from the above mentioned topics. A Seminar to be presented by each student as part of term work.

REFERENCE

Using JAVA 2, Joseph L weber, PHI
JAVA 2 complete, Sybex, BPB
Java2 The complete Reference, Patrick Naughton, T M H
Computing concepts With JAVA2, Cay Horstmann, WILEY
JSP Java Server Pages, Barry Burd, IDG Books India(p) Ltd
Java2 Programming Bible, Aaron Walsh, IDG Books India(p) Ltd
Java2, swing, servlets, JDBC & JAVA Beans Programming Black Book Steven Holzner dreamtech press

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CLASS: B.E (Automobile / Mechanical)		Semester – VIII	
Project II			
Periods per week 1 Period of 60 min.	Lecture		
	Practical	8	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Examination	--	--
	Practical	--	-
	Oral Examination	--	50
	Term Work	--	75
Detailed Syllabus			

Guidelines for submission of report of Project II
Body of Project

Introduction
Literature Survey
Objective
Methodology
Feasibility study
Design/synthesis/Analysis
Fabrication and Details
Drawings
Test Rig and Tests
Results
Case Study
Results / Discussion
Conclusion
Future work
References

Appendix

This should contain Drawings, Graphs, coding used etc.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Production Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI

SCHEME OF INSTRUCTIONS AND EXAMINATON(R-2001)

COURSE : B.E. (PRODUCTION ENGINEERING)
YEAR : B.E., Semester VII*

Sr No.	Subject	No of Periods of 1 Hour			Duration Of Theory in paper Hours	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1.	Industrial Training and Project	-	-	-	-	-	100	-	100	200
	Total	-	–	-	-	-	100	-	100	200

Industrial training and project report should be of 24 weeks duration.
Contact teacher hours for project guidance –one hour per student per week.

COURSE : B.E. (PRODUCTION ENGINEERING)
YEAR : B.E., Semester VIII*

Sr No.	Subjects	No of Periods of 1 Hour			Duration Of Theory in paper Hours	Marks				
		Lecture	Practical	Tutorial		Theory paper	Term Work	Practical	Oral	Total
1.	Automation and control Engineering	4	2	-	4	100	25	25	-	150
2.	CAD/CAM	4	2	-	4	100	25	25	-	150
3	Economics Finance Accounting &costing	3	2	-	3	100	25	-	25	150
4.	Total Quality Management &and Productivity Techniques	4	2	-	4	100	25	-	25	150
5.	Industrial Management & HRD	3	2	-	3	100	25	-	25	150
6.	Elective	3	2	-	4	100	25	-	25	150
	Total	21	12	-	-	600	150	50	100	900

LIST OF ELECTIVES

1.Opreations Management	2.Artificial Intelligence	3.Sales and Marketing Management
4.Plastic Engineering	5.Industrial Robotics	6.Mechatronics
7.Production Software	8.Material Handling System and Equipment Design	9.Materials Management

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- The course contents in semester VII and semester VIII are interchangeable. The examination for these two Semesters will be at the end of semester VIII.
- Industrial Robotics common with Mechanical and Automobile Engineering Branches of engineering.

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IN - PLANT TRAINING

B.E. (Production) semester VII

Project supervision and guidance : 1 hour per student per week.

Evaluation : Term Work : 100 Marks

: Oral : 100 Marks

Objective

To acquaint the student with overall functioning of an Industrial organisation, exposure to the organisation Structure, various direct / indirect activities and Procedures associated with the production function.

Approach

Hand on experience in tackling real appropriate case study and investigative assignments.
An investigative and analytical approach looking at a Problem in its entirely and not in isolation the project report should contain problem definition and objective, background information, possible approaches and approach selected, data identification, analysis or investigation carried out, results and discussion.
Develop skill in presenting a factual report on specification directed study stressing clarity, brevity and simplicity of styles.

DETAILED SYLLABUS

Project areas

1. Product and process innovation and development.
2. Cost reduction, value engineering / analysis, method improvement, productivity analysis and improvement, layout and material handling investigation.
3. Design of production tooling.
4. Quality control, SQC, SPC,TQM and rejection analysis.
5. Production planning and control.
6. Any problem involving analysis and investigation in production technology, inventory, plant engineering,

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maintenance, stored and purchase, process and tool engineering.

7. Any other areas of interest to the organisation, connected with technology and management

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AUTOMATION AND CONTROL ENGINEERING

B.E. Sem.VIII Production Engineering

Hours per week :	Lecture	:	4 hours.	
	Practical	:	2 hours.	
Evaluation :	Theory Examination	:	4 Hours	100 Marks
	Term work	:	-	25 Marks
	Practical	:	-	25 Marks

Objective : To acquaint the student with need, options and application of automation as an effort and skill saving approach in manufacturing operations.

Approach : Equal emphasis on theoretical principles and design features.

Weightage : Section 1 – 5%
2, 3, 4 – 25% each
5, 6 – 10% each

DETAILED SYLLABUS

1. Automation : Definition, concepts, types of automation, low/medium/high cost, hard/flexible automation, semi/fully automated machine tools, job/material transfer devices.

2. Control System Fundamentals : Control system concepts, classification of control systems, mathematical representation of system equations, response characteristics of components and systems, through classical solution analog computer and Laplace transformation frequency response analysis, Polar plots, Bode plots and Nyquist plot, stability of components and systems, root locus method of analysis.

3. Low Cost Automation Using Pneumatics : Electro pneumatic Operational principles and uses of pneumatic power systems, design and functioning of pneumatic components, construction of pneumatic controls and circuit diagrams for conveying, feeding, clamping, indexing, cutting and non-cutting operations; principles of electro-pneumatic control and circuit design for single and multiple actuators.

4. Hydraulic fluid power automation: Advantages of hydraulic fluid power automation, Hydraulic control for industrial applications, circuit design. Electro hydraulic principles and components used in electro hydraulics, Industrial applications based on electro hydraulics. Circuit design for electro hydraulics. Proportional values and activation technology.

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Industrial applications with proportional values. Operational principles and uses of hydraulic power system; design and functioning of hydraulic components, hydraulic pumps, filters, control devices, linear and rotary actuators, in basic circuits, complex hydraulic controls, electro-hydraulics, commissioning and safety regulation of electro-hydraulic controls, proportional hydraulics, proportional valves, activation technology, basic controls and practical exercises.

5. Logic Gates : AND, OR, NOT NAND and NOR; applications of basic control circuits based on these gates.

6. Electrical Control Devices : Features and design principles of electrical circuits in drives, clutches and brakes; thermal relays, time relays; electrical circuits for machine tools.

TERM WORK

1. At least one class test (10 marks) to be conducted at the middle of semester.
2. At least three assignments on concepts and applications.
   (i) Pure pneumatic control, electro pneumatic control.
   (ii) Electro hydraulic control, hydraulic automation.
   (iii) Control Engg. Concepts through block diagram root lows and bode plots.
3. Reporting work carried out in laboratory.

TEXT BOOKS

1. Pneumatic Circuits and Low Cost Automation: Fawce, JR.
2. Fundamentals of Pneumatics:Festo series.
3. Industrial Hydraulics: Pippenger.
4. Automation, Production System and CIM: Mikell Groover, Prent ice Hall.
5. Engineering Systems and Automatic Control: Peter Dransfield
6. Design of Machine Tools: S.K. Basu.
7. Automatic Control Systems, S.N. Verma.
8. Machine Tool Design, Volume IV: Acherkan.
9. Automated Assembly: Geoffery, Broothroyd, Corradopoll and Lawrence E. Murch; Marcel Deeker Inc. 1982

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REFERENCE BOOKS

1. Vickers Manual on Hydraulics.
2. Pneumatic Applications: Werner Deppert and Kurt Stoll.
3. Mechanisation by Pneumatic Control Vol 1 and Vol 2: Werner Deppert and Kurt Stoll.
4. Hydraulics and Pneumatics for Production: Stewart .
5. Control of Fluid Power: pipperiger and Pace.
6. Control System Technology:C.J. Chermond
7. Maintenance of Pneumatic Equipment: Festo Series.
8. Industrial Hydraulic Control: peter Rohner.
9. Control Engineering: Ruth V. Buckley.
10. Automatic control Engineering: Francis H. Raven.

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CAD/ CAM

B. E (PRODUCTION) Semester VIII

Hour per week — Lecture : 4 hours.
Practical : 2 hours.

Evaluation :				
	Theory examination :	4 hours	100	Marks.
	Term Work :	-	25	Marks.
	Practical :	-	25	Marks.

Objective : Exposure to the emerging technology using computers in two major areas of the discipline namely design and manufacturing.

Approach : Training in theory and skills in use of computer, emphasis on its contribution towards flexibility, speed, cost, reliability and Productivity.

Weightage :		
Section 1	:	30 percent
Section 2	:	50 percent
Section 3	:	20 percent

DETAILED SYLLABUS

1. Computer Aided Design (CAD):

Fundamentals of CAD: CAD system definition and historical perspective, design process, application of computer for design, manufacturing data base design; Work station, graphics terminal, operator input devices, plotters and other output devices, central processing unit; Computer graphics software and data base; Software configuration of graphics system, functions of graphics package, data base structure and Net working, Geometrical modelling: Wire frame models, wire frame surfaces and solids generation, editing and uses of solid models , extracting wire frame from surfaces/ solids, other CAD features, hidden line removal, real

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time picture, animation, Transformation matrices for 2D and 3D graphics (Translation, shearing, scaling, reflection and rotation).

2. Computer Aided Manufacturing (CAM):

   Numerical control of machine tools, devices of NC system, Data processing unit, tape formats and tape readers, linear and circular interpolators, positioning and contouring control loops, incremental and absolute systems, computer control concepts, DNC and CNC systems, adaptive control system; Elements of CAM system; CAM data base, fundamental elements of CNC, benefits of CNC, Computer assisted part programming, canned cycles, parameter programming (FANUC or SINUMERIC controller), NC programming with interactive graphics, NC languages, tooling for CNC machines, CNC machine setup.

3. Computer Integrated Manufacturing (CIM):

   Computer applications in manufacturing, automation, integrated production management systems inventory and materials requirement planning, manufacturing resource planning, selection criteria and evaluation of alternative systems, benefits of CIM, computer aided inspection procedure and methodology application, computer aided process planning technique and applications in manufacturing organizations.

TERM WORK:

1. At least one class test (10 Marks)
2. At least four assignments on concepts and applications.
3. Record of laboratory work (programming and manufacturing of components on CNC milling and or CNC lathe machines)

TEXT BOOKS:

1. Computer Aided Design and Manufacturing: Mikel P Groover and Emory W. Zimmers, Prentiec Hall.
2. Introduction to Computer Aided Drafting: Donald D. Vorsnet.

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3. Computer Numerical Control and computer aided Manufacturing: G E Thyer.
4. Numerical Control And Compute Aided Manufacturing: T K Kundra, R N Rao, N K Durai.
5. Automation, Production Systems And Computer Integrated Manufacturing: M P Groover.
6. CAD/CAM/CIM: P Radhakrishnan and S Subramanyan.

REFERENCE BOOKS

1. Micro CADD: Computer AIDED Design AND Drafting In Micro Computer : David L Goetsch.
2. Computer Graphics: Donald Hearn and M P Baker.
3. Geometric Principles and Procedures for Computer Graphic Application : Chasen S H
4. CAD/CAM Hand book: Machever C and Baluth R E.
5. Programming For Numerical Control Machines: Roberts A D and Prentice R C.
6. Computer Integrated Manufacturing: Alan Weatherall.
7. CAD/CAM Systems, Planning and Implementation: Charles S Knox.
8. CAD/CAM Handbook: Eric Teicholz.

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ECONOMICS, FINANCE, ACCOUNTING AND COSTING

B. E (PRODUCTION) Semester VIII

Hour per week : Lecture : 3 hours.
Practical : 2 hours.

Evaluation :				
Theory examination	:	3 hours,	100	Marks.
Term Work	:	-	25	Marks.
Oral	:	-	25	Marks.

Objective : To study as an allied discipline so as to give a professional background to the area of specialisation.

Approach : The teaching and evaluation should aim at a general overview of concepts in economics and finance and principles and procedures in accounting and costing. The evaluation should try to assess the general understanding and not the detailed intricacies.

Weightage : Equal Weightage for all sections.

DETAILED SYLLABUS

1. Economics : Definitions, basic concepts, utility, price, value, cost. Law of diminishing utility, law of diminishing return, monopoly, perfect competition / oligopoly, Equilibrium price in perfect competition.
2. Money and banking : Banks, Functions, reserve bank functions, money, stock markets.
3. Sources of industrial finance: Long term and short term.
4. Investment analysis : Simple Pay back period ,Accounting Rate of Return, Time value of money, Discounted cash flow. NPV , IRR,BCR ,Discounted payback, Annual Capital Charge

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5. Financial accounting :Accounting concepts and conventions, Mechanics of Accounting , Understanding financial statements, Profit and loss account, Balance sheet, Ratio Analysis, Capital and revenue expenditure, Depreciation.
6. Cost Accounting : Elements of cost , Material cost accounting, Methods of pricing of material issue , stores routine, Bin card ,store ledger, Labour cost accounting ,Time card ,job card, overhead cost accounting ,collection Analysis, allocation, . apportionment, absorption of over heads, Machine hour rate.
7. Costing : Job costing , unit costing, operating costing.
8. Cost control : Budgetary control ,flexible budget , standard costing; material,
   labour and overhead variances, marginal costing, Break even analysis ,PV chart.

TERM WORK

1. At least one class test (10 marks)
2. At least two assignments in each of the four areas.

TEXT BOOK

1. Economics Paul A. Samuelson: McGraw Hill 8th Ed.
2. Advanced Economics theory :M.L .Jhingan , Vikas publication House.
3. Financial Management Theory and practice : Maheswari and Prasanna Chandra; TMH, 1995.
4. Managerial Economics : Varshneya ; Sultan Chand & sons.
5. Fundamentals of Financial management , Text and cases : Prasanna Chandra, TMH, 1995.
6. Accounting for Management : Bhattacharya S. K. and Dearden John.
7. Management accounting :M.Y. Khan , P.K. Jain,TMH 1994.

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8. Cost accounting : Prasad N.K. ,Syndicate Book Pub. Co. 1989.
9. The practice of management accounting : K.S. Shastry and Nand Dhameja,Wheeler publication 1995.
10. Cost accounting : Bhabatosh Bannerjees ,World Trade pvt Ltd, Shripati Bhattacharyaji.
10. Modern economic theory : Sampat Mukherji, Wishwa Prakashan.
11. Micro economic theory : M. C. Vaish, Wishwa prakashan.
12. Cost accounting : C. S. Rayudu , TMH 1996.
13. Management accounting concepts and cases : N.K. Kulshreshta,TMH 1996.

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TOTAL QUALITY MANAGEMENT AND PRODUCTIVITY TECHNIQUES

B. E (PRODUCTION) Semester VIII

Hour per week		Lecture	: 4 hours.		
		Practical	: 2 hours.		
Evaluation	: Theory examination		: 4 hours	100	Marks.
	Term Work		: -	25	Marks.
	Oral		: -	25	Marks.

Objective : Exposure to the newly emerging trends in management of production systems aiming at customer satisfaction quality delivery, moral and cost as the present day "mantra" for survival and growth.

Approach : Focus on the necessity of flexible, competitive and responsive organization necessitated by compelling market forces operating in a widening and rapidly changing business environment. Emphasis on quality systems and their associated responsibilities.

Weightage : Equal Weightage for all sections.

DETAILED SYLLABUS

1. Introduction: Basic concepts and definitions, fitness for use, historical reviews awareness, quality task, quality functions.
2. Policies and objectives: Need for quality policies, examples of quality policies, leadership concepts, quality objectives, role of senior management, quality council, quality statements, strategic planning.
3. Customer relation and satisfaction: Origins of consumerism. Product knowledge, who is customer? Customer perception of quality, customer complaints and redressal, product safety and reliability, service quality.

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4. Cost of Quality: Prevention, appraisal and failure cost of quality, Hidden cost of quality.
5. Quality Improvement: Juran trilogy, management controllable defects,operator controllable defects, sporadic and chronic problems of quality.
6. Vendor Relations: Vendor assessment, vendor development, quality of bought out components, managing vendor quality, vendor rating, vendor appraisal, vendor certification, relationship development.
7. ISO 9000 & 14000, QS 9000, Elements, policy, manual, procedures and documentation, internal audit, surveillance audit, maintaining of certification.
8. Bench marking: Introduction, definition and significance, collection of data for bench marking and its use.
9. Control Charts X, R, P, nP and C-charts. Process capability, acceptance sampling-AQL, LTPD, AOQL, Producers and Consumers risk, Single sampling Plan ,Double sampling plan only.
10. PDCA cycle, Problem solving tools, QFD, Customers vice.
11. Productivity improvement techniques. 5S, POKAYOKE, SMED, Kaizen (Continuous process improvement through JIT)

TERM WORK

1. At least one class test (10 Marks)
2. At least five assignments on above syllabus
3. One seminar /Case study

TEXT BOOIKS

1. Quality Planning and Analysis: J M Juran, F M Gryana; TMH
2. Total Quality Management: D H Bester Field et. al. Prentice Hall.
3. Quality Is Free: Philip B Crossby: Mentor/ New American Library 1979
4. What is Total Quality Control? The Japanese way : Ishikawa K, PH 1985
5. TQM in new product manufacturing: H G Menon; TMH 1992

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6. Japanese manufacturing techniques RJ Schonberger, The Free Press 1982
7. World Class Manufacturing: The lessons of simplicity applied RJ Schonberger, The Free Press 1986
8. Wonderland of Kaizen: A Total Quality culture for survival: Shyam Talawadekar.

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INDUSTRIAL MANAGEMENT AND HRD

B.E. (Production) semester VIII

Hours per week	:	Lecture	: 3 Hours		
		Practical	: 2 Hours		
Evaluation	:	Theory Examination	: 3 Hours,	100	Marks
		Term Work	: -	25	Marks
		Oral	: -	25	Marks

Objective : Exposure to the various facets associated with this important ,rather most significant resource of industrials organizations.

Approach : Focus on the behavioural developments,leadership and individuals and groups and groups.

Weightage:

Section			
1	:	5	percent
2,3,4	:	15	percents each
5,6	:	25	percent each

1. Evolution and Developments of thought : Evolution of managements thought,clinical,scientific,behavioural,quntitiativesystem,contingency,cont empory management approach, Thoery z – concepts.
2. Organization structure :Definition, need, types of organization ,responsibility, authority,accountability,delegation,span of control.
3. Decision Making : Types of decision , steps in rational decision making
4. Planning : Definition, characteristics of good plan, steps in planning,strategic planning.
5. Communication : Principles of effective communication, Barriers of communication.
6. Leaderships : Styles, Manager as a leader, Leaderships in TQM context.
7. Functions of personnel Management: Managerial and operative functions.
8. Human Behavior : Perception, attitude,Group, types of groups, groups behaviour morale, Job satisfaction.
9. Human resource development:
   (a) Human resource planning,Job description, Job analysis and job evaluation, Recruitment and selection procedure.
   (b) Motivation:Theories of motivation, job design, enlargement and enrichment,Performance appraisals
   (c) Training and Development: Concepts and difference between training and development,Methods, steps, types of training.
   (d) Promotion : Basis for promotion, merit and demerits

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(e)Maintenance of human resource: Safety, steps in safety programme ,safety
Engg and management,occupational hazard, accident prevention.

10. Compensation and salary Administration: Factory act ,Industrial dispute act ,salary and wage fixation, Machinery for setting grievances collective bargaining, Industrial relation,Trade unions, conflicts management.

TERM WORK

1. At least one class test (10 marks)
2. At least four assignments based on above topic.

TEXT BOOKS

1. Personnel Management and Human Resources ; C. S. Venkataratnam, B. K. Srivastava; TMH 1995.
2. Principles of Management : P. C. Tripathi, P. N. Reddy; TMH 1991 Organizational Behavior.
3. Industrial and Business Management : Martand T. Teslang.
4. Oraganisation Behaviour , Text and case : Uma Sekram,TMH,1995
5. Oraganisational Behaviour : F. Luthans, McGraw Hill.
6. Personnel Management : C. B. Memoria.
7. Factory Administration and Management : A. S. Deshpande.

REFERENCE BOOK

1. The Change in world of the Executive : Peter Drucker.
2. In search of excellence : Tom Peter and R. H. Waterman, Harper,1996.

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6. ELECTIVE

6.1 OPERATIONS MANAGEMENT

B.E. (Production) Semester VIII

Hours per week	Lecture	:	3 hours	
	Practical	:	2 hours	
Evaluation	: Theory Examination	:	4 hours	100 Marks
	Term Work	:	-	25 Marks
	Oral	:	-	25 Marks

Objective : Study of procedural and control aspects of operations in service Organizations and in project type production system

Approach : Focus on similarities and difference in comparison with Conventional production operations; emphasis on functions and procedures.

Equal weightage for all sections.

DETAILE SYLLABUS

1. Service Organisations: Definition, scope, characterizing feature role in business and production systems, types of services and systems, functions, objectives, resources, constraints, performance criteria.
2. Material System: Demand estimation and operations; budgeting procurement to supply process and stages, sourcing and purchasing procedure, administrative, financial, contractual and accounting aspects, specifications, inspection, transportation and storage, classification, codification and computerization, standardization and specification; inventory management and service level; records, stock taking and disposal, transportation and storage.
3. Plant Engineering: Equipment availability, breakdown and preventive maintenance, spare parts management; replacement analysis, house keeping and plant services; facilities planning and materials handling, crew scheduling, information management, budgeting and control.
4. Transportation and Distribution: Multilevel inventories, Modes of transport and option evaluation; operation scheduling and route optimization logistics and costs; control options and procedures.
5. Miscellaneous Services: Consultancy, communication, catering, recruitment and planning, health care and hospitals, security, system related operational and expertise aspects.
6. Project Management: Technological and financial evaluation;

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feasibility study reports, capital structure and cost capital for project

7. contracting and funding, cost control, administrative, personnel, level, environmental and social considerations, project monitoring and control.

TERM WORK

1. At least one class test (10 marks)
2. At least four assignments.

TEXT BOOKS

1. Operations Management, Theory and Problems; Joseph G. Monks; McGraw Hill 1987.
2. Production and Operations Management; S.N. Charry; TMH, 1988.
3. Theory and Problems in Production and Operations Management; S.N. Chary; TMH, 1995.
4. Production and Operations management, Manufacturing and Services;
5. Purchasing and Material Management; Wilbur B. England and Michae
6. Advanced Project Management; F.L. Harrison
7. Management of Technology; Edward P. Hawthorne; McGraw Hill

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6. ELECTIVE

6.2 ARTIFICIAL INTELLIGENCE

B. E (PRODUCTION) Semester VIII

Hours per week : Lecture : 3 hours.
Practical : 2 hours.

Evaluation :	Theory examination :	4 hours	100	Marks.
	Term Work :	-	25	Marks.
	Oral :	-	25	Marks.

Objective : To acquaint the student with need, options and application of artificial intelligence in manufacturing opreation

Approach : A system approach stressing concepts, logics,basic problem method, algorithem, interacting with an expert system.

Equal Weightage for all sections.

DETAILE SYLLABUS

1. **Introduction:** Definition, Underlying assumptions, A.I. Niques, Application areas
2. **Problem Definition & Analysis:** Problem as state approach, Production systems, Control Strategies, Heuristic search, Problem characteristics, Role of knowledge.
3. **Basic Problem Methods:** Forward Vs. Backward reasoning. Problem Trees Vs. Problem Graphs, Knowledge Representation & the Frame Problem, Heuristic Functions. Weak methods, Hill climbing, Breadth first – Best first search.
4. **Knowledge Representation Using Predicate Logic** : Introduction, Representing simple facts in logic, Augmenting the representation, The basis of resolution, The unification alogorithm
5. **Introduction to Expert Systems:** Structure probabilistic reasoning, Direct inference Vs. Search, Interacting with an E.S. (Example parallel to prospector or Mycin may be considered.)

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6. **A.I. in robotics:**
   a) Introduction to machine vision, Sensing & Digitising Function, Image processing & analysis.
   b) Robot intelligence & task planning: Introduction, State space search, Problem reduction, Use of predicate logic, Means ends analysis. Problem solving, Robot learning & task planning.
7. Introduction to programming in PROLOG & LISP
8. Applications of AI & ES in various fields of Production Engg. like Scheduling, Process Planning, Material Handling, Inventory Control, Quality Control etc. (Discussions of case studies only)

TERM WORK

1. At least one class test (10 marks)
2. Minimum Six Exercises bases on.
   1) Programming Exercises in Prolog
   2) Travelling Salesman & Optimum Path. Depth First. Breadth First. Best First Search. Representing Facts Using Logic. Chain coding for Boundary Representation. AI for Machine Vision etc.
   3) Case studies on Applications of A.I. & E.S. in production engg. & management.

REFERENCE BOOKS

1. Artificial Intelligence – Rich. Knight (TMH)
2. A comprehensive guide to A.I. & E.S. – Levin, Drang, Edelson (Mc graw Hill)
3. Introduction to artificial intelligence – Eugene Charniak (Addison Wesley, Narosa Publishing Co.)
4. Expert Systems – Theory & Practice – Jean Louis Ermine (PHI)
5. Industrial Robotics, Technology, Programming & Applications – Groover, Weiss, Nagel, Odrey (Mc Graw Hill)
6. Robotics: Control, Sensing, Vision & Intelligence Fu. Gonzalez, Lee (Mc Graw Hill)
7. Robotics Technology & Flexible Automation – S.R. Deb (TMH)
8. Handbook of Expert Systems in Manufacturing – Rex Mauss. Jessic Keyes (Mc Graw Hill)
9. Introduction to Artificial Intelligence & Expert Systems – Patterson (PHI)
10. A.I. Technology – Applications & Management (ICC 1993) Ed. Balgurusamy B. Sushila (TMH)
11. CAD / CAM Robotics, Factories of the future. (1992) Vol. II & III Juneja, Pujara, Sagar (TMH)
12. CAD, CAM, Automation, Robotics and factories of Future – Ed. Abdul Mubeen, S. Alful Rizvi (Narosa) – Proceedings of INCARF – 96

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13. Proceedings of International Conference on Advances in MECHANICAL & INDUSTRIAL ENGG. – Feb. 1997 (Ajay printers & publishers, 19, Civil Lines, Roorkee).

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6. ELECTIVE

6.3 SALES AND MARKETING MANAGEMENT

B. E (PRODUCTION) Semester VIII

Hour per week	:	Lecture	:	3 hours.	
		Practical	:	2 hours.	
Evaluation	:	Theory examination	:	4 hours.	100 Marks.
		Term Work	:	-	25 Marks.
		Oral	:	-	25 Marks.

Objective : Additional exposure to the subject which along with design and production forms a complemetary function in production system.

Approach : Study of concepts and techniques of various aspects of the subject.

Equal Weightage for all sections.

DETAILED SYLLABUS

1. Marketing management and the consumer :

Sales management, Marketing and strategies marketing mix, the four p's; product, place ,promotion and price ;final consumers :Characteristics, population , income , education of house hold head geographic location; buying motives ,phsicological and learned needs motives ,satisfication, of senses , preservation of species, fear, rest, pride, sociability, striving, curiosity or myster; where they buy and why ,how consumers buy, basic factors affecting marketing behaviours , behaviour changes,Who does the family buying ,products, number of buyers, geographical location ,basic purchasing

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motives, multiple buying influence inventory policy, reciprocity,wholesalers,retailers,their number and location buying habits and practise in various types of buyers.

2. Product policy :

Strategies for developing separate products or market product differentiation , market segmentation,planned obsolescence or progress,Developing a product sources of new ideas , packing, branding, advantages of branding ,degree of brand preference .Final consumer product convenience product , shopping goods style and fashion , fashion cycle, speciality goods consumer research ,industrial goods general characteristics derived, fairly inelastic demand national buying.

3. Developing Place Strategies:

Degree of market expense ,intensive distribution selective distribution, exclusive distribution , channels of distribution wholesalers retailers ,nature of marketing and consumer ,nature of product sales effort required ,relative costs and benefits.

4. Price Policies :

Under the market ,above the market : specific price policies, leader pricing ,new product pricing, geographic pricing.

5. Pricing Objects :

Target return, short and long term targets, profit maximisation ,no economic objectives, market share, business stability ,promotional policies ,variables of promotional competition, personal selling ,advertising, publicity and sales, promotion ,size of promotional effort.

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6. Advertising :

Functions , factors influencing its use, attributes of products suitable for advertising , size of advertising budget, selection of advertising copy, selection of the media ,mechanical features of media, quantitative measures, allocating advertising over time ,evaluating effectiveness of advertising. Personal selling : recruiting , selecting and training of sales persons ; allocation of sales territories coverage on the basis of numbers of contact ,frequency , nature of transportations service , establishing call schedules, setting standards , laying out routes , controlling coverage Expenses control; method of control ,honour plan ,flat allowance,flexible expenses, combination of flat and flexible sales performance objectives setting volume, objectives, determining market potential and sales potential ,gross profit direct sales, expenses, sales activity , combining objective .Sales control, internal company records.

7. Marketing Research :

Scientific methods, definition of problem, situation analysis ,informal investigation, planning formal research project,research methods ,observation methods ,survey method, experimental method ,how research problem arise, analysis of internal data , measuring performance, the ice berg principle,where to get more data,government or private source; motivation research, need for motivation research ,psychological analysis of consumer behaviour ,use of motivation research in formulating product place pricing ,advertising policies, unique selling proposal (USP) formulation and evaluation.

TERM WORK

1. At least one class test (10 marks).
2. At least three assignments in the form of seminars report, problem and analysis of case studies.

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TEXT BOOKS

1. Marketing Management : Analysis ,Planning and Control ;Philip Kotler , Prentice Hall of India, 6th Edition.
2. Marketing : A Managerial Introduction; J. C. Gandhi ,THM 1994.
3. Marketing : Amoria and Joshi ; Kitabi Mahal.
4. Principle of Marketing and salesmanship : J.C.Sinha , S.Chand.
5. Sales Management : Concepts, Practices and Cases ; Eugene M. Johnson ,David L. Kurtaz AND Eberhard E. Scheuing : McGraw Hill 1994
6. Professional sales Management : Ralph E. Anderson, Joseph F. Hair ,Jr Alan J. Bush ; mCgraw Hill 1993.

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6. ELECTIVE

6.4 PLASTIC ENGINEERING

B. E (PRODUCTION) Semester VIII

Hour per week : Lecture : 3 hours.
Practical : 2 hours.

Evaluation :

Theory examination :	4 hours,	100	Marks.
Term Work :	-	25	Marks
Oral :	-	25	Marks

Objective : Better equip the student evaluate and use plastics as engineering materials.

Approach : A detailed exposure to materials, processes, equipment and tooling aspects.

Equal Weightage for all section.

DETAILS OF SYLLABUS

1. Plastics : Definition, Composition, resins, additives and fillers, Chemistry of resins, types , Chemical, physical, processing Manufacturing processes of resins and plastic, materials, Finished forms, recycling, waste disposal, environmental aspects. contribution to and comparative performance of plastic in various sectors of business and economy.
2. Processing of plastic : Processes based on type of material, product design and production volume.

   Casing processes : gravity, still casting, continuous casting, centrifugal casting.

   Moulding processes : injection, compression, transfer.

   Miscellaneous : foaming, thermoforming, laminating.

   Joining processes : sealing, welding, adhesive bonding.

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Continuous extrusion processes for films, sheet, section calender dering, laminating,etc.

finishing processes : printing,embossing,etc.

Processing equipment : for moulding, extrusion, blowing,calendaring, welding,etc: construction,major units, operational and control features, specifications,cost and productivity

2. Design of moulds : for injection, compression and transfer moulding , feeding system ,overflows, breathers and vents, cooling /heating of moduls ,locking, ejection, mounting of plate moulds, inserts, moulds materials, machining, fabricating of moulds, polishing of cavities, design of extrusion dies for different shapes, die materials, manufacture, mounting heating / cooling of dies.

TERM WORK

1. A least one class test (10 marks).to be conducted at the middle of semester.
2. At least four assignment on above topic.

TEXT BOOKS

1. Operation Management, theory and problems : Joseph G. Monks
   Mcgraw Hill 1987.
2. Production and operations management : S.N. Chary ; TMH 1988.
3. Theory and problems in production and operation Management:S.N. Chary; TMH 1995.
4. Production and operation management , Manufacturing and services ; James B. Dilwork ; McGraw Hill 1993.

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5. Purchasing and material Management ; Wilbur B. England and Michael R. Landers; Richard Darwin ,1975.
6. Advanced project Management ; F . L. Harrison.
7. Management of Technology ; Edward P. HAWTHORNE ; McGraw Hill.

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6. ELECTIVE

6.5 INDUSTRIAL ROBOTICS

B. E (PRODUCTION) Semester VIII

Hours per week	:	Lecture	:	3 hours.	
		Practical	:	2 hours.	
Evaluation	:	Theory examination	:	4 hours	100 Marks.
		Term Work	:	-	25 Marks.
		Oral	:	-	25 Marks.

Objective : To acquaint the student with need, options and application of artificial intelligence in manufacturing operation

Approach : A system approach stressing concepts, logics,basic problem method, algorithem, interacting with an expert system.

Equal Weightage for all sections

DETAILED SYLLABUS

1. **Introduction:** Automation & robotics, Robotic System & Anatomy, Classification, Future Prospects
2. **Drives:** Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position & Velocity Sensors, Actuators, Power Transmission Systems.
3. **Robot & its Peripherals** : End Effecters – types, Mechanical & other grippers, Tool as end effecter
   Sensors: Sensors in Robotics, Tactile Sensors, Proximity & Range Sensors, Sensor Based Systems, Uses Vision Systems – Equipment
4. **Machine Vision:** Introduction, Low level & High level vision, Sensing & Digitising, Image processing & analysis, Segmentation, Edge detection, Object description & recognition, Interpretation, Applications
5. **Programming for robots:** Methods, Robot programme as a path in space, Motion interpolation, level & task level languages, Robot languages, Programming in suitable languages Characteristics of robot.

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6. **Robot Kinematics**: Forward, Reverse & Homogeneous Transformations, Manipulator Path Control, Robot Dynamics.
7. **Root Intelligence & Task planning**: Introduction, State space search, Problem reduction, Use of predictive logic, Means – Ends Analysis, Problem solving, Robot learning, Robot task planning.
8. **Robotic application in manufacturing**: Material transfer, Machine loading & unloading, Processing operations, Assembly & Inspectors, Robotic Cell Design & Control.
9. Social Issues & Economics of Robotics.

TERM WORK

1. At least one class test.
2. Minimum SIX exercises based on above topics including programming of robots.

REFERENCE BOOKS

1. Industrial Robotics: Technology, Programming & Applications :Grover, Weiss, Nagel, Ordey (Mc Graw Hill)
2. Robotics : Control, Sensing, Vision & Intelligence : Fu. Gonzalex, Lee (Mc Graw Hill)
3. Robotic Technology & Flexible Automation : S.R. Deb (TMH)
4. Robotics for Engineers :Yoram Koren (Mc Graw Hill)
5. Fundamentals of Robotics : Larry Health
6. Robot Analysis & Control : H. Asada, J.J.E. Slotine
7. Robotic Technology : Ed. A Pugh (Peter Peregrinus Ltd. IEE, UK)
8. Handbook of Industrial Robotics : Ed. Shimon Y. No. of (John Wiley)

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6.ELECTIVE

6.6 MECHATRONICS

B. E (PRODUCTION) Semester VIII

Hour per week	Lecture	:	3 hours.
	Practical	:	2 hours.

Evaluation :	Theory examination	:	4 hours	100	Marks.
	Term Work	:	-	25	Marks.
	Oral	:	-	25	Marks.

Objective : Highlight managerial aspects of this crucial resources focusing on scope . logistics ,functions and responsibilities

Approach : A system approach stressing analysis and design features directed towards organisational goals.

Equal Weightage for all sections.

DETAILE SYLLABUS

1. Mechatronics defined, scope, various engineering philosophies forming the mechatronics roles played by mechanics and electronics in modern technological fields.
2. Architecture & addressing modes of 8086/8088 microprocessor. Its instructions set programming for 8086/8088 with assembly language and its use other than as a computer.
3. Interfacing hardware with real world, analog interface and data acquisition, digital i/o interfacing, special function interfacing signal conditioning, special utility support hardware.
4. Signal processing and data processing: Principles of analogue signal conditioning, signal level changes, linearization, conversion, filtering and impedance matching passive circuits instrumentation amplifier using pampas specifications and circuits in instrumentation, digital signal conditioning, converters compactors DAC/ADC data acquisition system.

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5. PLC: Indroduction to the design and mode of operation of programmable logic control (PLC) conversion and documentation of control into runnable PLC programme.

6. Mechanical elements of roots: robot co-ordinating system, robot drive, mechanism lead screws chain and linkage belt drives gear drives, harmonic drives, cyclo speed reducers, end effectors, gripper techniques, gripper drives, systems hydraulics drives, pneumatic drives, electric motor drives.
7. Robot arm kinematics: kinematics, rotation matrix, composite representation, homogeneous co-ordinate and transformation matrix, danvit hartenberg representation.
8. Robot programming languages : various robot programming languages, characteristics of root level language, characteristics of task level programming.
9. Concepts of computerized numerical control machines tools – open loop servo systems, design consideration of spindle drives and machines slide motions, stepper motors, servo, motors, ball screws linear bearing, closed loop servo systems, feed back systems linear and rotary transducers automatic tool changing devices.

TERM WORK

(i).At least one class testof (10 Marks).
(ii).Term work shall be based on the following topics:
1. Microprocessor based stepper / DL motor drive.
2. Microprocessor based instrumentation readout.
3. Microprocessor based PID controller
4. Microprocessor servo drive
5. Robot programming
6. CNC programming
7. Power electronics
8. Signal conditioning with OPAMPS.

REFERENCE BOOKS

1. 8086/8088 microprocessor programming : Lieu Fibson
2. 8086/8088 microprocessor programming: Triebel & Singh
3. OPAMP and Linear Integrated Circuits: Couphlin & Driscoll
4. Process control & instrumentation technology: Cirtis D. Johnson
5. Robotics: K.S. Fu. R.C. Gonzalex,C.S.C. Lee Johnson
6. Robotics: An introduction – D. Maclogy – D.M. J. Harris

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7. Industrial Control & Instrumentation: W. Bolaton. (Orient Longman)
8. Industrial Robotics: Bernard Hodges (Faico Publishing House second edition)
9. CNC Technology and Programming : Steve Krar (McGraw Hill)
10. Computer Aided Manufacturing : P.N. Rao, N.K. Tiwari, T.K. Kundra.

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6. ELECTIVE

6.7 PRODUCTION SOFTWARE

B. E (PRODUCTION) Semester VIII

Hour per week : Lecture : 3 hours.
Practical : 2 hours.

Evaluation :	Theory examination :	4 hours	100	Marks.
	Term Work :	-	25	Marks.
	Oral :	-	25	Marks.

Objective : Additional focussed exposure to the effective and widely growing use of computers as a problem solving and management tool in production engineering.

Approach : Familiarization with standard software packages in specific areas.Emphasis on identifying application areas and development of logic for software.

Equal Weightage for all sections.

DETAILED SYLLABUS

1. Introduction : Information system development, system analysis and design, categories of information system ,transaction processing systems, management information systems, decision support systems, system development strategies, equipment design, development of software, implementation and evaluation.
2. Tools for determining system requirement: Basic requirements, fact –finding techniques ,tools for documenting procedures and

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decisions, decision concepts, decision trees, decision tables, types of table entries.

3. Structured analysis development strategy: Data flow analysis,tools for data flow strategy, development of data flow diagrams, features of data dictionary , elements and structures.
4. Computer aided system tools : Role and benefits of tools categories of automated tools ,frontend,backend and intergraded tools computer assisted systems engineering (CASE)tools data flow diagrams.
5. Analysis to design transition : Design objective, elements of design, design of out put files, data base interaction, input control, procedure and programme specification., input source documents, input validation, transaction validation.
6. Design of Files and use of Auxiliary storage devices: Basic file terminology, data structured diagrams, types of files, methods of files organisation, backup and recovery of files.
7. Design of Data base Interactions : System development in data base, relationship in data, data structured diagrams, structuring the data.
8. Design of Data Communication : Communication system, channels, network, design of local area network (LAN),distribution system, design of file processing in communication environment.
9. Systems Engineering and Quality assurance : Identification of adjectives, programme structured chart, design of software and documentation.
10. Hardware and Software selection : Determining size and capacity requirement ,computer evaluation and measurement , evaluation of software

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TERM WORK

1. At least one class test (10 marks).
2. Minimum three assignments on above syllabus giving more stress on system analysis , data flow analysis and logic design in the board area of production management.
3. Assingments should cover following areas : Sales forecasting , production programme, material requirement planning, manufacturing resources planning, capacity planning, inventory control, stores management, maintenance management, CPM – PERT,scheduling loading, line balancing, plant layout, plant location,etc.
4. At least two problem assignment using standard packages.

TEXT BOOKS

1. Analysis and Design of Information System : James A. Senn:Int .Ed(II):McGraw Hill Pub. 1989.
2. Management Information System – Startegy and Action:Charles Parker and Thomas case : 2nd Ed. 1993, Indian Ed. Mitchall McGraw Hill , N.Y.
3. Management Information system : David Kronke: McGraw Hill 1989.
4. Introduction to System Design : Vol .I & II , Nat. Comp.Cent. UK Galgotia Booksource,1979.

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6. ELECTIVE

6.8 MATERIAL HANDLING SYSTEMS AND EQUIPMENT DESIGN

B. E (PRODUCTION) Semester VIII

Hour per wee	:	Lecture	:	3 hours.	
		Practical	:	2 hours.	
Evaluation	:	Theory examination	:	4 hours	100 Marks.
		Term Work	:	-	25 Marks.
		Oral	:	-	25 Marks.

Objective : To acquaint the student with various types of material handling equipments, operation, characteristics, applications and design parameter.

Approach : A system approach stressing concepts, Construction, suitability, safety and design aspects.

Equal Weightage for all sections.

DETAILE SYLLABUS

1. **Introduction**: Definition, Scope, Basic Concepts, Principles of material handling, Economics, Concepts of Unit Load, Bulk load, Containerisation & Palletisation.
2. **Facilities Design Function**: Scope, Objectives, Plant Layout & its objectives, Principles & types: Relationship of plant lay out. with material handling .
3. **Material Flow**: Operation Sequence, Material Flow Pattern, Stages of Material Flow – at receiving, in process & at shipping, flow planning criteria & design of flow pattern.
4. **Space Determination & area Allocation**: Space planning for various activities like office, storage, production etc. factors considered in area allocation, future expansion.

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5. **Packaging** : Principles, packaging materials, testing, objective.
6. **Material Handling Equipments (Basic handling system, characteristics, application and limitations of various equipments given below)**
    a. Storing equipment like pallets, bins, racks, decking, order picking, positioning equipment.
    b. Hoisting equipment like jacks, , hand trolleys, hoists, power hoist, various types of cranes & elevators.
    c. Conveying equipment like belt, chain, roller, wheel, trolley, tray conveyers, gravity & vibratory type conveyors, screw conveyors, pneumatics conveyor
    d. Mobile equipment like hand trucks, fork lift trucks, powered industrial trucks & tractors, powered stackers.
7. **Selection of M.H. Equipment**: Factors affecting, Procedure, preparation of layout of material handling,equipments selection guidelines.
8. **Material Handling in CIMS**: Need, comparison with conventional systems, equipment like Industrial. Robots & AGVs etc.
9. **Safety & Training**: Need, Environmental & Human Factors in material handling system.
10. **Equipment design** : Designing of the handling system into the layout , hoist mechanism, hoisting gear, parameters to be considered for the design of material handling equipments.

TERM BOOKS

1.At least one class test of (10 marks).
2.Minimum four assignments based on above topics.

TEXT BOOKS

1. Material Handling – Immer, J.R.
2. Plant layout & material handling –James Apple (John Wiley)
3. Material Handling System Design – James Apple (John Wiley)
4. Material Handling Principles & Practice – Theodore H. techonba, ogicus).

REFERENCE BOOKS

1.Materials handling equipment: Alexandrow – MIR Publication
2. Material handling equipment by rudenko : Mir Publications
3. Handbook of materials handling by R.G.T. Lindkwist : Ellis Horwood Ltd.
4.Material handling equipment: R.B. Choudhari, Khanna Publishers.

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6. ELECTIVE

6.9 MATERAIAL S MANAGEMENT

B. E (PRODUCTION) Semester VIII

Hour per week	Lecture	:	3 hours.		
	Practical	:	2 hours.		
Evaluation	: Theory examination	:	4 hours	100	Marks.
	Term Work	:	-	25	Marks.
	Oral	:	-	25	Marks.

Objective : Highlight managerial aspects of this crucial resources focussing on scope . logistics ,functions and responsibilities

Approach : A system approach stressing analysis and design features directed towards organisational goals

Equal Weightage for all sections.

DETAILE SYLLABUS

1. Indroduction : Importance of material management, source searching. Uncertainty in material management.
2. Codification : Need of codification , various coding systems
3. Store : Functions of store , stock taking procedure.
4. Computer application : Integrated material management function with other elements of the production system like PPC material accounting , cost control.
5. Inventory control : Different inventory models, Quantity discount models, shortage model and probabilistic inventory models.
6. Supply chain Management: Definition, scope and relevance and practices, strtategic sourcing, supplier development and rating, out sourcing, supply chain performance ,computer application.

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7. Tender : Various types of tenders and their suitability
8. Legal aspects of purchasing : Law of agency ,Law of contract, law of pertaining to sale of goods & arbitration, special contract, Breach of contract
9. International purchasing : Need , procedure, Nature of documents clean and foul bills of loading ,function of letter of credit
10. Purchasing under uncertainty : Principles of rationality ,minima, maxima, optimum and regret.
11. Management of surplus , absolute and scrap: Genesis of surplus material ,categories of scrap, Essential of scrap disposal, channels of disposal of scrap.

TERM WORK

3. At least one class test (10 marks).
4. At least four assignments.

TEXT BOOKS

1. Materials Management systems; Brown R. G. ,Wiley , 1966
2. Modern purchasing principles and practice ; P. P. Kapoor, S.Chand 1976.
3. Modern Materials Management;Mille D.W.and R;JTosione; J. B. Campbell , N.Y. 1977.
4. Focus Forecasting computer Techniques for Inventory control: Smith B.T. CBI Publication ,Boston , 1978.
5. Decision system for Inventory Management and production planning ; Peterson and Silver, Ed. Wiley , 1979.
6. Material Management ; P. Gopalkrishana and M . Sundaresani; Prentice.Hll , 1996.

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7. Purchasing and supply Management ; Donald Dobler & David Burt, TMH 1996.
8. Purchase Manaegment : L. C. Jhamb , Everest publishing House.
9. Purchasing and Inventory Control : K. S. Menon , Wheeler Publishing
10. Supply chain Management, strategy, planning and operation: Sunil chopra and Peter Meindl ,Pearson Education Asia,2001
11. Inventory control theory and practice : Starr and Miller , Prentice Hill New Delhi, 1974.
12. Production and operation Management : S.N. Charry, TMH,New Delhi 200.
13. Intergrated Production control system, Management, analysis, design : David D. Bedworth, James . E .Bailey ,John Wiley &sons, New york 1987.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Automobile Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTION AND EXAMINATION (R-2001)

COURSE: B.E. (AUTOMOBILE)
Semester: VII

PART – A

S. N.	Subject	Duration	TW	P	O	Total
1.	In plant Training and Project	10 WEEKS (including summer vacation after Semester VI)	100	---	50	150

Teacher contact hours for Project guidance: one hour per student per week.

PART – B (At least 10 weeks of instructions)

S. N.	Subject	L	P/T	Theory (hours)	Theory Marks	T W	P	O	Total
1.	Advanced Design of Machine Elements	6	3	4	100	50	---	25	175
2.	CAD/CAM & FEA*	6	3	4	100	50	---	25	175
3.	E–Commerce & Industrial Finance*	6	2	3	100	50	---	---	150
4.	Elective – I	6	3	3	100	25	---	25	150
	TOTAL	**24**	**11**	**---**	**400**	**275**	**---**	**125**	**800**

COURSE: B.E. (AUTOMOBILE)
Semester: VIII

S. N.	Subject	L	P/T	Theory (hours)	Theory Marks	T W	P	O	Total
1.	Vehicle Design	3	3	4	100	25	---	25	150
2.	Autotronics	4	2	3	100	25	---	25	150
3.	Industrial Engineering & Enterprise Resource Planning*	4	2	3	100	25	---	25	150
4.	Vehicle Maintenance	3	2	3	100	25	25	25	175
5.	Vehicle Dynamics	4	2	3	100	25	---	25	150
6.	Elective – II	4	2	3	100	25	---	25	150
	TOTAL	**22**	**13**	**---**	**600**	**150**	**25**	**150**	**925**

***Common with Mechanical Engineering**

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COURSE: B.E. (AUTOMOBILE)

SEMESTER: VII – ELECTIVE I	SEMESTER: VIII – ELECTIVE II
Industrial Robotics**	Artificial and Machine Intelligence*
Business Process & Re-engineering#	Supply Chain Management*
Advanced Finite Element Analysis#	Dynamic System Analysis*
Concurrent Design of Products & Processes#	Optimization*
Computer Integrated Manufacturing#	Vehicle Safety
Automobile Pollution	Noise, Vibration and Harshness

- **Common with Mechanical Engineering**
- **Common with Mechanical, and Production Engineering branches.

NOTE:

Semester VII consists of two parts.

1. Part A consists of 10 weeks In plant Training & Project including summer vacation after semester VI.
2. Part B consists of theory subjects with at least 10 weeks of instruction.

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COURSE: B.E. AUTOMOBILE

Semester VII

PART --A

CLASS: B.E (Automobile)		Semester - VII
1. IN PLANT TRAINING AND PROJECT		
Duration : 10 Weeks including summer vacation after semester VI.		Teacher Contact Hour : One hour per student per week.
		Marks
Evaluation System	Oral Exam	50
	Term Work	100

BODY OF PROJECT

Introduction
Literature Survey
Objective
Methodology
Feasibility study
Design/synthesis/Analysis
Fabrication and Details
Drawings
Test Rig and Tests
Results
Case Study
Results / Discussion
Conclusion
Future work
References

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COURSE: B.E. AUTOMOBILE

Semester VII

PART --B

CLASS: B.E (Automobile)		Semester - VII	
1. ADVANCED DESIGN OF MACHINE ELEMENTS			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	3	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Exam	4	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	50

1. PISTON

Material of construction, Types of piston, Manufacturing proceses,Design of piston, Design of piston pin ,Design of piston rings.

2. CONNECTING ROD

Material of construction, Types of connecting rod Manufacturing processes, Design calculation of split type connecting rod and its drawing.

1. CRANK SHAFT

Material of construction Types of crankshaft, Manufacturing processes, Design calculation and drawing

2. FLYWHEEL

Material of construction, Types of flywheel, Manufacturing processes, Design calculation and drawings.

3. CAMSHAFT AND VALVE OPERATING MECHANISM

Material of construction, Types of cam profile, Manufacturing processes, Design of cam profile for (i) Tangent cam and (ii) Generated cam Design calculation and drawings. Design calculation and drawings of valve operating mechanism like rocker arm, valves and valve springs.

4. DESIGN OPTIMIZATION

Introduction, Problem formulation, optimization methodology and its methods.

5. CAD/CAE APPLICATION

Use of CAD/CAE for the designing of above components.

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TERM WORK:

Assignments (At least Four A2 size drawing sheets & eight exercises based on the syllabus)

TEXT BOOKS:

1. High Sped Diesel Engines by P.M. Heldt.
2. Machine Design by Pandya and Shah.
3. Internal Combustion Engine by L.C. Lichty
4. Machine Design by Sharma & Purohit

REFERENCE BOOKS:

1. Automobiles Design by Giles-Vol. I, II& III
2. Internal Combustion Engine by V.L. Maleev
3. Gasoline Engine Analysis by J.B.Fenton
4. Automotive design by Colchin and Demidov
5. Inernal combustion Engine by Mathur and Sharma
6. Machine design by Khurmi and Gupta

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CLASS: B.E. (Automobile)		Semester - VII	
2. CAD/CAM & FEA			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	3	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	50

CAD/ CAM -Computer Aided Design and Manufacturing

1. **Introduction**
   The design process, The role of modeling and communication, Modeling using CAD, Product life cycle & CAD /CAM, Concurrent engineering, Computer for design process, CAD System Architecture

2. **Elements of interactive computer Graphics**
   The design workstation & its functions, Operator input devices (Mouse, Keyboard, tracker ball and Joy stick etc.), Output devices (Printers & Plotters), two dimensional computer graphics, vector generation, The windowing transformation, Three dimensional Computer graphics, viewing transformation, Homogeneous coordinates, Perspective projection, Visual realism, Hidden line removal and hidden surface removal algorithm, light and shade ray tracing

3. **Techniques for geometric modeling**
   Graphic standards, The parametric representation of geometry, Bezier curves, Cubic spline curves, B-Spline curves, Parametric representation of line, circle, ellipse & parabola, constructive solid geometry, Feature Based modeling, Feature recognition, Design by feature

4. **Transformation, Manipulation and Data Storage**
   2D & 3D Transformations (Translation, Rotation, and Scaling & Magnification), Concatenations, Matrix representation, Problems and object oriented programming on Transformations. Object transformation, mirror transformation, Data Structures for interactive modeling, Bill of materials from attribute data, The use of Object Orientation and associativity, Engineering data management system, Relational data base for design, Object Oriented Database, Structured Query language, Design Information Systems. Artificial Intelligence in Design, Representation of Knowledge, Knowledge base Engineering

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CAM (COMPUTER AIDED MANUFACTURING

1. **NC TECHNOLOGY**
   Introduction, basic components of NC system, NC procedure, NC Coordinate systems, and NC motion control systems, Applications, Advantages and disadvantages of NC machines.

2. **NC PART PROGRAMMING**
   Introduction, the punched tape in NC, Tape coding and format, Manual part programming.

3. **COMPUTER AIDED NC PART PROGRAMMING**
   Introduction, Part programmers job, Functions of a post processor, NC part programming languages, Elements of a APT language, The MACRO statement in APT, NC programming with interactive graphics.

4. **CNC**
   Problems with conventional NC, CNC functions and advantages, DNC, Adaptive control, CNC programming concepts, Trends and new developments in NC including FMS.

5. **Finite Element Analysis**
   Introductory Concepts : Introduction to FEM. Brief History. General FEM procedure. Applications of FEM in various fields. Advantages and disadvantages of FEM.

   Differential Equations in different fields : Types of Differential Equations. Primary and Secondary Variables and types of Boundary Conditions.

   Matrix Algebra : Matrix operations, Gauss Elimination Method to get inverse of a Matrix. Partitioning of Matrix.

   FEM Procedure : Definitions of various terms used in FEM like element, order of the element, internal and external node/s, degree of freedom, primary and secondary variables, essential boundary conditions, natural boundary conditions, homogeneous and non-homogeneous boundary conditions, discretization, band-width, aspect ratio, coarse and fine meshing, etc.

   Pre-processing, Processing and Post-processing – Topology.

   Direct Application of Element Matrix Equations : Analysis and solution of problems in various fields like Structural Mechanics, Thermal, Nuclear, Fluid etc. (Stepped and Taper Bars, Fins, Fluid Network, Spring-Cart systems, Plane Trusses, Beams) using direct element matrix equations to obtain global matrix equation. Method of Elimination. Penalty Approach method. Sources of error.

TERM WORK

- Assignments at least one on each topic (both CAD/CAM and FEA)
- Assignments using I-DEAs Master series or ANSYS or -at least one-which shall cover tasks like Model-prepeartion, Mesh generation, Simulation,Postprocessing etc.
- One in-semester test

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TEXT BOOKS

1. CAD/CAM by Ibrahim Zeid.
2. CAD/CAM/CIM by P. Radhakrishnan.
3. Introduction to Finite Elements Methods by Desai and Abel, CBS Publication.
4. FEM in Structural and Continuum Mechanics by Zienkiewiez O.C.Vol.I & II.
5. Textbook of FEAnalysis, P.Seshu, Prentice Hall

REFERENCE BOOKS

1. Computer Graphics by Hearn & Baker.
2. Introduction to Finite Elements in Engineering by Tirupati R. Chandrupatla & Ashok D.Belegundu.
3. Applied Finite Elements Analysis by Larry J. Segerlind.
4. Finite Elements Hand Book by H. Kardestuneer.
5. Concepts & Applications of Finite Element Analysis by R.D.Cook.
6. Finite Element Method, Reddy J. N., McGRAW-HILL
7. Introduction to FE in Engg., Chandrupatla, Belugundu, Prentice Hall.
8. FEM in Engg, Rao S. S., Pergamon Press
9. Applied FEA, Segerlind, John Wiley
10. FEM, Fagan
11. FEA for undergraduates, Akin J. Ed, Academic Press

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CLASS: B.E . (Automobile)		Semester - VII	
3. E-Commerce & Industrial Finance			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	--	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	--
	Term Work	--	25

I E-COMMERCE

1. **INTRODUCTION**
Understanding E-Commerce , Emergence of the internet. Emergence of the worldwide web. Advantage and disadvantages of E- Commerce, E-Commerce in action, Reality and myth.

2. **ENABLING TECHNOLOGIES OF E- COMMERCE**
Internet client/server application, Networks and internets, Software agents, Internet standards and specifications, Internet service providers, Staffing for E-Commerce.

3. **E-COMMERCE BUSINESS SOLUTIONS.**
E- Marketing , Online marketing, advantages of online marketing, E- advertising : various means , Efficiency of E- Advertising , E- branding , Marketing strategies , E Security , Security on Net , E- business
Risk management issues
E-Payment systems , Online payment categories , Digital token based E-Payment systems , Risk and E- Payment systems
Designing E- Payment Systems.
E- Customer relationship management , E- CRM solutions, E-CRM toolkit , CRM capabilities and the customer life cycle.
E-Supply Chain Management.
Strategic advantages and benefits , Components and architectures , Major trends in SCM, E- strategy server dimensions, value chain and E- strategy, Planning the E-Commerce project , Brand management strategies.

4. **TRANSITION TO E-COMMERCE IN INDIA**
E-transition challenges to Indian corporate, The information technology Act 2000 , Positive aspects for corporate sector, Some Indian case studies , E- Commerce best practices , Modern trends in E- Business.

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II Industrial Financing

5. THE SCOPE OF Industrial FINANCE
Introduction , Finance defined , Microfinance v/s Macrofinance , Corporate finance and other disciplines , The financial manager , The goal of corporate finance , profit maximization and traditional goal , Improving open tradition through value maximization.

FINANCIAL MARKETS
The other form of organization Capital, cash money and Govt. securities, Financial market overview , How new securities are issued , Public issue : General cash offer, Public issue : Rights offering , Private placement.
Types of financial markets
The common stock market , the bond market , The money market , International financial market , Efficiency of financial market, interest rates , the term structure of interest rates , The risk structures of interest rates.

6. AN OVERVIEW OF INVESTMENT APPRAISAL METHODS
Time value of money, The accounting rate of return method , The net present value method , The internal rate of return method , a comparison of NPV and RR method, Discounted payback method, Annual capital charge.

7. SOURCES OF LONG TERM FINANCE
Equity finance , The new issues market , Right issues , Script issues , Preference shares , DEBT finance , Hybrid finance , Sources of intermediate term finance, term lones and leases , Short term financial markets , Managing corporate liquidity , The concept of circulating resources , The impact on risk and return , Managing current assets , Manage financial structure.

8. WORKING CAPITAL MANAGEMENT
Objectives , Working capital policies , Working capital and cash conversion cycle, Overtrading , The management of stock , Management of costs.

9. MERGERS AND TAKEOVERS.
Terminology , Justification for acquisition , Trends in takeover activities , Valuation of the target company , The financing of acquisition , Strategies and tactical issues.

10. INTERNATIONAL FINANCIAL MANAGEMENT
Exchange rates , Fixed verses floating exchange rates , Spot rates , forward rates , Future rates, Factor affecting exchange rates , Foreign exchange exposure managing foreign exchange , Exposure Recent trends.

TERM WORK.
1. Class test
2. At least ten assignments / problems on concepts, Case studies and analysis based on the topics mentioned above.

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TEXT BOOKS.

1. E- Commerce A management perspective
   P.T.Joseph , Prentive Hall of India Pvt. Ltd.
2. E- Commerce strategies
   Charles Trepper , Prentive Hall of India Pvt. Ltd.
3. E- Business and ERP , Transforminf the Enterprise
   Grant Norris , James R. Hurley, John Willey & Sons. Inc.
4. Fundamentals of financial management
   Prasanna Chandra , 3rd Edition , Tata Mcgraw Hill Publishing Company Ltd.
5. Introduction to Corporate finance
   Terry's Maness , Mc Graw Hill series in Finance

REFERENCE BOOKS.

1. Corporate Finance Principles And Practises, Denzil Watson & Tong Heads , Financial Time Pitman Publisher
2. handbook Of Corporate Finance, Edward I. Altmass , Willy Professional Banking & Finance Services
3. Introduction to Financial Management, Bidil Dickerson , Eudere F. B. , The Dryden Press

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CLASS: B.E. (Automobile)		Semester - VII	
4. ELECTIVE - I: Industrial Robotics			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	3	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25

1. **Introduction:** Automation & robotics, Robotic System & Anatomy, Classification, Future Prospects
2. **Drives:** Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position & Velocity Sensors, Actuators, Power Transmission Systems.
3. **Robot & its Peripherals** : End Effecters – types, Mechanical & other grippers, Tool as end effecter
   Sensors: Sensors in Robotics, Tactile Sensors, Proximity & Range Sensors, Sensor Based Systems, Uses Vision Systems – Equipment
4. **Machine Vision**: Introduction, Low level & High level vision, Sensing & Digitising, Image processing & analysis, Segmentation, Edge detection, Object description & recognition, Interpretation, Applications
5. **Programming for robots**: Methods, Robot programme as a path in space, Motion interpolation, level & task level languages, Robot languages, Programming in suitable languages Characteristics of robot.
6. **Robot Kinematics**: Forward, Reverse & Homogeneous Transformations, Manipulator Path Control, Robot Dynamics.
7. **Root Intelligence & Task planning**: Introduction, State space search, Problem reduction, Use of predictive logic, Means – Ends Analysis, Problem solving, Robot learning, Robot task planning.
8. **Robotic application in manufacturing**: Material transfer, Machine loading & unloading, Processing operations, Assembly & Inspectors, Robotic Cell Design & Control.
9. Social Issues & Economics of Robotics.

TERM WORK:

1. At least one class test.
2. Minimum SIX exercises based on above topics including programming of robots.

TEXT BOOKS:

1. Robotics for Engineers - Yorem Koren
2. Robotics in Practice - J. F. Engelberger

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3. Computer Integrated Manufacturing Technology and Systems - Ulrich rembolds, Christial Blume
4. Computer Aided Design in Mechanical Engineering – Ramamurthy

REFERENCES:

1. Robot Dynamics
2. Robotics - John Craig
3. Robot manipulators : mathematics, Programming and Control - Paul r p
4. Industrial Robotics - Groover and Simmers
5. Measurement systems - Ernest deoblin
6. Mechanical Measurements - Beckwith and Lewisbuck
7. Modern control Engineering - K. Ogata
8. Automatic Control Systems - Benjamin Kus
9. Robotic Engineering An Integrated approach - Richard D. Klafter and et. al.
10. Intelligent Robotic Systems - Spyros G. Tzafestas

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CLASS: B.E. (Automobile)		Semester - VII	
4. ELECTIVE - I: BUSINESS PROCESS REENGINEERING (BPR)			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	3	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

1) What is BPR
2) Considerations in BPR
3) TQM
4) SW available for BPR
5) How to Plan Your Project, Select the Right Team, and Choose Your Approach
6) Articulate the business issues driving the project
7) Clearly define your project's objectives
8) Gain buy-in from key business leaders
9) Define the project scope
10) Create a powerful team
11) Choose your reengineering steps
12) Select and work with consultants
13) Prepare a project budget
14) Project Planning Template and Guidelines
15) Reengineering Team Selection Criteria and Approach
16) Methodology Selection
17) Consultant Selection
18) Project Readiness Assessment

TERM WORK

Assignments (atleast 4 & a Case Study report of 10 – 15 pages on any topics from syllabus)

REFERENCES:

1. Reengineering the Corporation - A Manifesto for Business Revolution by Michael Hammer and James Champy.

2. Reengineering for Results: Keys To Success From Government Experience, Dr. Sharon L. Caudle; National Academy of Public Administration; Aug 94; on line text

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3. Business Process Improvement

4. The Breakthrough Strategy For Total Quality, Productivity, And Competitiveness, H. James Harrington

5. The Change Management Toolkit for Reengineering. For companies and individuals involved in reengineering and represents a practical approach to the management of change in any organization - from Holland and Davis, WorthingBrighton Press.

6. Competing for the Future, Gary Hamel and C.K. Prahalad; book review and ordering info.

7. Deming Management Method, TheMary Walton; Perigee Books, Book review

8. Best Practices In Reengineering, McGraw-Hill, New York, NY, 1995 by David K. Carr and Henry J. Johansson, Coopers and Lybrand

9. Managing the Change Process: A Field Book for Change Agents, Team, Leaders and Reengineering Managers; David K. Carr,Kelvin J. Hard,William J. Trahant

10. New Tools For New Times: The Workflow Paradigm, Second Edition, WARIA **Book** Review on line, http://www.waria.com/waria/fischer.html

11. Process Innovation: Reengineering Work Through Information Technology, Thomas Davenport; Harvard Business School Press

12. Reengineering Revolution, A Handbook (The) HarperCollins Publishers, Inc. , New York, 1995, Michael Hammer and Steven A. Stanton; Book Review Only

13. The Wisdom of Teams : Creating the High-Performance Organization, Jon R. Katzenbach Douglas K. Smith

14. Winning With Quality: Applying Quality Principles In Product Development, John W. Wesner, Jeffrey M. Hiatt, and David C. Trimble

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CLASS: B.E (Automobile)		Semester – VII	
4. ELECTIVE - I: ADVANCED FINITE ELEMENT ANALYSIS			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	3	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

1.Introductory Concepts : Introduction to FEM. Brief History. General FEM procedure. Applications of FEM in various fields. Advantages and disadvantages of FEM.

2 A. Differential Equations in different fields : Types of Differential Equations. Primary and Secondary Variables and types of Boundary Conditions. Methods of solving Differential Equations – Exact Method, Finite Difference Method.

2 B. Matrix Algebra : Guass Elimination Method to get inverse of a Matrix. Partitioning of Matrix.

2 C. Numerical Integration : Newton-Cotes Method, Guass Quadrature Method.

3. FEM Procedure : Definitions of various terms used in FEM like element, order of the element, internal and external node/s, degree of freedom, primary and secondary variables essential BCs, natural BCs, homogeneous and non-homogeneous BCS, discretisation, shape function and interpolation function, band-width, aspect ratio, coarse and fine meshing, etc.

Derivation of Lagranges Interpolation Functions in Cartesian (Local and Global) and actura co-ordinate systems.

Pre-processing, Processing and Post-processing – Detail study Topology.

4. FEM Weighted Residue Approach :

A. Non-weak form type Methods : Approximate Solution, Residue, weighted integral equation. Weight functions. Methods to generate Matrix Equations from Governing Differential equations: Collocation Method, Sub-domain Method, Method of Least Squares, Galerkin Method, Petrov-Galerkin Method.

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5. Weak-form type Method : Rayleigh-Ritz Method : To generate Element Matrix equation in Local Co-ordinate System, using interpolation functions including Lagrange's family of Interpolation functions, trigonometrical functions etc . in the fields like Thermal, Nuclear, Fluid Structural etc.
C. Assembly and Solution : To generate Global Matrix equation. Substitution of Global BCs. Solution. Method of Elimination, Penalty-approach Method.

5. Direct Application of Element Matrix Equations : Analysis and solution of problems in various fields like Thermal, Structural Mechanics, Nuclear, Fluid etc. (Stepped and Taper Bars, Fins, Fluid Network, Spring-cart Systems, Plane Trusses, Beams).

6. Error Analysis : Various sources of errors. Convergence criteria

7. Introduction to Time-dependent problems in 1-D .

8. Two Dimensional Problems- Introductory approach: Derivation of Interpolation function for triangular and rectangular elements. Topology. Assembly. Solution.

TERM WORK

- Assignments at least one on each topic
- Assignments using I-DEAs Master series or other similar-at least 1- which shall cover tasks like Model-prepeartion, Mesh generation, Simulation,Postprocessing etc.
- Assignments using ANSYS, ADAMS or other similar- at least 1- which shall cover tasks like Model-prepeartion, Mesh generation, Simulation,Postprocessing etc.
- Minimum one seminar
- One in semester test

REFERENCES

Sr. no.	Title	Author	Publisher
1	Finite Element Method	Reddy J. N.	McGRAW-HILL
2	Introduction to FE in Engg.	Chandrupatla, Belugundu	Prentice Hall
3	FE Procedures	Bathe	Prentice Hall
4	FEM in Engg.	Rao S. S.	Pergamon Press
5	Applied FEA	Segerlind	John Wiley
6	FEM	Fagan	
7	Concepts and Applications of FEA	Cook, Malkus, Plesha	John Wiley
8	FEA for undergraduates	Akin J. Ed	Academic Press
9	Theory, problems of FEA Schaum's series	George R. Buchanan	McGRAW-HILL
10	FEM	Norrie, Vries	Academic Press
11	FEA in Engg. Design	S Rajsekaran	Wheelar
12	Boundary and FEs, Theory, Problem	J Ramchandran	Narosa
13	Textbook of FEAnalysis	P.Seshu	Prentice Hall

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CLASS: B.E. (Automobile)		Semester - VII	
4. ELECTIVE - I: CONCURRENT DESIGN OF PRODUCTS AND PROCESSES			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	3	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25

1. CONCURRENT ENGINEERING CONCEPTS

2. NEW APPROACHES TO MANUFACTURING

Goals of Product and System design.Drivers of change in Manufacturing. Concurrent Design of Products and Processes.Product Design. Fabrication and assembly System Design . Designing Production systems for Robustness and Structure.

3. HISTORY AND MACRO ECONOMICS OF MANUFACTURING

Generic problems in High Volume Manufacturing. Generic problems in low Volume Manufacturing . Ecnomic and demographics of Manufacturing in India.

4. EXAMPLES OF RECENT ADVANCED PRODUCTION SYSTEMS

Large scale Productio . Small scale Batch Production

5. BASIC PROCESS ISSUES

Process Models, Why Process Models are important . Types of Process Models . Relation between Models and Specifications . Relation between Specifications and Technology . Relation between Models control, Automation and Process improvement . Fabrication Processes . Assembly Processes, Assembly Processe Models . Models of test and Inspection tasks . Models of Manufacturing systems.

6. STRATEGIC APPROACH TO PRODUCT DESIGN

Steps in Strategic approach to Product design . Comparison to other Product Design Methods

7. TECHNICAL ASPECTS OF PRODUCT DESIGN

Assembly sequence generation . Choosing a good assembly sequence . Tolerences and their relation to assembly . Design for material handling and part mating . Creation and evaluation of Testing strategies.

8. BASIC ISSUES IN MANUFACTURING SYSTEM DESIGN

System Design Procedure . Design factors. Intangibles . Assembly resourse alternatives . Task assignment . Tools and Tool changing . Part feeding alternatives . Material handling alternatives . Floor layout and system architecture alternatives . System design and Economic analysis

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9. ASSEMBLY WORKSTATION DESIGN

Strategic issues . Technical Issues . Economic analysis

10. ECONOMIC ANALYSIS OF SYSTEMS

Types of manufacturing Cost . Pro-Forma cash flow . Determining allowable investment . How are alternative investments evaluated . Sensitivity analysis . Effect of recycling and rework . . Alternative system justification

12. ECONOMIC - TECHNICAL SYNTHESIS OF ASSEMBLY SYSTEMS

Unit Cost equation . Annualized Cost factor . Preliminary System estimation . Assembly system synthesis

13. SYSTEM SIMULATION

Simulation as an alternative to analysis . Discrete Event simulation tools . An example simulation

TERMWORK

Assignments (at least six on above listed topics)

TEXT BOOKS:

1. Concurrent Design of Products and Processes - James L. Nevins et al. MGH
2. Engineering Productivity through CAD/CAM - Dimitris N. Chorafas Butterworths
3. Automatic assembly - Boothroyd G. et. al. - Marcel Dekker NY

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CLASS: B.E (Automobile)		Semester – VII	
4. ELECTIVE - I: COMPUTER INTEGRATED MANUFACTURING, (CIM)			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	3	
	Tutorial	--	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

1. FUNDAMENTALS OF MANUFACTURING AND AUTOMATION

Production operations and automation strategies . Production Economics

2. HIGH VOLUME PRODUCTION SYSTEMS

Detroit Type automation . Analysis of Automated Flow lines . Assembly systems and line Balancing .Automated Assembly systems

3. NUMERICAL CONTROL PRODUCTION SYSTEMS

Numerical control . Part Programming . Flexible Manufacturing systems

4. QUALITY CONTROL AND AUTOMATED INSPECTION

Automated Inspection and Testing

5. CONTROL SYSTEMS

Linear Feedback Control systems . Optimal Control . Sequence Control and Programmable Controllers . Computer process Control

6. COMPUTER INTEGRATED MANUFACTURING

Fundamentals of CAD/CAM . Computerized Manufacturing Planning systems . Shop Floor Control and automatic Identification techniques . Computer Networks for Manufacturing . Future automated factory

TERMWORK

Assignments at least six using I-DEAs Master series , NCPACK,CAMAND or other similar & six on topics listed above

TEXT BOOKS:

1 Automation, Production Systems, and Computer integrated Manufacturing - Mikell P. Groover
2 CAD/CAM/CIM - P. Radhakrishnan
3 Computer Aided Mechanical Design and analysis - V. Ramamurthy

REFERENCES :

4 CAD/CAM - Mikell P. Groover and Emory. W. Zimmer
5 Fundamentals of CIM Technology - Oavid I. Goetsch
6 Computer Integrated Manufacturing Techniques and Applications - Michael Hardeski

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CLASS: B.E (Automobile)		Semester - VII	
4. ELECTIVE - I: AUTOMOBILE POLLUTION			
Periods per week 1 Period of 60 min.	Lecture	6	
	Practical	3	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Exam	4	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

1. INTRODUCTION

The atmosphere and atmospheric pollution, Pure air, Sources of pollution, Constituents of pure air, Atmospheric interactions and processes, Acid Rain, Reasons for acid rain and its effects.

2. AIR POLLUTION EFFECTS ON PHYSICAL AND ECONOMIC SYSTEM

Effects on visibility . Effects on Economic materials and structures . Effects on Indoor air quality

3. EFFECT OF FOLLOWING ELEMENTS ON HUMAN BEING & THEIR CONTROL CONCEPTS

Sulphur Oxides and black suspended particulate matter . Ozone and oxidants . Oxides of nitrogen. Carbon monoxide . Unburnt hydrocarbon . Lead

4. SOURCES OF POLLUTANTS & BASIC CONSTITUNTS OF THE EXHAUST IN I. C. ENGINE

Evaporative losses, crank case blowby, Exhaust Emissions. Constituents: Carbon monoxide, Unburnt hydrocarbon, Oxides of nitrogen, Particulate matter. Methods o measurement of vehicle emissions C.V.S., Driving cycles, Details of the measurement of CO, HC, and NOx by infrared , FID, and Chemi-luminiscence methods.

5.CONTROL OF ENGINE EMISSIONS

By injection parameters, Lubricating oil, Compression ratio, Crankcase ventilation, Fuel composition, Injection/ Ignition timing, Charcoal canister, Exhaust gas Recirculation(EGR), load, air injection Thermal reactors, Catalytic converter.

6. EXHAUST GAS ANALYSIS

Numerical calculations to determine constituents of exhaust gas by mass basis and by volume basis, smoke meter, Exhaust gas analyzer, Orsat apparatus. Total Hydrocarbon measurement/analysis by Flame Ionisation Detector(FID). Carbon dioxide/carbon monoxide measurements/ analysis by Non Dispersive infrared analyzer and NOx Measurement.

7. ELECTRONIC ENGINE CONTROL TECHNOLOGIES

Electronic throttle control, Closed loop canister purge control system, EGR mass flow rate estimation, Air-fuel ratio control. Exhaust emission regulations.

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8. NOISE REDUCTION AND CONTROL

9. RECENT TRENDS .

TERM WORK:
Assignments atleast 5 covering the entire syllabus and laboratory experiments as follows

EXPERIMENTS: (At least 8 experiments from the list given below)

1. Exhaust gas analysis of 4 stroke petrol engine by using exhaust gas analyser
2. Exhaust gas analysis of 4 stroke diesel engine by using exhaust gas analyser
3. Exhaust gas analysis of 2 stroke petrol engine by using exhaust gas analyser
4. Exhaust gas analysis of 4 stroke petrol engine by using Orsat apparatus
5. Exhaust gas analysis of 4 stroke diesel engine by using Orsat apparatus
6. Exhaust gas analysis of 2 stroke petrol engine by using Orsat apparatus
7. Study of exhaust gas mass emission equipment .
8. Evaporative emission measurement.
9. Study of Catalytic converters
10. Study of particulate traps
11. Study of particulate measurements

TEXT BOOKS.

1. Internal combustion Engines by Mathur and P. L. Sharma
2. Air pollution By Rao & Rao

REFERENCE BOOKS

1. Internal combustion Engines & Air pollution by Edward F. Obert
2. Pollution control and conservation by Dr. m. Kovacs
3. Air pollution Volume I to Volume XII by Arthur C. Stern
4. Air pollution by Henry C. Perkins
5. Air pollution by Spedding
6. I.C.Engine fundamentals by J.B. Heywood

Electronic Engine Control Technologies by Ronald K. Jurgen

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COURSE: B.E. (AUTOMOBILE)

Semester: VIII

CLASS: B.E (Automobile)		Semester - VIII	
1. VEHICLE DESIGN			
Periods per week 1 Period of 60 min.	Lecture	3	
	Practical	-	
	Tutorial	3	
		Hours	Marks
Evaluation System	Theory Examination	4	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25

1. CLUTCH:
   Numerical exercises on single plate , multiplate, cone and centrifugal clutch. Design and calculations for single plate and centrifugal clutches.

2. GEAR BOX
   Design of spur gear , Design of helical gears, Design of simple gear box , Design of bearings .

3. PROPELLER SHAFT & UNIVERSAL JOINT
   Materials and design calculations.

4. DIFFERANTIAL
   Design of differential and axles etc.

5. STEERING SYSTEM
   Numerical problems on steering systems.

6. BRAKES
   Numerical and design calculations on brakes.

7. LATEST TRENDS
   Transmissions like CVT , IVT and Brakes etc.

TERM WORK:
Assignments (Minimum six drawings)

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TEXT BOOKS.

1. Machine Design by Pandya & Shah
2. Machine drawing by K.R. Gopalkrishna
3. Automobile Engineering Drawing by R. B. Gupta
4. Machine Design By Khurmi & Gupta
5. Machine Design By Sharma & Purohit

REFERENCES:

1) Automobile Design bu Giles – Vol I, II & III
2) High Speed Diesel Engine by P.M. Heldt.
3) Internal Combustion Engine by V. L. Maleev
4) Internal Combustion Engine by L.C. Lichty
5) Internal Combustion Engines – Vol I by C.F. Taylor
6) Automobile Chassis – Design and calculations Mir Publication by P. Lukin and Gasparyants and Radionaov

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CLASS: B.E (Automobile)		Semester - VIII	
2. AUTOTRONICS			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

1. **BATTERY:** Requirements, construction, principle of operation and working of the following types of batteries: Lead-Acid, Alkaline, ZEBRA, Sodium Sulphur and Swing. Ratings, charging, maintenance and testing of Lead-Acid battery.

2.**FUEL CELLS:** Introduction to fuel cells and fuels used. Construction, operation of Proton Exchange Membrane, Alkaline Electrolyte, Medium & High Temperature fuel cells. Reformers.

3. **42VOLT TECHNOLOGY**
Introduction, Transition from 12V to 42V electrical system, Need of 42V automotive electrical system, 42V auto motive power system, Method of controlling 12 V system in 42 V architecture. Present developments in 42V technology.

4. **CHARGING SYSTEM:** Requirements of a charging system.
Dynamo: principle of operation, construction, working. regulators, combined current and voltage regulator, etc..
Alternator: principle of operation, construction, working. Rectification from AC to DC.

5. **STARTING SYSTEM:** requirements, various torque terms used. starter motor drives; Bendix, Flow through Barrel, Rubber compression, Compression Spring, Friction Clutch, Overrunning Clutch, Dyer. Starter motor solenoids and switches, glow plugs.

6. **ELECTRONIC IGNITION SYSTEM:** Capacitor Discharge Ignition System, Distributor less ignition system, direct ignition system. Hall effect pulse generator, Inductive pulse generator, constant dwell system, constant energy system.

7. **WIRING:** Cables, sizes, colors, codes, connectors. Multiplex wiring system, harness system, CAN system.

8.**ELECTRONIC ENGINE CONTROLS**: Electronic Control Module (ECM), operating modes of ECM (closed loop and open loop), inputs required and output signals from ECM, Electronic Spark Timing, Electronic Spark control, Air Management System, Idle speed control.

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9.SENSORS AND ACTUATORS:

9.1 AUTOMOTIVE SENSORS: Thermistors inductive sensors, position sensors (rotary, linear), Pressure Sensors, knock sensors, Hot wire and thin film air flow sensors, Vortex flow/Turbine fluid

flow sensors, Optical sensors, Oxygen sensors, Light sensors, Methanol sensor, and Rain sensor operating principles, application and new developments in the sensor technology.,

9.2 AUTOMOTIVE ACTUATORS: Introduction, Function, operating principles, construction of solenoid actuators, relays, Motorized actuators, Thermal actuators, Electro hydraulic and Electromechanical valve actuators etc., application and new developments in the actuator technology

10.LIGHTING: Types of lamps, energy demand of lighting systems.
Head lamps: construction and types, setting and control. *Reflectors*: parabolic, bifocal, homifocal, poly-ellipsoidal. Fog lamp, side lamp, tail lamp, parking lamp, brake warning light, trafficators, blinkers, flashers, Electronic flasher circuit, instrument panel lights, body interior illumination. *Gauges:* Fuel, temperature, oil pressure etc.
Accessories: Electric horn, wipers, fuel pump, power operated windows, etc.

11.TELEMATICS
Introduction, services and application, Telematics system view and Present developments in Telematics Technology.

12.INTELLIGENT VEHICLE SYSTEMS:
Requirements, working, components, system control of the following systems:.
Anti-Lock Braking System, Active suspension, Traction Control, Electric power steering. Global Position System , Advanced vehicle navigation, Driver assistance concept, adaptive cruise control. Introduction to Intelligent Transportation System.

TERM WORK:
Assignments atleast 5 covering the entire syllabus and laboratory experiments as follows

EXPERIMENTS:
01.Study of Battery.
02.Study of Fuel Cells.
03.Dismentling, Inspection, and Assembly of Alternator/Dynamo.
04.Dismentling, Inspection, and Assembly of Startor Motor.
05.Experimental study of Temperature sensors.
06. Experimental study of Pressure sensors.
07. Experimental study of Position sensors.
08. Experimental study of Oxygen sensors.
09.Experimental study of operation of Air management System under different operating conditions.
10. Experimental study of Effects of operating variables on injector activating pulses.
11. Experimental study of functioning /Working of Idle speed Control system.

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12. Experimental study of effect of Spark Advances on the engine emissions.
13. Experimental study of the electro-magnetic fuel injector.
14 Troubleshooting

TEXT BOOKS.

1.Understanding Automotive Electronics by William B. Ribbens
2.Automobile Electrical and Electronics by Tom Denton
3.Intelligent Vehicle Technologies by Michel Parent,Ljubo Vlacic,Fumio Harashima.
4.Light Weight Electric/Hybrid Vehicle Design by John Fenton and Ron Hodkinson
5.Computerised engine control by Dick King

REFERENCE BOOKS.

1.Automotive Electronic Hand book By Ronald K.Jurgen
2. Car Electronics (second edition) edited by Shuji Mizutani
3. SAE Journals and special Publications

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CLASS: B.E (Automobile/Mechanical)		Semester - VIII	
3. INDUSTRIAL ENGINEERING AND ENTERPRISE RESOURCE PLANNING			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25

I INDUSTRIAL ENGINEERING

1. INTRODUCTION

System approach in manufacturing organization , Feature , identification of different types of manufacturing systems (Mass, Batch , Job and Continuous)

2. ORGANISATION STRUCTURE AND BEHAVIOUR

Definition , need , types , hierarchy , functional matrix relationship , Responsibility , Authority delegation , Span of control , Recent developments (Lean , network , Virtual , SBU'S), Theories of motivation and leadership , Productivity improvement techniques)

1. PRODUCTION MANAGEMENT

Production , Planning & control , Inventory Control , Statistical Quality control , Total quality management , policies and objectives , Organization for Quality , Cost of Quality , designing for quality , Quality systems & Standards.

2. WORK STUDY , METHODS ENGINEERING & ERGONOMICS

Defination and Objectives , Use of micromotion and memotion study , Work measurements , Significance and procedure of work measurement , Techniques of time study , Maynard operation sequencing training (MOST) , Ergonomics , Safety , Safety devices , Occupational health and hazards , Design of Work Place.
Industrial psychology , Fatigue , Physical environment , Sound , Lighting, Ventilation.

3. FACILITIES PLANNING

Types of layout, Location of facilities, (Product, Process, Line , Cellular/group)Techniques for layout design for process ad product layouts, Assembly line balancing.

4. MODERN DEVELOPMENTS IN INDUSTRIAL ENGINEERING

MRP-I (Material requirement planning), MRP-II (manufacturing resources planning), JIT , KANBAN ; Push and pull production systems , Theory of constrants , BPR (Business process Re engineering) , Lean manufacturing , Agile manufacturing, Supply chain management , Enterprise Resources planning –ERP.

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II ERP (ENTERPRISE RESOURCE PLANNING)

1. **INTRODUCTION**
   What is ERP? Why ERP system is required? Managing enterprise with ERP – The new paradigm , Evolution of ERP, Material requirement planning (MRP) , manufacturing Resoueces Planning (MRP-II)

2. **THE EMERGENCE OF ERP SYSTEMS**
   Salient feature of of ERP systems , Different perspectives of ERP systems, Information systems perspective , Manufacturing perspective , ERP systems and management perspectives.

3. **ERP & SUPPLY CHAIN MANAGEMENT (SCM)**
   ERP & Business Process Reengineering (BPR). ERP & Integrated Management Systems .
   ERP & Multiplant management. ERP & Enterprise Paperless Management

4. **JUSTIFICATION OF ERP SYSTEMS**
   Cost / Benefit analysis , Tangible and intangible benefits , Selection and implementation of ERP systems.

5. **ERP SYSTEM IN INDIA**
   ERP : Perspective of Indian Industries. Recent trends in ERP

TERM WORK.

At least five assignment on concepts , Case studies , and analysis based on the topics mentioned above.

TEXT BOOKS.

1. Management A Global Perspective , 10th Edition , Heinz Weihrich , Harold Koontz , Tata McGraw Hill Publishing Company Ltd (international Edition).
2. Production and Operation Management , Chase, Acquilano & Jacks , Tata McGraw Hill
3. Time and Motion Study , Ralph M. Barnes.
4. Total Quality management , J.S. Oakland
5. Work Study and Ergonomics , H.S. Sham , Dhanpatrao
6. ERP and beyond integrating your entire organization , Gang A. LangenWalter, The St. Lucas Press/ Apics Series on resources management

REFERENCES:

1. E- Business & ERP Transforming the Enterprise
   Grant Norris , James R. Hurley , Kenneth M. Hurtley , John R. D. , John D. B.
2. Plant layout , Facilities planning By M. Apple
3. TQM (Total Quality management) By Besterfield
4. Business process reengineering Myths & Realities By Colen Coulsan , Thomson press
5. Business Process redesign – A View From the inside By Ashley , Bragenza , Andrew Myers
   (International Thomson Business Press)

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CLASS: B.E (Automobile)		Semester - VIII	
4.VEHICLE MAINTENANCE			
Periods per week 1 Period of 60 min.	Lecture	3	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	25
	Oral Examination	--	25
	Term Work	--	25

I ENGINE MAINTENANCE:

1. ENGINE TUNING & VEHICLE CARE :Definition, Necessity, procedure, it's effects, preparation of check sheet for engine tuning and important steps in vehicle maintenance, Maintenance and its types.

2. ENGINE ANALYSIS: Definition, Testing and diagnosis of various engine and vehicle systems by engine analyzer.
Computerized engine analysis for SI and CI engines, various tests conducted on computerized engine analyzer or Auto Master and test procedure.

3. ENGINE COMPRESSION AND VACUUM TEST
Testing equipments and test procedure

4. ENGINE OVERHAULING: Definition, types of overhaul: i)Top overhaul or Decarbonising,ii)Major Overhaul and overhauling procedure

5. DIAGNOSIS OF VARIOUS ENGINE FAULTS such as failure to start, misfire, overheating , lack of power, etc. Engine noises and engine wear

6. ENGINE LUBRICATING SYSTEMS: Purpose, various lubricating systems, types of lubricants used in different vehicle components, Characteristics of lubricants, Engine oil, and analysis of fresh and used oil.

7. INSPECTION SERVICE AND TROUBLESHOOTING OF IGNITION SYSTEMS: Battery troubles and their causes, effects and remedies, Ignition timing.

8. STARTER MOTOR, GENERATOR AND ALTERNATOR: Types of starting devices used in an automobile , Differences between starter motor generator and alternator, Routine maintenance & servicing procedures for all.

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FAULT TRACING

1. **TRANSMISSION AND DRIVE LINE COMPONENTS:**
Introduction, Manual transmission-troubles diagnosis and servicing, Manual transaxles trouble diagnosis and servicing. Automatic transmission-trouble diagnosis and servicing.

2. **STEERING AND SUSPENSION SYSTEMS:**
Trouble diagnosis, their causes, inspection and servicing of steering and suspension components, Wheel alignment, procedure of Computerized wheel alignment.

3. **BRAKING SYSTEMS:**
Drum brakes and Disc brakes, troubles, causes, and their remedies, Power brakes, ABS trouble diagnosis and their servicing

4. **WHEELS AND TYRES:**
Wheel balance, wheel run out, static and dynamic balancing, wheel repairing, Computerized wheel balancing procedure, Tyre inspection ,tyre wear and its remedy, Tyre retreading, Tyre servicing and repair, Demounting of tyre from rim.

5. **ON BOARD DIAGNOSTICS:**
Diagnostic equipments, Study of operation of latest diagnostic equipments such as Oscilloscopes, Engine analyzers, serial port communications. On Board diagnostics, Networking, Electronic Service Bay, Multi Protocol Adaptor etc.

6. **PRESENT TRENDS IN PAINTING AND DENTING:**
Painting technology, paint defects, causes and remedies, Body repairing & reconditioning methods.

TERM WORK:
Assignments (Minimum six) and laboratory experiments as follows

EXPERIMENTS:

1. To perform engine analysis of petrol & diesel engines using a computerized engine analyzer or Auto Master.
2. To perform wheel balancing on a computerized wheel balancer.
3. To find the steering geometry of a vehicle using a computerized wheel aligner
4. Removing and refitting of tyre using an automatic tyre changer.
5. Dismantling, inspection and repairing and assembly of engine components.
6. Experiment on calibration of the fuel injection pump.
7. Study of body repairing and reconditioning methods.

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TEXT BOOKS.

1. Automotive Mechanics by W.H. Crouse and Anglin.
2. Automobile Electrical and electronic systems(Second Edition) by Tom Denton
3. Automotive Mechanics by Joseph Heitner.

REFERENCE BOOKS:

1. Mechanics of road vehicle by W. Steeds
2. The Motor vehicle by Newton Steeds Garrett.
3. The Mechanism of Car by Arthur W. Judge.
4. Automobile repair Guide by Dwaggins.
5. AA Book of car- Drive publication Ltd., London
6. Maruti Service Manual-MUL ,Haryana.
7. Maruti Gypsy Service Manual-MUL, Haryana.
8. SAE Journals.

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CLASS: B.E (Automobile)		Semester - VIII	
5. VEHICLE DYNAMICS			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

1. FUNDAMENTALS OF VEHICLE DYNAMICS: Simple spring mass system of two masses, Motion after the hump, Acceleration for stepped input, Single mass system with two degree of freedom, Theory and problems from Conjugate points, Fundamental approach to vehicle modeling.

2. TYRES: Tyre construction, Tractive properties, Cornering properties, Camber thrust, Aligning moment, Combined braking and cornering, Conicity and ply steer, Tire vibrations, Jack Knifeing of articulated vehicles, Tyre properties affecting vehicle rollover.

3. ROAD LOADS: Aerodynamics, Drag, side force, Lift force, Rolling resistance, Total road loads, Ride, Vehicle response properties, Perception of ride.

4. SUSPENSION SYSTEMS: Solid axles, Independent suspensions, Anti- Squat and anti- pitch suspension geometry, Equalizing type of suspension, Interconnected suspension, Active suspension, Variable rate leaf spring.

5. STEERING SYSTEMS: Steering geometry, Front wheel geometry, Steering system forces and moments, Steering system effects, Influence of front wheel drive, four wheel steering, Steering oscillations, Shimmy, wheel wobble.

6. DYNAMICS OF SYSTEMS: Steady state cornering, Low speed turning, High speed cornering, Suspension effect of cornering, Stability derivatives (Derivation and problems), Analysis of two degree of freedom model in yaw and side slip, Steady state and Transient behavior.

7. VEHICLE ROLLOVER: Roll Center of suspension linkages, Roll axes and roll angles, Non- Roll layout, No Roll suspensions, Anti- roll bar and its effects, Euler's equation of motion, Inertia tensor axes, Characteristics of on road rollover, Rollover resistance, Anti rollover Braking.

8. RECENT TRENDS IN VEHICLE DYNAMICS: Stability Control systems, Introduction of vehicle sensors, Central tyre inflation systems , Influence of parameters at vehicle rollover, Vehicle dynamics simulations, Latest trends.

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TERM WORK:

At least 10 Assignments based on entire syllabus

TEXT BOOKS:

1. Vehicle dynamics By S.R. Ellis.
2. Fundamentals of Vehicle Dynamics By Thomas. D. Gillespie.
3. Road Dynamics By W. Steed

REFERENCE BOOKS.

1. Mechanics of Road vehicle By Steeds.
2. Mechanics of vehicles By J.J. Taborelc.
3. Automobile suspension and Handling By Colin Campell.
4. Car suspension By Bastow.
5. SAE SP-1445
6. SAE 2000-01-1624
7. SAE 2000-01-2669

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
6. ELECTIVE II : Artificial and Machine Intelligence			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
Evaluation System		Hours	Marks
	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25

1 AI and Internal Representation

Artificial Intelligence and the World, Representation in AI, Properties of Internal Representation, The Predicate Calculus, Predicates and Arguments, Connectives Variables and Quantification, How to Use the Predicate Calculus, Other Kinds of Inference Indexing, Pointers and Alternative Notations, Indexing, The Isa Hierarchy, Slot-Assertion Notation, Frame Notation

2 Lisps

Lisps, Typing at Lisp, Defining Programs, Basic Flow of Control in Lisp, Lisp Style, Atoms and Lists, Basic Debugging, Building Up List Structure, More on Predicates, Properties, Pointers, Cell Notation and the Internals (Almost) of Lisp, Destructive Modification of Lists, The for Function ,Recursion, Scope of Variables, Input/Output, Macros

3. Neural Networks and Fuzzy systems

Neural and fuzzy machine Intelligence, Fuzziness as Multivalence, The Dynamical Systems approach to Machine Intelligence, The brain as a dynamical system, Neural and fuzzy systems as function Estimators, Neural Networks as trainable Dynamical system, Fuzzy systems and applications, Intelligent Behavior as Adaptive Model free Estimation, Generalization and creativity, Learning as change, Symbol vs Numbers, Rules vs Principles, Expert system Knowledge as rule trees, Symbolic vs Numeric Processing, Fuzzy systems as Structured Numerical estimators, Generating Fuzzy rules with product space Clustering, Fuzzy Systems as Parallel associators, Fuzzy systems as Principle based Systems

1. Neural Network Theory

Neuronal Dynamics: Activations and signals, Neurons as functions, signal monotonicity, Biological Activations and signals, Neuron Fields, Neuron Dynamical Systems, Common signal functions, Pulse-Coded Signal functions

2. Genetic Algorithms

A simple genetic algorithm, A simulation by hands, similarity templates(Schemata), Mathematical foundations, Schema Processing at work, The two- armed and k-armed Bandit Problem, The building block hypothesis, The minimal Deceptive Problem

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Computer implementation of Genetic algorithm, Data Structures, Reproduction , Cross over and Mutation, Time to reproduce and time to Cross Mapping objective function to fitness form, Fitness scaling
Applications of genetic algorithm, De Jong and Function Optimization, Improvement in basic techniques, Introduction to Genetics based machine learning, applications of genetic based machine leaning

3. Data Mining
Introduction to Data Mining, Computer systems that can learn, Machine learning and methodology of science, Concept learning, Data ware house, designing decision support systems, Client server and data warehousing, Knowledge Discovery Process, Visualization Techniques, K- nearest neighbor, Decision trees, OLAP tools, Neural networks, Genetic algorithm, Setting up a KDD environment, Real life applications, Customer profiling, Discovering foreign key relationships

TERM WORK

a. Software development in lisp and other languages and packages for practices and algorithm discussed in the syllabus.
b. written assignment on any four topics discussed above
c. One seminar by every student from the aforesaid area.
d. One class test

TEXT BOOK

1. Introduction to Artificial Intelligence By Eugene Charniak, Drew McDermott- Addison Wesley
2. Neural Networks and fuzzy systems Á dynamical systems approach to machine Intelligence by Bart Kosko- PHI
3. Genetic Algorithms in search, Optimization & Machine Learning by David E Goldberg-Addison wesley
4. Data Mining by Pieter Adriaans and Dolf Zantinge – Pearson Education Asia
5. Data Warehousing in the Real World by Sam Anahory and Dennis Murray, Addison-Wesley

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
6. ELECTIVE II : SUPPLY CHAIN MANAGEMENT			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25

1) INTRODUCTION TO SUPPLY CHAIN MANAGEMENT

Do we have the best suppliers at the lowest possible prices?
Are we getting and sending materials as quickly as possible?
Can the voices of our customers be heard in our processes?
Are customers satisfied with our products?

2) CREATING OUTCOME-DRIVEN TASKS AND PROCESSES

Retooling the structure and business strategy of the organization
Setting up effective people/responsibility charts
Incorporating technology for maximum benefit
Creating performance-based rewards
Measuring results

3) MATERIALS MANAGEMENT

Scope, importance, classification of materials, Procurement, Purchasing policies, vendor development and evaluation, Inventory control systems of stock replenishment, Cost elements, EOQ and its derivative models. Use of computers for materials function.

4) LOGISTICS AND COMPETITIVE STRATEGY

System view of logistics – Coordination and management of transportation, Inventory Order processing, Purchasing, warehousing materials handling, packaging and customer service standards

5) SUPPLY CHAIN MANAGEMENT

Distribution network design, channels of Distribution, Plant and warehouse location.

6) TRANSPORTATION SYSTEMS

Individual Freight and passenger modes, intermodal transportation and third party transportation services, economic social, and political roles of transportation, demand, cost and service characteristics of different transport services, carrier selection and evaluation methods, contracting for transportation services, freight rate structure, Private fleet

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management, Claim management, International transportation, Ocean carrier management, port administration and regulation, costing and pricing issues of international transportation, logistics, cost transport mode choice, Dispatch decisions, routing decisions, routing Models, packaging to suit mode of Transport.

7) TOTAL DISTRIBUTION COST ANALAYSIS

8) LOGISTIC INFORMATION SYSTEMS.

TERM WORK:
Assignments (at least four based on above listed topics & a Case Study report of 10 – 15 pages on any topics from syllabus.

TEXT BOOKS:

1. Materials Managemet and purchasing, Ammer DS Taraporewala
2. Logistics and Supply Chain Management, Martin Christopher, Richard Irwin

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
6. ELECTIVE II : DYNAMIC SYSTEMS ANALYSIS			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term Work	--	25

Introduction to Dynamic systems Analysis
Modeling of Mechanical Systems
Modeling of Hydraulic, Pneumatic, Electromagnetic, and Non-Engineering Systems
Fundamentals of Dynamic system analysis
Response of Dynamic Systems to Inputs
Linear Mechanical Vibrations
Linear Control Systems
Numerical Methods for Dynamic System Analysis
Introduction to Nonlinear Dynamics

TERM WORK

Assignments (atleast 2 using ADAMS or any other similar and 10 based on above topics)

TEXT BOOKS:

1. Introduction to Dynamic Systems Analysis, Thomas D. Burton
2. Introduction to Physical Systems Dynamics, Ronald C. Rosenberg

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CLASS: B.E (Automobile / Mechanical)		Semester - VIII	
6. ELECTIVE II : OPTIMIZATION			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Exam	4	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

1. INTRODUCTION

Need for optimization and historical development classification and formulation of optimization problem, Classical optimization methods, Calculus based methods, Enumerative schemes, Random search algorithms, Evolutionary algorithms.

OPTIMUM DESIGN OF MECHANICAL ELEMENTS

Purpose and application of optimum design, Effects of manufacturing errors, Characteristics of mechanical systems, Selection of optimum configuration, Critical regions material and dimensions.

Formulation of Primary and Subsidiary design equations, Limit equations and Normal redundant and incompatible specification.

Exact and Interactive techniques. Optimal design of elements and systems, shafts, gears, bearings, High-speed machinery, cams etc.

Linear Programming model

Formulation, objective function, constraints, decision variables, canonical and standard forms, parameters and variables, classical problems such as crew scheduling, Knap sack, napkin/caterer, product mix etc.

Graphical method for two variable problems, simplex algorithm and tabular representation, types of solution such as feasible / non feasible, degenerate / non degenerate, optimal / sub optimal, unique / alternate / infinite optimal, bounded / unbounded value and solution and their interpretations from simplex table, cycling phenomena, mutual solution of problems involving upto three iterations.

Duality concept, dual problem formulation, dual simplex method, primal sub optimal - dual not feasible, and other primal - dual relations, interpretation of dual variables.

Duality Properties, sensitivity analysis for variation of parameter at a time.

Transportation, Transshipment and Assignment models.

As special cases of LP model, Problem formulation and optimality conditions in Vogel's penalty and Hungarian methods of solution. traveling salesman problem as a special case of assignment problem, sensitivity analysis manual solution of problems involving upto three iterations.

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Integer LP Models
Gomary's Cutting plane algorithms, branch and bound technique for integer programming

Simulation Models
Monte Carlo or experimenting method based on Probabilistic behavior data and random numbers, application in Probabilistic real life problems.

TERM WORK:
Atleast 10 assignments covering the total syllabus and one class test

TEXT BOOKS:
1. Optimization Theory and application by S..S Rao.

REFERENCE BOOKS:

1. Optimization for Engineering Design by Deb & Kalyanway.
2. Optimization Methods by Mital K.V
3. Operation Research - An Introduction by H.A. Taha.
4. Statistical Distribution in Engineering by Karl Bury.
5. Artificial Intelligence Through Simulated Evolution by Foged, Owence and Walsh.
6. Conference proceedings – Annual conference on Evolution programming.

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CLASS: B.E (Automobile)		Semester - VIII	
6. ELECTIVE II : VEHICLE SAFETY			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

1. INTRODUCTION

2. BASIC CONCEPTS OF VEHICLE SAFETY

Underlying principles, Fail-safe, Alternative design, Redundancy and derating, Fault tolerance, Safety factors, positive guidance, warnings and instructions, Universal design, Survivability and injury reduction, System engineering, Digital models and Man testing.

3. STUDY AND DESIGN

Study of various kinds of collisions and impacts such as front, side and rear. Design of passenger car for structural safety, Passenger car body structure for energy absorption, Vehicle design for pedestrian injury prevention, Human impact response and tolerance criteria, Design of dummies and simulation of impacts, Design of school bus for safety.

4. OCCUPANT INJURY PREVENTION: BIOKINETICS

Introduction, active and Passive safety, Seat belts and passenger restraint systems, Seats and Seat frames, Door locking locking and retention devices, Safety glasses, Child protection devices.

5.STEERING COLUMN AND BRAKING SYSTEMS

Collapsible and impact protection devices, Design of running gear for safety, Load sensing and pressure regulating devices, Split or dual braking systems, Antilock braking systems, traction control devices.

10. CRASH TESTING

Human testing, crashworthiness, compliance testing, component testing, Proving ground testing, In-field testing.

11. VISIBILITY, LIGHTING AND ELECTROMAGNETIC CAPABILITY

Illumination and glare, Front, rear and side visibility, Warning and signaling devices, Anti theft devices, Design of visual displays and controls, Head up displays.

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12. FUTURE TECHNOLOGY

Collision avoidance radar warning system, Low tyre pressure warning system, Advanced driver information system.

13. SAFETY REGULATIONS OF EEC, FMVSS AND CMVR

TERM WORK:

At least 5 Class assignments and laboratory experiments as follows.

EXPERIMENTS: (At least 8 experiments from the list given below)

1. Measurement of wiping area.
2. Eye lids and H-point determination
3. Study of Tell Tale symbols in Indian cars.
4. Study of signaling and warning devices-turn Indicators, horns-performance evaluation.
5. Lighting devices-study of legal requirements, testing and evaluation.
6. Testing of vehicles for braking regulations.
7. Study of control devices in two wheelers.
8. Measurement of turning circles and steering behaviour in transient operation.
9. Calibration of speedometer and odometer.
10. Study of maneuverability as per ISO.
11. Safety belt-evaluation for compliance with regulations.
12. Impact testing of bumpers.
13. Study of dummies for impact test,
14. Door latch testing.
15. Hood latch (bonnet) testing.
16. Rear view mirror testing.
17. Evaluation of bypass noise.
18. Measurement of interior noise in vehicles.
19. Rollover test.

TEXT BOOKS.

1. Automotive vehicle safety by George Peters and Barbara Peters
2. Body Design By Polowski
3. Central Motor vehicle Rules(CMVR).

REFERENCE BOOKS

1. SAE Handbook
2. International conference on Vehicle Safety 2002
3. Vehicle safety by Limpert
4. Understanding Automotive electronics by William Ribbens
5. EEC Regulations
6. SAE special publications

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CLASS: B.E (Automobile)		Semester - VIII	
6. ELECTIVE II : NOISE,VIBRATION &HARSHNESS (NVH)			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Exam	3	100
	Practical	--	-
	Oral Exam	--	25
	Term Work	--	25

1. INTRODUCTION

2. **BASICS OF VIBRATIONS:** Basic concept ,.mathematical models, system characteristics & response, single & multi dof systems.

3. **VIBRATION CONTROL :** Isolators , tuned absorbers, untuned viscous dampers, applications –single cylinder engines, multicylinder engines. Simple rubber engine mounts, hydro-elastic mounts, semi-active mounts, active mounts,.Mass elastic models, measurements. limits for passenger comforts.

4. **FUNDAMENTALS OF ACOUSTICS:** general sound propagation, plane wave propagation, spherical wave propagation.

5. **HUMAN RESPONSE TO SOUND :** The audible range.

6. **SOUND MEASUREMENT:** Instrumentation, sound level meters, frequency analysers, sound intensity analysers, real time measurements.

7. **AUTOMOTIVE NOISE CRITERIA** : Drive by noise test, noise from stationary vehicles, interior noise in vehicles.

8. **AUTOMOTIVE NOISE** – sources & control methods: Engine noise ,transmission noise, intake & exhaust noise, aerodynamic noise, tyre noise, brake noise.

9. **GENERAL NOISE CONTROL PRINCIPLES :** sound in enclosures, sound energy absorption, sound transmission through barriers.

10. **HARSHNESS** – causes , frequency limits.

TERM WORK:

Assignments and laboratory experiments (Minimum six)

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TEXT BOOKS:

1. Mechanical vibrations by S.S.Rao
2. Theory of machines & mechanisms – by Shigley &Uicker.
3. Automotive Mechanics- By Dr, N. K. Giri.

REFRENCE BOOKS:

1) Road vehicle aerodynamic design-an introduction. -By Barnard R.H. (Longman)
2) Structural vibrations: Analysis & damping. -By Beards C.F. (Longman)
3) Noise & vibration control By Beranek L.L.(McGrawhill)
4) Vibration problems in Engg. By Timoshenko , weaver, s.young.
5) Noise control: Measurement, analysis and control of sound & vibrations By Wilson C.E. Publisher - Harper & row
6) An introduction to modern vehicle design. By jullian.happian.smith.
7) Noise & vibrations -By white R.G.
8) Accoustics design & noise control. -By Rettinger , Michael.
9) Fundamentals of vehicle dynamics. -By Thomas Gellespie

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Electrical Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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SEMESTER VII (Electrical)

Sr. No.	Subjects	No. of Periods per Week			Duration of Theory Paper (Hrs)	Marks				
		Lectures	Practicals	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1.	Protection & Switchgear Engineering	4	-	1	3	100	25	-	25	150
2.	Computer Aided Power Systems Analysis	4	2	-	3	100	25	-	-	125
3.	Control Systems – II	4	2	-	3	100	25	-	-	125
4.	Communication Engineering-II	3	2	-	3	100	25	-	25	150
5.	Elective – I	4	2	-	3	100	25	-	25	150
6.	Project – A	-	-	4	-	-	25	-	-	25
	Total	**19**	**8**	**5**	**-**	**500**	**150**	**-**	**75**	**725**

SEMESTER VIII (Electrical)

Sr. No.	Subjects	No. of Periods per Week			Duration of Theory Paper (Hrs)	Marks				
		Lectures	Practicals	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1.	Design & Estimation of Electrical Systems	3	2	-	3	100	25	-	25	150
2.	Drives & Controls	4	3	-	3	100	25	-	25	150
3.	Industrial Controllers	4	2	-	3	100	25	-	25	150
4.	Elective – II	4	2	-	3	100	25	-	25	150
5.	Project – B	-	8	-	-	-	50	-	50	100
	Total	**15**	**17**	**-**	**-**	**400**	**150**	**-**	**150**	**700**

Elective I	Elective II
High Voltage Engineering	FACTS (Flexible AC Transmission Systems)
HVDC Transmission	Illumination Engineering
Electrical Traction	**Robotics
Analysis & Design of Switched Mode Converters	Reliability Engineering
Object Oriented Analysis & Design	Project Management

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**Common with Electronics, Instrumentation, IT, Computer Engineering branches
Group size should be restricted to minimum 2 students and maximum 5 students for projects.

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B.E. (Electrical) SEM-VII

Protection & Switchgear Engineering

Lectures/week: 4 Hours
Tutorials/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Term work: 25 Marks
Oral: 25 Marks

1. **Principles of Circuit Braking**
   - 1.1 Initiation of arc, arc extinction, D.C and A.C.circuit breaking, arc voltage and current waveforms in an A.C. circuit.
   - 1.2 Definition of transient recovery voltage, rate of rise of TRV, expression for TRV for different values of arc resistance, current chopping.
   - 1.3 Theories of arc extinction, arc control devices, HRC fuse.
   - 1.4 Ratings and specifications of circuit breakers, making and breaking capacities, short circuit testing, Acquaintance of ISI standards.
2. **Low Tension Switchgear**
   - 2.1 Different types of LT Switchgears:
     - (a) Air Circuit Breaker (ACB): construction and working
     - (b) Miniature Circuit Breakers (MCB) and Moulded Case Circuit Breakers (MCCB)
   - 2.2 Contact shapes and materials, Contact bounces.
3. **Medium and High Tension Switchgear**
   Principle of arc quenching in
   - (a) Air Blast Circuit Breaker (ABCB)
   - (b) Bulk Oil Circuit Breaker (BOCB)
   - (c) Minimum Oil Circuit Breaker (MOCB)
   - (d) Vacuum Circuit Breaker
   - (e) SF6 Circuit Breaker.
4. **Protective Relaying**
   - 4.1 Objective of protective relaying
     - (a) Protective zones, Primary and backup protection.
     - (b) Desirable qualities.
   - 4.2 Principle and characteristics of
     - (a) Overcurrent Relays - Time setting, plug setting, IDMT relays.
     - (b) Directional Relays.
     - (c) Distance Relay- Resistance, Reactance, Impedance, MHO relays.
     - (d) Differential Relay.
5. **Power System Protection**
   - 5.1 Relevant protection for different types Earthfaults.
   - 5.2 Protection of Transmission lines & feeders. Pilot wire relaying.
   - 5.3 Protection of Transformers, Buchholz relay.
   - 5.4 Protection of Generators, protection against loss of prime mover and loss of excitation, field suppression, out of step relaying.
   - 5.5 Protection of Induction Motors against single phasing and overcurrent.
   - 5.6 Earth Leakage Circuit Breakers.
6. **Types of Relays**
   - 6.1 Static Relays, µP based protective schemes (programming or interfacing excluded).
   - 6.2 Introduction to DSP based protection (only simple schemes, advantages, etc.)

Term Work:

Term work shall consist of at least six tutorials/assignments/computer programs carrying weightage of 15 marks and a test covering the entire syllabus carrying weightage of 10 marks.

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Text Books:

1. Badri Ram and Vishwakarma D.N. *Power System Protection and Switchgear*,TMH Publication,1st Ed. 1994
2. Ravindranath and Chander, *Switchgear and Protection*, Wiley Eastern Ltd. 1st Ed. 1977.
3. Paithankar Y.G. and Bhide S.R., *Fundamentals of Power System Protection*, PHI Publication, EEE 2003.
4. Rao Sunil S. Switchgear and Protection, Khanna Publication, 4th Ed., 1997.
5. Rao Madhav, *Static Relays*, TMH Publication, 2nd Ed., 1994.

Reference Books:

1. GEC Relay Guide.
2. Phadke A.G. and Thorp J.S, "*Computer Relaying for Power Systems*", John Wiley & sons, 1st Ed. 1990.

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B.E. (Electrical) SEM-VII

Computer Aided Power System Analysis

Lectures/week: 4 Hours
Practicals/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Term work: 25 Marks

1. Load Flow Studies
1.1 Introduction
1.2 Network Model Formulation
1.3 Formulation of *YBUS* by singular transformation
1.4 Load Flow Problem
1.5 Gauss-Seidel Method
1.6 Newton-Raphson Method
1.7 Decoupled Load Flow Methods
1.8 Comparison of Load Flow Methods
1.9 Control of Voltage Profile

2. Optimal System Operation
2.1 Introduction
2.2 Optimal Operation of Generators on a Busbar
2.3 Optimal Unit Commitment
2.4 Reliability Considerations
2.5 Optimum Generation Scheduling
2.6 Optimal Load Flow Solution
2.7 Optimal Scheduling of Hydrothermal System

3. Automatic Generation and Voltage Control
3.1 Introduction
3.2 Load Frequency Control (Single Area case)
3.3 Load frequency Control and Economic Dispatch Control
3.4 Two-area Load Frequency Control
3.5 Optimal (two-area) Load Frequency Control
3.6 Automatic Voltage Control
3.7 Load Frequency Control with Generation Rate Constraints (GRCS)
3.8 Speed Governor Dead-band and its Effect
3.9 Digital LF Controllers
3.10 Reactive Power Control

4. Power System Stability
4.1 Introduction
4.2 Dynamics of Synchronous Machine
4.3 Power Angle Equation
4.4 Node Elimination Technique
4.5 Steady State Stability
4.6 Transient Stability
4.7 Equal Area Criterion
4.8 Numerical Equation of Swing Equation
4.9 Multimachine Stability
4.10 Factors Affecting Transient Stability

5. Power Quality
5.1 Introduction
5.2 Harmonics in power supply

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5.3 Defining quality of power

Term Work:

The term work shall consist of a minimum of four computer programs covering the syllabus carrying weightage of 15 marks and a test covering the entire syllabus carrying weightage of 10 marks.

Text Books:

1. Nagrath I.J. and Kothari D.P., *Modern Power System Analysis*, TMH Publication, second edition, 1989.
2. Wadhawa C.L., *Electrical Power Systems*, Wiley Eastern Ltd, Second Edition 1991.
3. Gupta B.R., *Power System Analysis and Design*, Wheeler Publishing, Third Edition,1998.
4. Saadat Hadi, *Power System Analysis*, TMH Publication, first edition, 2002.

Reference Book:

1. Soman S.A., Khaparde S.A. and Shubha Pandit, *Computational Methods For Large Sparse Power System Analysis, An Object Oriented Approach*, Kluwer Academic Publisher, New York 2001.
2. Glover D.J. and Sarma M.S., *Power System Analysis and Design*, Thomson Asia Pte Ltd, 2003.

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B.E. (Electrical) SEM VII

Control System -II

Lectures/week: 4 Hours
Tutorials/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Term work: 25 Marks

1. Design Specifications
- 1.1 Relative stability
- 1.2 Steady state accuracy (error)
- 1.3 Transient response
- 1.4 Frequency response characteristics

2. Control configurations
- 2.1 Series (Cascade) compensation
- 2.2 Feedback compensation
- 2.3 State feedback compensation
- 2.4 Series feedback compensation
- 2.5 Feed forward compensation

3. Design via root locus techniques
- 1.1 Transient response design via gain adjustment
- 1.2 Improving steady state error via Cascade compensation
- 1.3 Improving transient response via Cascade compensation
- 1.4 Improving steady state and transient response
- 1.5 Feed back compensation

4. Design via frequency response
- 4.1 Transient response via gain adjustment
- 4.2 Lag compensation
- 4.3 Lead compensation
- 4.4 Lag-lead compensation

5. Design via state space
- 5.1 Advantages of state space
- 5.2 Analysis of the state equations
- 5.3 Control-law design for full-state feedback
- 5.4 Selection of pole locations for good design
- 5.5 Estimator design
- 5.6 Compensator design : combined control law and estimator
- 5.7 Introduction to the reference input with the estimator
- 5.8 Integral control and robust tracking

6. Digital control
- 6.1 Digitization
- 6.2 Dynamic analysis of discrete systems
- 6.3 Design by emulation
- 6.4 Discrete design
- 6.5 State space design methods

7. Hardware characteristics
- 7.1 Analog to Digital (A/D) converters
- 7.2 Digital to Analog (D/A) converters
- 7.3 Anti-alias prefilters

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7.4 The computer

8. **Word size effects**
   - 8.1 Random effects
   - 8.2 Systematic effects

9 **Sample rate selection**
   - 9.1 Tracking effectiveness
   - 9.2 Disturbance rejection
   - 9.3 Effect of anti alias prefilters
   - 9.4 Asynchronous sampling

Term work:

Term work shall consist of at least six assignments and at least 3 computer programs/simulations carrying weightage of 15 marks and a test covering the entire syllabus carrying weightage of 10 marks

Text Books:

1. G. Franklin, J. D. Powell & Abbas Emami-Naeini : *Feedback control of Dynamic systems*, 4th edition (LPE), Pearson Education Asia
2. J. Wilkie, M. Johnson & R. Katebi : *Control engineering : an introductory course*, 1st edition, Palgrave
3. Norman S. Nise: *Control system engineering*, 3rd edition, , John Wiley and sons, Inc
4. B.Kuo & F. Golnaraghi : *Automatic control systems*, 8th edition, John Wiley and sons, Inc
5. K.Ogata: *Modern Control Engineering*, Prentice-Hall, 3rd edition, 1996.

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B.E. (Electrical) SEM-VII

Communication Engineering II

Lectures/week: 3 Hours
Practical/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Term work: 25 Marks
Oral: 25 Marks

OBJECTIVES

This subject aims at giving system-oriented introduction to advancements in communication system in the areas of digital and wireless communication.
The orientation of the syllabus will be to discuss the system using the block diagram approach, the various technical issues related to that system and its application.

1. **Overview of Basic information theory**
   - Concept of information, Entropies of discrete system, Rate of transmission- redundancy, Efficiency and channel capacity, Source encoding Huffman technique, Transmission rate and channel capacity of noisy channels, Shannon's theorem, sampling theorem

2. **Digital modulation Techniques**
   ASK, FSK, PSK, DPSK, QPSK, M-PSK, MSK, QAM, TFM and QPRS

3. **Digital demodulation Techniques**
   Probability of error, Integrator, optimum filter, matched filter and correlation receiver

4. **Coding Techniques (Algorithmic approach)**
   Linear block codes, cyclic codes and convolution codes

5. **Introduction to Advanced communication techniques**
   - Satellite communication – Orbital aspects, satellite system link models.
   - Microwave communication – transmission lines, wave guides, microwave oscillators, microwave amplifier.
   - Optical fiber communication- type of fibers, optical source, detectors.
   - Wireless cellular communication -

Term work:

Report on at least six experiments performed and minimum three assignments given based on the above syllabus duly graded carrying weightage of 15 marks and a test covering the entire syllabus carrying weightage of 10 marks.

Text Books:

1. Tomasi W., *Advanced Electronics Communication Systems*, PHI, 4th Ed., 1998.
2. Haykin S., *Communication Systems*, John Wiley & sons, 3rd Ed., 1995
3. Taub & Schilling, *Principles of Communication Systems*, McGraw Hill, 2nd Ed., 1987.
4. Roddy & Coolen-" *Electronic Communications* ", Prentice Hall India, 3rd Ed. 1995

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B.E. (Electrical) SEM-VII

Elective 1: High Voltage Engineering

Lectures/week: 4 Hours
Practical/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Term work: 25 Marks
Oral: 25 Marks

1. **Electrostatic Fields, their control and estimation.**
   - Electric field stress, its control and estimation.
   - Analysis of Electrical field intensity in Homogenous Isotropic Single dielectric and multi dielectric system.
   - Introduction to Numerical methods for the estimation of Electric Field Intensity.

2. **Conduction and breakdown in air and other gaseous dielectrics in electric fields.**
   - Ionization processes, Townsend's current growth equation-Primary and secondary processes, Townsend's criterion for breakdown in electronegative gases.
   - Paschen's law, breakdown in non-uniform fields and corona discharges.
   - Post-breakdown phenomena and application.
   - Practical considerations in using gas for insulation purposes.

3. **Conduction and breakdown in liquid dielectrics**
   - Conduction and breakdown in pure liquids
   - Conduction and breakdown in commercial liquids.

4. **Breakdown in solid dielectrics**
   - Intrinsic, Electro-mechanical and Thermal breakdown
   - Breakdown of solid dielectrics in practice
   - Breakdown of composite insulation
   - Solid dielectrics used in practice
   - Application of insulating materials in electrical power apparatus, electronic equipments.

5. **Generation of High Voltage and Currents.**
   - Generation of HV DC, HV AC and Impulse Voltage
   - Generation of impulse currents
   - Tripping and Control of impulse generators.

6. **Measurement of high voltage and currents**
   - Measurement of HV DC, HV AC and impulse voltage and currents.

7. **Testing and evaluation of dielectric materials and power apparatus.**
   - Non-destructive testing of dielectric materials
   - DC resistivity measurement
   - Dielectric and loss factor measurement,
   - Partial discharge measurements.
   - Testing of insulators, bushing, isolators, circuit breakers, cable, transformers, high voltage motors, surge diverters.
   - Radio interference measurement.

8. **High Voltage laboratory- Design, Planning and Layout**
   - Size and dimensions of the equipment and their layout.
   - Earthing and its importance.

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Term work

At least 6 experiments including a report on visit to a high voltage laboratory covering the topics mentioned in the above syllabus.

Text Books

1. Naidu M.S. and Kamaraju V, *High Voltage Engineering*, TMH Publication, 2nd edition.,1995
2. Wadhwa C.L. "*High Voltage Engineering*" Wiley Eastern Ltd, 1st edition., 1994.
3. Kuffel E. and Abdullah M., *Introduction to High Voltage Engineering*, Pergamon, 1970.
4. Kuffel E., *High Voltage Engineering*, Pergamon, 1984.

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B.E. (Electrical) SEM VII

Elective I: HVDC Transmission

Lectures/Week: 4 Hours
Practical/Week: 2 hours

Theory:100 Marks
Term work: 25 Marks
Oral : 25 Marks

Duration: 3 hours

1. **HVDC System configuration and components**
   - Classification of HVDC links
   - components of HVDC transmission system.
2. **Converter Theory and Performance Equation**
   - Valve characteristics, converter circuit
   - converter transformer rating, multiple bridge converter.
3. **Converter Faults and Protection**
   - Converter faults
   - Protection against overcurrents
   - Overvoltage in converter stations
   - Protection against overvoltages.
4. **Control of HVDC Systems**
   - Basic principle of control , control implementation
   - Converter firing control system , valve blocking and bypassing
   - Starting and stopping , power flow reversal
   - Controls for enhancement of AC system performance
5. **Harmonics and Filters**
   Ac side and DC side harmonics.
6. **Influence of AC systems strength on AC / DC system Interaction**
   - Short circuit ratio, reactive power and AC system strength
   - Problem with low effective short circuit ratio (ESCR)
   - Solution to problems associated with weak systems
   - Effective inertia constant, forced commutation.
7. **Responses to AC and DC system Faults**
   - Dc Line fault, converter fault , Ac system fault .

Termwork

Termwork shall consist of at least six experiments/assignments carrying weightage of 15 marks and a test covering the entire syllabus carrying weightage of 10 marks.

Text Books:

1. Padiyar K.R., *HVDC Transmission Systems*,1st Ed., Wiley Eastern Ltd., 1991
2. Kimbark E.W., *HVDC Transmission*,1st Ed. Wiley, 1965

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B.E. (Electrical) SEM VII

Elective I: Electric Traction

Lectures/Week: 4 Hours
Practical/Week: 2 hours

Theory:100 Marks
Term work: 25 Marks
Oral : 25 Marks

Duration: 3 hours

1. Electric Traction- Principle and History

1.1 Systems of traction.
1.2 The Indian Scenario, vis-à-vis Electric traction.
1.3 Present day State of art.
1.4 Electric traction as a Viable Transport Strategy for the 21st century.
1.5 Advantages of Electric Traction over other systems of traction.
1.6 Choice of traction system – Diesel – Electric or Electric.

2. Mechanics of train movement

2.1 Speed – time curve for train movement.
2.2 Requirement of tractive effort and T-N curve of a typical train load.
2.3 Specific energy consumption.
2.4 Factors affecting specific energy consumption.

3. Adhesion, types of suspension and mechanism of torque transmission

3.1 Adhesion
3.2 Coefficient of adhesion
3.3 Suspension and mechanism of torque transmission
3.4 Weight transfer.
3.5 Effect of unsprung mass and wheel diameter.

4. Traction Motor

4.1 Introduction
4.2 Type of traction motor best suited for traction duties.
4.3 Available motor characteristics and their suitability for traction duties.
4.4 Rating and specification of key parameters.
4.5 Optimization of design and constructional features for improved power to weight ratio.

5. Traction motor – Principles and gear

5.1 Introduction.
5.2 Traction control of DC locomotives and EMU's
5.3 Traction control system of AC locomotives
5.4 Control gear
5.5 PWM control of induction motors
5.6 Power circuit equipment (Other than traction motors)
5.7 Auxiliary circuit equipment of a locomotive.

6. Protection of electric locomotive equipment and circuits (Safety considerations and monitoring)

6.1 Introduction
6.2 Broad strategy for protection
6.3 Surge protection
6.4 Overload protection of main power circuits
6.5 Earth fault protection of power of auxiliary circuits
6.6 Protection from over-voltage and under-voltage

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6.7 Differential current protection of traction circuits
6.8 Protection against high and low air pressure in the compressed air circuit.
6.9 Temperature monitoring.
6.10 Protection of transformer by Bucholz relay
6.11 Protection against accidental contact with HT equipment
6.12 Protection against fires.

7. **Electric Traction Sub-Systems (Overhead Equipment)**
   7.1 Introduction
   7.2 Overhead Equipment (OHE)

8. **Sectioning**
   8.1 Bonding of Rails and Masts
   8.2 Materials Employed in OHE, Type of OHE Masts, Portals ,Insulators, Bonds Foundations, Conductors and Jumpers.
   8.3 Basic Consideration for design of OHE.
   8.4 Structural Design of Masts.
   8.5 Design of foundation and checks for stability
   8.6 Design parameter of cantilever assembly.
   8.7 Design parameters of Turn out cross over.
   8.8 Schedule of Dimensions, overhead line crossing.

9. **Electric Traction Sub-Systems (Power Supply Installations)**
   9.1 Lay out design of 137/25 KV Traction Substation.
   9.2 Protection scheme of Traction Substation.
   9.3 Booster Transformers and Return Conductor .
   9.4 Salient 2x25 kv AC System.
   9.5 Supervisory Control and Data Acquisiton (SCADA)

Termwork

Termwork shall consist of at least six experiments/assignments carrying weightage of 15 marks and a test covering the entire syllabus carrying weightage of 10 marks.

Text Books:

1. Upadhayay J. & Mahindra S.N., *Electric Traction,* Allied Publishers Ltd., 1st Ed.
2. Rao P.S., *Principle of 25 KV Overhead Equipment,*S.R.(Nasik) Printpack Pvt Ltd., 1st Ed.

Websites

- www.irieen.com (Indian Railways Institue of Electricval Engineering, Nasik Road)
- www.wr.railnet.gov.in/bctweb/ELECTRICAL.htm
- www.scrailway.gov.in

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B.E. (Electrical) SEM VII

Elective I: Analysis and Design of Switched mode Converters

Lectures/Week: 4 Hours
Practical/Tutorial /Week: 2 hours

Theory:100 Marks Duration: 3 hours
Term work: 25 Marks
Oral : 25 Marks

1 **DC - DC Switched mode Converters**

- Review of Step down (Buck) Converter, step up (Boost) Converter, Buck – Boost Converter.
- Duty cycle derivation, different conduction modes, Voltage and current waveforms, output voltage ripple.
- Resonant converters – Basic resonant circuit concepts, series and parallel resonant circuits Quasi resonance, ZCS and ZVS resonant switch converters, Comparison of ZCS and ZVS topologies.

2 **Switching DC power Supplies**

- Linear regulator versus switching regulator, Three pin regulators
- Schematic of Switched mode DC power supply, dc – dec converters with electrical isolation – fly back and forward converters –duty cycle derivation, waveforms. Comparison of converters.
- Turn off and turn on problems in switching regulators.

3 **Control aspects**

- Introduction
- Regulation and control problem, voltage mode control, current mode control,
- Geometric control of power converters, Hysteresis control
- P, PI, PID Controllers, power factor corrector.

4 **Converter design**

- Selection of output filter capacitor, selection of energy storage inductor
- switch voltage and power stress, snubbed circuit design, pulse width modulator circuit, Integrated circuit blocks
- control circuitry in PWM dc-dc converters, opto electronic couplers, base drive circuits.
- Thermal resistance, Heat Sinks, Simple heat sink calculations.
- Magnetic materials and core, Copper windings and wire size, high frequency transformer design procedures, selection of switching device.

Term Work

Term work shall consist of five tutorials covering the syllabus and either simulation or fabrication of a switched mode de- dc converter. A mini project may be given for fabrication to a group as a part of the term work. All the above carries a weightage of 15 marks and a class test carries weightage of 10 marks.

Text Books

1) Mohan N. Undeland T. & Robbins W., *Power Electronics: Converters, Applications and Design,* John Wiley, 3rd edition, 2002.
2) Umanand L. Bhat S.R., *Design of Magnetic Components for Switched Mode Power Converters,*Wiley Eastern Ltd., 1992.
3) Krein P.T., *Elements of power Electronics*, Oxford University Press,1st edition, 1998.
4) Rashid M., *Power Electronics: Circuits, Devices and Applications*, PHI, 2nd edition, 1993

Reference Books:

1) Pressman A., *Switching and Linear Power Supply, Power Converter design,* McGraw Hill International, 1st edition., 1977

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B.E. (Electrical) SEM VII

Elective I: Object Oriented Analysis & Design

Lectures/Week: 4 Hours
Practical/Tutorial /Week: 2 hours

Theory:100 Marks
Term work: 25 Marks
Oral : 25 Marks

Duration: 3 hours

Objectives:

This course is *not* a course in Object-Oriented Programming. Rather, this course is abstracted one level above the programming course. It focuses on principles, concepts, processes, methods, and best practice models that transcend and yet can be implemented with (most) any object-oriented programming languages. Code examples illuminating key concepts in OO design may be provided in various OO languages such as C++ or JAVA. It is the *concepts* that are central, not their particular implementations. A primary focus of the course will be to come to terms with many common patterns in software design, which provide proven and repeatable templates on which to base implementations.

Pre-requisites: Course in any one programming languages (C++ preferred).

1. **Introduction and Problem Statement**
   - Essentials of the object-oriented paradigm,
   - Issues in Complexity, Modeling and Abstraction

2. **Classification and Abstraction**
   - Classes and Objects
     - State and Behavior
   - Static/Structural Modeling
     - Inheritance and Abstraction
     - Aggregation and Composition
     - Class Relationships (Associations, Dependencies, Whole/Part)

3. **Static Modelling in UML**

   Static Class Diagrams

4. **Dynamic Modelling in UML**

   Sequence/Collaboration Diagrams.

5. **Object Oriented Analysis**
   - Use Cases
   - Class identification Strategies (CRC, etc.)
   - Data Modelling vs. Class Modelling.

6. **Object Oriented Design**
   - Implementation Details
   - Abstract Classes
   - Use of Interfaces in Compositional Frameworks

7. **Introduction to Design Patterns** (concept only)

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Term Work

Term work shall consists of at least two OOA&D case studies with detailed documentation using UML, supported by implementation of prototypes. All the above carries a weightage of 15 marks and a class test carry weightage of 10 marks.

Text Books:

1. Object Oriented System Development, Ali Bahrami, Irwin McGraw Hill, 1999.
2. Designing flexible object oriented systems with UML, Charles Richter, Techmedia, 1st edition, 2000.
3. Design Patterns Elements of reusable object oriented software, Erich Gamma et.al. , AWL Addison Wesley, 1994.

Reference Books

1. Ivan Jacobson, Graddy Boach, Lames Rambaugh, "*The Unified Software Development Process*", AWL 2001.
2. Alan Dennis, Barbara H. Wixom, David Tegarden, "*System Analysis and Design – An Object Oriented Approach with UML*", John Wiley Eastern, 2002.

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B.E. (Electrical) SEM-VIII

Design and Estimation of Electrical Systems

Lectures/week: 3 Hours
Practicals/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Oral : 25 Marks
Term work: 25 Marks

Objectives:

This course focuses on applying the knowledge of Electrical Engineering acquired so far, to the different electrical systems encountered in the field. The scope of this subject would revolve around a general understanding of various electrical systems and practical considerations in their design, various roles of an Electrical Engineer in industry. This would involve project feasibility, planning, preparing and reading electrical drawings, preparing time & cost estimates and analyzing its role at various stages during the life cycle of a project, etc.

1. **Introduction**
   - Review of basic electrical engineering formulae
   - Types of Electrical Projects
   - Different electrical systems in industrial/commercial/residential project.
   - Activities of an Electrical Engineer as design/maintenance/project engineer
   - Overview of Applicable IS/international standards and codes for products and installations

2. **Project Management**
   - Justifying project investments – Financial feasibility
   - Project Planning- QAP, WBS, Scheduling, Logistics
   - Project Implementation, Project Management application software- capabilities, Limitations, selection.

3. **Estimation & Tendering**
   - Project Engineering- different electrical drawings; Single Line Diagrams in detail
   - General equipment design/selection criteria
   - Estimation : importance, Preparing rough and detailed estimates;
   - Databases required for reasonably accurate estimates, underlying assumptions in estimates and sensitivity analysis
   - Tender documents and tendering procedures.

4. **Power Distribution System**
   - Different distribution systems and selection criteria
   - Temporary and permanent power supply
   - Electrical load – size, LF, DF, future estimates
   - Transformers
     - Types of transformers and transformer sizing
     - Design Consideration and selection criteria
   - Magnetic Material
     - Winding
     - Other Accessories
   - Power factor improvement
   - Sub-station equipment options
   - Future trends

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5. **Distribution Switchgear – HT/LT**
   - Different types and their selection
   - Switchboards, MCCs
   - Control schemes, Mimics, PLCs, Process Controllers,
   - Electronic Instrumentation
   - Protection – upstream & downstream co-ordination and
   - Discrimination; Protection Relays
   - Metering, Instrument Transformers
   - Future Trends.

6. **Cables**
   - Different types and their classification
   - Types of installations per IS/IEE
   - Conductor sizing, Insulation selection
   - Cable management systems- conduit sizing, trenches, Trays
   - Cable installations; cable terminations, Cable accessories
   - Cables and Bus bars
   - Future Trends

7. **Emergency Power Supply**
   - Types of power emergencies – power breakdown, Fire
   - DG Sets – sizing, selection criteria
   - Batteries – types, sizing, selection criteria
   - UPS
   - Future Trends

8. **Motors**
   - Selection criteria, Energy efficient motors
   - Variable speed drives
   - Design consideration and selection criteria for induction motors
     - Magnetic Material
     - Winding
     - Other Accessories

   Future Trends

9. **Energy Audit**
   - Why energy audit?
   - Broad outlines of energy audit
   - Recommendation of energy audit – Financial justifications;
   - Implementing recommendations – retrofitting of energy efficient devices
   - Energy Managements Systems- SCADA, BMS (Building Management Systems)
   - Future Trends

10. **Special Electrical Installations**
    - Computer Installations
    - Communications – EPABX, internet, video conferencing
    - Fire Protection & Extinguishing
    - Security Systems
    - Elevators
    - CC/MA TV, PA / Audio

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11. **Lighting System and Illumination**
    - Different types of light sources and their application
    - Average lumen method for interior lighting system
    - Design consideration and recommendation for domestic, commercial and industrial applications (concept only)

Term Work

The term work will consist of at least 6 experiments/assignments duly performed, properly recorded and graded, which will carry a weightage of 15 marks & the test will carry a weightage of 10 marks.

Text Books:

1. Thumann A., *Introduction to Efficient Electrical Systems Design*, Fairmont Press,2nd Ed.1999.
2. Kushare B.E., *Handbook on energy efficient motors,* International Copper Promotion council (India), 1st Ed. 2002.
3. Sawhney A.K. "A course in Design of Electrical Machines", Dhanpat Rai & sons, New Delhi, 1996.
4. Valia A., *Designing with Light- A Lighting Handbook*, Lighting Systems, 2002

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B.E. (Electrical) SEM VIII

Subject: Drives and Control

Lectures/week: 4 Hours
Practicals/week: 3 Hours

Paper: 100 Marks **Duration:** 3 Hours
Oral : 25 Marks
Term work: 25 Marks

1. **Electrical Drives**
   - Introduction
   - Advantages of electrical drives
   - Parts of electrical drives
   - Choice of electrical drives
   - Status of D.C. and A.C. drives.

2. **Dynamics of Electrical drives**
   - Fundamental torque equations
   - Speed torque conventions and multiquadrant operation
   - Equivalent values of drive parameters
     - Loads with rotational motion
     - Loads with translational motion
   - Measurement of moment of inertia
   - Components of load torques
   - Nature and classification of load torques
   - Calculation of Time and Energy-Loss in Transient operations
   - Steady state stability
   - Load equalization.

3. **Selection of Motor Rating**
   - Thermal model of a motor for heating and cooling
   - Classes of motor duty
   - Determination of motor rating
     - Continuous duty
     - Equivalent current, torque and power methods for fluctuating and intermittent loads
     - Short time duty
     - Intermittent periodic duty
   - Energy efficient motors.

4. **Braking of AC and DC Drives**
   Motor characteristics under braking conditions
   - Regenerative braking
   - Dynamic braking
   - Plugging

5. **Electromagnetic control of motors**
   - Starting
   - Speed control
   - Braking
   - Sequential operation of motors

6. **Control of DC Drives**
   - Review of methods of speed control of different types of DC motors

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- Single phase separately excited DC machines drive – continuous mode and discontinuous mode.
- Three-Phase DC motor drives (Separately Excited)
  - 3 Phase half wave converter drive
  - 3 Phase semi-converter drive
  - 3 Phase full converter drive
  - 3 Phase dual converter drive
- Braking action of rectifier controlled separately excited motors
- Single phase series DC motor drives
  - Power factor control
  - Extinction angle control
  - Symmetrical angle control
  - Pulse width modulation control (P.W.M.)
  - Sinusoidal P.W.M.
- DC chopper drives
- Closed-loop control DC drives
- PLL control of DC drives.

7. Control of AC Drives

- Three Phase induction motor
  - Review of schemes for speed control of induction motors
  - Direct vector control schemes (elementary treatment only)
  - Indirect vector control schemes (elementary treatment only)
- Introduction to variable speed drives for synchronous motor control

8. Special Motors

- Stepper Motor Control
  - Control of two-phase stepper motor
  - Control of four-phase stepper motor
  - Microstepping
  - Torque improvement at higher stepping rates.
- Brushless DC Motor drives
- Switched reluctance motor drives

9. Control of Electrical drives using microprocessors and microcontrollers

- Dedicated hardware systems versus microprocessor control
- Application areas and functions of microprocessors in drive technology
- Control of electric drives using microprocessors.

Term Work

The term work will consist of at least 6 experiments/assignments duly performed, properly recorded and graded, which will carry a weightage of 15 marks & the test will carry a weightage of 10 marks.

Text Books:

1. Dubey G.K., *Fundamentals of Electrical Drives*, Narosa Publishing House,2nd Ed. , 2002.

2. Krishnan. R., *Electric Motor Drives: Modeling, Analysis and Control*, Prentice Hall of India, 1st Ed. , 2002.

3. Bose B.K., *Modern Power Electronics and AC Drives*, Pearson Education Asia, 1st Ed. , 2002

4. Rashid M.H., *Power Electronics: Circuits, Devices and Applications*, Prentice Hall of India. 2nd Ed. , 2001

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5. Subrahmanyam V., *Electrical Drives: Concepts and Applications* ,Tata-McGraw-Hill, 1st Ed. , 1994.

Reference Books:

1. Pillai S.K, *A First course on Electrical Drives*, Wiley Eastern Publications, 2nd Ed., 1989.

2. Kushare B.E. , *Handbook on Energy Efficient motors*, International Copper Promotion council (India), 1st Ed. 2002.

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B.E. (Electrical) SEM VIII

Industrial Controllers

Lectures/week: 4 Hours
Practicals/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Oral : 25 Marks
Term work: 25 Marks

1. **Controller assessment framework**
   - Close loop stability
   - Disturbance rejection performance
   - Reference tracking performance (Proportional control, Integral control,
   - derivative control, PI and PID controller formula)

2. **Simple tuning method**
   - Choice of controller structure
   - Manual tuning method
   - Proportional control of a system with a first order model
   - Proportional and Integral control of a system with a first order model
   - Proportional and Derivative control procedure
   - PID controller design by pole-placement

3. **The practical aspects of PID controller**
   - Understanding common notation for industrial PID controllers
   - Industrial PID control technology
   - The issues in implementing an industrial PID controller
   - Integral wind-up and anti windup circuits
   - Implementing the derivative term
   - Industrial PID controller structures
   - Different forms of industrial PID controllers
   - Reverse acting controllers
   - Digital PID control

4. **PID controller tuning methods**
   - oscillation or quarter amplitude Understanding PID tuning procedures
   - Process reaction curve PID tuning method
   - Sustained oscillation PID tuning
   - Damped decay PID tuning procedure
   - The relay experiment

5. **Introduction to programmable controllers**
   - Introduction to PLC functions
     - Industrial motor control circuits
     - Relay ladder logic circuits
     - Building a ladder diagram
     - Motor control starter circuits
   - Introduction to PLC components
     - Rack assembly
     - Power Supply
     - PLC programming units
     - Input output sections

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- Processor unit
- Addressing
- Relationship of data-file addresses to I/O modules

6. **Fundamental PLC programming**
   - PLC program execution
   - Ladder diagram programming language
   - Ladder diagram programming
   - Relay logic instructions
   - Timer instructions
   - Counter instructions
   - Data manipulation instructions
   - Arithmetic operations
   - Writing a program

7. **Advanced programming PLC interfacing and troubleshooting**
   - Introduction
     - Jump commands
     - Data manipulation
   - Programmable controller interfacing
   - Discrete I/O modules
   - Troubleshooting I/O interfaces
   - Analog I/O signals
   - Special purpose modules
   - Troubleshooting programmable controllers

Term Work

The term work will consist of at least 6 experiments/assignments duly performed, properly recorded and graded, which will carry a weightage of 15 marks & the test will carry a weightage of 10 marks.

Text Books:

1. Bartelt T., *Industrial Control Electronics : Devices, Systems and Applications*, Delmar Thomson Learning, 1st Ed, 1997.

2. Dunning G. : *Introduction to Programmable Logic Controllers*, Delmar Thomson Learning, 2nd Ed.,2001

3. Wilkie J., Johnson M. & Katebi R. : *Control Engineering : An Introductory Course*, Palgrave-MacMillan, 1st Ed., 2001

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Elective II - Flexible AC Transmission Systems (FACTS)

Lectures/week: 4 Hours
Practicals/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Oral : 25 Marks
Term work: 25 Marks

1. Load Compensation

- Reactive Power (VAR) Compensation for isolated loads
- Power Factor correction
- Voltage Regulation
- V-Q characteristics for an inductive load
- System load line
- Effect of shunt capacitor / reactor bias on the system V-Q characteristic
- V-Q characteristics of VAR compensators in terms of shirt circuit levels
- Load balancing in 3-phase loads with parallel compensation

2. Transmission Line

- Wave equation
- Standing waves
- Surge impedance and SIL
- Voltage and current profile along unloaded line
- Ferranti effect
- Effect of loading on reactive power requirement

3. Voltage control

- Tap changing transformers
- Booster transformers
- Static voltage regulators
- Thyristorised series voltage injection

4. Converters and Inverters

- Real and reactive power enhancement of a power system in time domain (using series and parallel configurations)
- Protection of valves

5. Types of compensators

- Passive and active compensators
- Shunt reactor / capacitor compensators
  - Single
  - Multiple
  - Mid-point
- Static compensators
  - Control schemes and characteristics of
    - FC – TCR
    - TCR – TSC
    - TSC and other combinations

6. Dynamic compensation

- Introduction
- Effect on stability of a power system

7. Unified Power Flow Controller (UPFC)

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- Basic relationships for power flow control
- Synchronous voltage sources
- Implementation of synchronous voltage source
- Shunt compensation by synchronous voltage source
  - Reactive power compensation scheme
- Series compensation by synchronous voltage source
  - Reactive series compensation
- Unified power flow concept

8. Harmonics

- Harmonics generated by FACTS and their mitigation
- Different power quality problems that could be solved using flexible sub-systems.

Term Work

The term work will consist of at least 6 assignment/experiments duly performed, properly recorded and graded, which will carry a weightage of 15 marks & the test will carry a weightage of 10 marks.

Text Books:

1. Miller T.J.E., *Reactive Power Control in Electric Systems*, Wiley Europe, 1st Ed. 1983.
2. Hingorani N.G. & Gyugyi L., *Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems*, Wiley-IEEE Press, 1st Ed. 1999

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B.E. (Electrical) SEM VIII

Elective II - Illumination Engineering

Lectures/week: 4 Hours
Practicals/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Oral : 25 Marks
Term work: 25 Marks

1. Light, Sight & Colour

Electromagnetic radiation, Laws of radiation, Light flux, Light intensity, Illuminance laws, Luminance, Surface reflectance.
Structure of the eye, photopic, mesopic and scotopic vision, trichromatism, perception details, visual performance, adaptation, flicker, glare, perception of objects and spaces, photocell, lighting measurement.
Physics of colour, colour mixing, colour appearance, colour temperature, surface colours, colour rendering & rendition index

2. Lamps and accessories

Light production by gas discharge, fluorescence, incandescence, daylight
Principle of operation, light efficacy, colour, electrical characteristics, typical applications, dimming condition of GLS filament, tungsten halogen lamps, fluorescent tubes, Compact Fluorescent Lamp (CFL), low and high pressure Sodium Lamps, high pressure mercury lamp, metal halide lamp

3. Luminaries

Functions of luminaries, Classification, Materials used in luminarie manufacturing, reflection, refraction, diffusion, polarization and optical design, photometric measurements, application data and its use.

4. Interior Lighting

Objectives, quantity and quality of light, selection of lamps, luminarie section, placement. Design considerations for lighting of offices, conference rooms, hospitals, teaching places, house, hotels, art galleries, museums, shops, shopping centers, temples factories etc., Design calculations.

5. Exterior Lighting Design

Exterior lighting objectives, choice of lamps type, luminaries, lighting of parks and gardens, pathways, outdoor work areas. Lamps and luminaries photometric data and its use in design calculation, glare consideration.

6. Road Lighting

Aims of road lighting, quantitative and qualitative lighting needs, luminance concept, road reflection characteristics, light sources, luminaries, road lighting design calculations, siting of luminaries on straight roads, junctions, and special situations, aesthetics, maintenance. Lighting for residential colony road lighting, tunnel lighting design requirements and criteria. High mast lighting for roads.

7. Utility Area Lighting

Objectives of utility area lighting, lighting for marshalling yards, outdoor working and storage areas, container terminals, airport aprons, docks and harbours etc., task analysis and considerations for lighting parameters and design.

8. Sports Lighting

Indoor and outdoor games, lighting parameter requirements for players, TV cameras, horizontal and vertical illuminance, glare limitation, level of competition, light sources, location of luminaries.

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9. **Decorative Flood Lighting**
Introduction to the principle of decorative building flood lighting, consideration for the shape and form, selection of lamps and luminaries, design criteria.

10. **Emergency Lighting**
Regulations standards and its requirements, escape lighting, standby system.

11. **Lighting Controls**
Types of lighting controls, strategy for selection, benefits of lighting control

12. **Distribution System and Maintenance**
Electric distribution system for lighting, maintenance strategies, group replacement schedule.

13. **Energy efficient lighting design and computer aided lighting design**
Techniques of achieving energy efficient lighting design, role of computers in lighting design, advantages and limitations of computer aided lighting design.

Term Work
At least eight practical/ assignments, including design calculations on indoor as well as outdoor lighting scheme and its layouts, should also include report on at least two existing lighting schemes one from interior like shopping centers/ theatre/ offices etc and one from exterior lighting like road/ stadiums/ gardens etc. and their evaluation.

Text Books:

1. Illuminating Engineering Society of North America, *IESNA Lighting Handbook*, IESNA Publishing 9th Ed. 2000
2. Cayless M.A. & Marsden A.M. , *Lamps and Lighting*, Edward Arnold-A div. Of Hodder and Stoughton 3rd Ed. 1983
3. Valia A., *Designing with Light- A Lighting Handbook*, Lighting Systems, 2002
4. Boer J.B. and Fischer D., *Interior Lighting*, Philips Technical Library, Kluwer Technische Boeken, 1st Ed. 1978
5. Bommel J.M. & Boer J.B., *Road Lighting*, Philips Technical Library, Kluwer Technische Boeken, 1st Ed. 1980

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B.E. ELECTRICAL ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Elective – II, Robotics

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: This course familiarizes students with the concepts and techniques in robot manipulator control, enough to evaluate, choose, and incorporate robots in engineering systems.

DETAILED SYLLABUS

Robotic Manipulation
Automation and Robots, Classification, Application, Specification, Notations.

Direct Kinematics
Dot and cross products, Co-ordinate frames, Rotations, Homogeneous, Co-ordinates, Link co-ordination arm equation, (Five-axis robot, Four axis robot, Six axis robot).

Inverse Kinematics
General properties of solutions tool configuration Five axis robots, Three-Four axis, Six axis robot (Inverse kinematics).
Workspace analysis and trajectory planning work envelop and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

Robot Vision
Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation (Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured Illumination, Camera calibration).

Task Planning
Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp planning, Fine-motion Planning, Simulation of Planer motion, Source and goal scenes, Task planner simulation.

Moments of Inertia.

Principles of NC and CNC Machines.

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BOOKS

Text Books:

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India
2. Fu, Gonzales and Lee, Robotics, McGraw Hill
3. J.J, Craig, Introduction to Robotics, Pearson Education

Additional Reading:

1. Staughard, Robotics and AI, Prentice Hall of India
2. Grover, Wiess, Nagel, Oderey, "Industrial Robotics", McGraw Hill
3. Walfram Stdder, Robotics and Mechatronics,
4. Niku, Introduction to Robotics, Pearson Education
5. Klafter, Chmielewski, Negin, Robot Engineering, Prentice Hall of India
6. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications

TERM WORK

1. Term work should consist of at least 10 practicals and assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. (Electrical) SEM VIII

Elective-II - Reliability Engineering

Lectures/week: 4 Hours
Practicals/week: 2 Hours

Paper: 100 Marks **Duration:** 3 Hours
Oral : 25 Marks
Term work: 25 Marks

1 **Introduction**
- The study of Reliability and Maintainability
- Concepts, Terms and Definitions
- Applications

2 **The Failure Distribution**
- The Reliability function
- Mean Time to Failure
- Hazard Rate Function
- Bathtub Curve
- Conditional Reliability

3 **Constant Failure Rate Model**
- The Exponential reliability Function
- Failure Modes
- Applications
- The Two parameter Exponential Distribution
- Poisson Process
- Redundancy and the CRF Model

4 **Time Dependent Failure Models**
- The Weibull Distribution
- The Normal Distribution
- The Log normal Distribution

5 **Reliability of Systems**
- Serial Configuration
- Parallel Configuration
- Combined Series-Parallel systems
- System Structure Faction, Minimal Cuts & Minimal Paths
- Common State devices

6 **Design of Reliability**
- Reliability Specification & Systems Measurements
- Reliability Allocation
- Design Methods
- Failure Analysis
- System safety & Fault Tree Analysis

7 **Maintainability**
- Analysis of Downtime
- The Repair – Time Distribution
- Stochastic point, process
- System Repair time
- Reliability under Preventive Maintenance

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- State Dependent Systems with repair

8 **Design for Maintainability**
- Maintenance Requirements
- Design methods
- Human factors and Ergonomics
- Maintenance & Spores Provisioning
- Maintainability Prediction & Demonstration.

9 **Fundamentals of Power system Reliability**
- Planning for reliability
- Outage definitions
- Reliability models – Basic Concepts.

10 **Reliability of Generating Capacity**
- The Probability of Capacity deficiency – loss of load method & loss of energy method.
- Reliability of the unit unavailability
- Reliability of the forecast

11 **Reliability of Interconnected systems**
- Two connected with independent loads
- Two connected load with correlated loads

12 **Bulk power system reliability**
- Effects of component failures & causes of system failures in bulk power System (only block diagram study).
- The scope of reliability engineering in power systems- the cost worth of reliability.

Term work

The term work will consist of at least 6 computer based experiments , properly recorded and graded, which will carry a weightage of 15 marks & the test will carry a weightage of 10 marks.

Reference Books

1. Ebeling C.E, *An Introduction to Reliability & Maintainability Engineering*, TMH publication, 2000.

2. Endrenyi J. *Reliability Modeling in Electric Power System*, John Wiley & sons, 1st Ed. 1979.

3. Billinton R & Allan R., *Reliability Evaluation of Power System*, Pitman Publishing Ltd., Plenum Pub Corp. 2nd Ed. 1996.

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B.E. (Electrical) SEM VIII

Elective II - Project Management

Lectures/week: 4 Hours
Practicals/week: 2 Hours

Paper: 100 Marks
Oral : 25 Marks
Term work: 25 Marks

Duration: 3 Hours

Objectives of the course: This course deals with the project management processes and their application to meet specific scope, time, cost , quality and people expectation goals related to a project.

1. **Introduction to Project management**
   Definition and History;

2. **Project Management Knowledge areas**
   - Project Integration Management;
   - Project Scope Management:
   - Project Time Management:
   - Project Cost Management:
   - Project Quality Management:
   - Project Human Resource Management:
   - Project Communications Management:
   - Project Risk Management:
   - Project Procurement Management

3. **Project Management Process:**
   - Initiating;
   - Planning;
   - Executing;
   - Controlling;
   - Closing;

Term work:
Term work shall consist of at least 2 case studies implemented using the tool set like Microsoft project 2000 and a test carrying a weightage of 10 marks.

Text Books:

Kathy Schwalbe, *"Information Technology Project management"*, Thomson Learning, 2nd Edition.
Philips *"Project Management"*, TMH Publication

Reference Books:

1. "*A Guide to the Project Management Body of Knowledge* "(PMBOK Guide), Project Management Institute , Newtown Square, Pennsylvania , USA.
2. Gido and Clements, " *Successful Project Management*", 2nd Edition, Thomson Learning

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Electronics Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTIONS & EXAMINATION
at
B.E.(Electronics Engineering)
(R-2001)
(Revised Scheme Considering 60 Minutes' Period Instead of 45 Minutes' Period as per AICTE Guide-lines)

SEMESTER-III

Sr. No.	Subjects	No. of Periods per Week			Duration of Theory Paper (Hrs)	Marks				
		Lectures	Practicals	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1.	* Applied Mathematics-III	4	-	-	3	100	-	-	-	100
2.	# Electronic Circuit Analysis & Design-I	4	3	-	3	100	25	-	-	125
3.	# Electrical Network Analysis and Synthesis	3	2	-	3	100	25	-	-	125
4.	Basics of Communication Engg.	3	3	-	3	100	25	-	-	125
5.	** Numerical Techniques	3	2	-	3	100	25	-	-	125
6.	Digital Design-I	3	2	-	3	100	25	-		125
Total		20	12	-	-	600	125	-	-	725

* Subject common with Biomedical, Instrumentation, Electrical and Electronics & Telecommunication Engineering branches.
# Subject common with Biomedical Engineering branch.
** Subject common with Biomedical, Electrical and Electronics & Telecommunication Engineering branches.

Semester IV

Sr. No.	Subjects	No. of Periods per Week			Duration of Theory Paper (Hrs)	Marks				
		Lectures	Practicals	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1.	* Applied Mathematics-IV	4	-	-	3	100	-	-	-	100
2.	# Electronic Circuit Analysis and Design-II	4	3	-	3	100	25	25	25	175
3.	Control Systems Engineering.	3	2	-	3	100	25	-	25	150
4.	Electrical Machines and Instruments.	3	2	-	3	100	25	-	25	150
5.	Principles of Microprocessor Systems	3	3	-	3	100	25	-	25	150
6.	Digital Design-II	3	2	-	3	100	25	25	25	175
Total		20	12	-	-	600	125	50	125	900

* Subject common with Biomedical, Instrumentation, Electrical and Electronics & Telecommunication Engineering branches.
# Subject common with Biomedical Engineering branch.

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SEMESTER-V

Sr. No.	Subjects	No. of Periods per Week			Duration of Theory Paper (Hrs)	Marks				
		Lectures	Practicals	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1.	* Applied Mathematics-V	4	-	-	3	100	-	-	-	100
2.	# Engineering Electromagnetics	3	-	1	3	100	25	-	-	125
3.	Electronic Measuring Instruments.	3	2	-	3	100	25	-	-	125
4.	Continuous Time Signals and Systems	4	-	2	3	100	25	-	-	125
5.	Microprocessors and Microcontrollers	3	3	-	3	100	25	-	-	125
6.	* Presentation and Communication Techniques	2	2	-	-	-	25	-	25	50
7	Electronics Workshop	-	3	-	-	-	-	-	25	25
Total		19	10	3	-	500	125	--	50	675

* Subject common with Biomedical, Instrumentation, Electrical and Electronics & Telecommunication Engineering branches.
# Subject common with Biomedical Engineering branch.

SEMESTER-VI

Sr. No.	Subjects	No. of Periods per Week			Duration of Theory Paper (Hrs)	Marks				
		Lectures	Practicals	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1.	Microwave and Fiber Optic Communication	4	2	-	3	100	25	-	25	150
2.	# Analog Integrated Circuits and Applications	4	3	-	3	100	25	-	25	150
3.	Communication Systems.	3	3	-	3	100	25	-	25	150
4.	Discrete Time Signal Processing	3	2	-	3	100	25	-	25	150
5.	Computer Organization	3	2	-	3	100	25	-	25	150
6.	# # Industrial Economics & Management	3	-	-	3	100	-	-	-	100
Total		20	12	-	-	600	125	-	125	850

Subject common with Biomedical Engineering branch.
Subject common with Instrumentation and Electrical and Electronics & Telecommunication Engineering branches.

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SEMESTER VII

Sr. No.	Subjects	No. of Periods per Week			Duration of Theory Paper (Hrs)	Marks				
		Lectures	Practicals	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1.	Basics of VLSI	4	2	-	3	100	25	-	25	150
2.	Instrumentation Systems	3	2	-	3	100	25	-	-	125
3.	Digital Communication	3	2	-	3	100	25	-	25	150
4.	Filter Theory and Applications	4	2	-	3	100	25	-	-	125
5.	Elective –I	4	2	-	3	100	25	-	25	150
6.	Project –A	-	-	4	-	-	25	-	-	25
Total		18	10	4	-	500	150	-	75	725

Elective I
Image Processing
Process Control & Instrumentation
Microcomputer System Design
DSP Architectures and Systems
Wireless Communication

SEMESTER VIII

Sr. No.	Subjects	No. of Periods per Week			Duration of Theory Paper (Hrs)	Marks				
		Lectures	Practicals	Tutorials		Theory Paper	Term Work	Practical	Oral	Total
1.	Power Electronics	4	2	-	3	100	25	-	25	150
2.	Data Communication & Networking	4	2	-	3	100	25	-	25	150
3.	Mechatronics	4	2	-	3	100	25	-	25	150
4.	Elective –II	4	2	-	3	100	25	-	25	150
5.	Project –B	-	8	-	-	-	50	-	50	100
Total		16	16	-	-	400	150	-	150	700

Elective II
Advanced Digital Signal Processing
Biomedical Instrumentation
Embedded Systems and Real Time Programming
**Robotics
+Telecom Network Management
VLSI Design

Group size should be restricted to minimum 2 students and maximum 5 students for projects.

+ Subject common with Electronics and Telecommunication branch

* Subject common with Computer Engineering and Electrical Engineering Branches.

** Robotics elective common with Electrical, Computers, IT and Instrumentation branches of engineering

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Basics of VLSI

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: This subject shall foundation for understanding the intricacies of very large scale integrated circuits and analyzing these circuits. The knowledge gained shall be useful for further elective on designing with VLSI circuits

DETAILED SYLLABUS

Physics of FET
NMOS, PMOS, enhancement and depletion mode transistor, MOSFET, threshold voltage, flatband condition, threshold adjustment, linear and saturated operation, FET capacitance, mobility saturation, thermal variation, short channel and hot electron effect

Silicon semiconductor technology
Wafer processing, mask generation, oxidation, epitaxy ion implantation, diffusion, metalization, basic NMOS and PMOS processes. Process simulation using CAD tools

Scaling
Scaling of MOS circuits, type of scaling, functional limitations of scaling, scaling of wires and interconnects

Design rules and layout
Purpose of design rules, NMOS and CMOS design rules and layout, Design of NMOS and CMOS inverters, NAND and NOR gates. Interlayer contacts, butting and buried contacts, stick diagrams, layout of integrated circuits, use of layout tools like MAGIC for integrated circuits.

MOS Inverters
MOSFET aspect and inverter ratio, Enhancement VS Depletion mode pull ups, standard CMOS inverter, transit time and switching speed of NMOS and CMOS inverters, NMOS and CMOS gates, transistor sizing and power dissipation, noise margin calculations, SPICE models and circuit simulation using PSPICE.

Design of basic VLSI circuits
Design of circuits like multiplexer, decoder, priority encoder, Flip flops, shift registers using MOS circuits

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Design Methodologies

Design analysis and simulation, design verification, design implementation, design synthesis, validation and testing of manufactured circuits.

BOOKS

Text Books:

1. E. D. Fabricus, Introduction to VLSI design, McGraw Hill Publications, first edition, 1990
2. Neil H.E. Weste, Kamran Eshraghian, Principles of CMOS VLSI Design: A Systems Perspective, second edition, Addison Wesley Publications, 1993
3. Rabaey Jan M., Chandrakasan Anantha, Nikolic Borivoje, Digital Integrated Circuits: A Design Perspective, second edition, Prentice Hall of India

TERM WORK

The Term work shall consist of at least four computer programs and atleast six assignments covering the whole syllabus, duly recorded and graded. This will carry a weightage of fifteen marks. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: **Instrumentation Systems**

Lectures: 3 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks**

Rationale: The art of measurement plays an important role in all branches of engineering & science. With the advancement of technology, measurement techniques have taken rapid strides during recent year with the introduction of different types of instrumentation devices. The aim is to bring these developments together.

DETAILED SYLLABUS

Fundamental Concept Of Measurement & Performance Characteristics of An Instrumentation System

System Configuration-Block diagram of a generalized measurement system,
*Generalized measurements- Transfer function representation & sinusoidal Transfer function.
*Zero order system
*First order system- Response of a system to Step, Ramp, Impulse input &Frequency response.
*Second order system – Response of the system to Step, Ramp input & Frequency response of. Second order system.
*Dead time element.
*Dynamic response of measurement systems.

Transducers

* Classification and Requirements.
*Displacement –
principle of transducers, potentiometric displacement transducer, L.V.D.T., Variable capacitance transducer, Hall effect- angular displacement transducer, Digital transducer.
*Strain-
Types of Strain gauge, theory of operation of resistance strain gauge, types of electrical strain gauge, Materials for strain gauge, Gauging techniques, Strain gauge circuits, Temperature compensation, Application.
*Vibration-
Vibration sensing Devices- Velocity transducer, Bonded Strain Gauge Accelerometer, Piezoelectric Accelerometer, servo Accelerometer, Digital Accelerometer.

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*Signal conditioners for vibration transducer output.
-voltage amplifier, Charge amplifier.
*Application.
Temperature-
*Classification of temperature sensors
*Resistance type temperature sensor, Platinum resistance thermometer.
*Thermister.
*Thermocouples- Properties, Material used for construction, Reference junction compensation, Thermocouple output linearizing circuits.
*Temperature measurement by radiation method - Optical pyrometer.
* Solid state transducer.
Pressure-
Diphragrams, capsule, Bourdon tube, Bellows, Variable reluctance type, Variable capacitance type, Thin film pressure transducer, Digital pressure transducer, Piezo electric transducer.
Force And Torque-
Different types of load cell configuration, Effect of temp. Variation, Dynamic response of elastic transducer, Digital force transducer.
Torque Measurement- Absorption type, Transmission type, Stress type, and Deflection type.
Flow-
Classification of flow meter, Head type flow meter, Electromagnetic type, Rotameter, Anemometer, Ultrasonic flow meter.
Photo Electric Transducer-
The photo multiplier tube, Photo conducive cell, Photo- Voltaic cell, Semiconductor photo diode, Photo transducer.

Data Acquisition
Generalized data acquisition system, Multi-channel DAS, Data logger, PC based data acquisition System, Concept of Virtual Instrumentation.

BOOKS

Text Books:

1. Rangan, Sharma &Mani, Instrumentation Devices and Systems, Tata McGraw Hill, second edition

Additional Reading:

1. Doebelin E .O., Measurement systems – Applications and Design, fourth edition, , Tata McGraw Hill, fourth edition, 1990.
2. Jones and Chin, Electronic Instruments and Measurements, John Willey and Sons, 1987.
3. Nakra and Chaudhary, Instrumentation, Measurement and Analysis, Tata McGraw Hill, second edition, 2003
4. Neubert H. K., Instrument Transducers, Oxford University Press,Second

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edition.

TERM WORK

1. Term work shall consist of at least eight practicals covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Digital Communication

Lectures: 3 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: The increase in demand for data transmission coupled with the availability of wideband communication channels and sophisticated integrated circuits have led to the development of efficient and reliable digital communication.

DETAILED SYLLABUS

Random variables
Review of probability theory, communications examples , Random variables, probability Distribution function , probability density function, joint cumulative distribution and probability density, average value and variance of a random variable, The error function, The Gaussian probability density The Rayleigh probability density, The central limit theorem.

Information Theory
Discrete messages, the concept of amount of Information, Entropy, Information rate, coding to increase Average Information per bit – Huffman coding, Lempel Ziv coding Shannon's Theorem, Channel capacity, capacity of a Gaussian channel, Bandwidth – S/N trade – off.

Error control coding
Rationale for coding and types of codes, Discrete memoryless channel , some Algebraic concepts – code efficiency and Hamming bound , linear block codes, Cyclic codes, Convolutional codes , maximum likelihood decoding of convolutional codes.

Baseband shaping for data transmission
Discrete PAM signals, Power spectra of discrete PAM signals, Intersymbol Interference, Nyquist's criteria for distortionless baseband, Binary transmission,

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correlative coding eyepattern , Baseband M - ary PAM systems.

Baseband Detection
Correlation receiver, Matched filter receiver, Detection of signals with unknown phase in noise, Equalization concepts [no algorithms expected], Tapped – Delay Lines equalization, liner predictive vocoders.

Digital Modulation techniques
Digital Modulation formats, coherent binary modulation techniques, coherent quadrature modulation techniques, Noncoherent binary modulation techniques ,Comparison of binary and quaternary modulation techniques, M – ary modulation, Power spectra, Bandwidth efficiency, Applications of digital modulation techniques.

Spread spectrum modulation
Pseudo – noise sequences, Baseband spread spectrum system, DS – BPSK, processing gain, Probability of error, Jamming Margin, Frequency – Hop spread spectrum, Applications.

BOOKS

Text Books:

1. Simon Haykin, Digital communication John Wiley and sons [Topics 3,4,5,6,7]
2. Taub and Schilling - Principles of communication systems – Tata McGraw Hill, second edition

Additional Reading:

1. John G. Proakis, Digital Communications, McGraw Hill
2. Bernad Shlar, Digital Communication, Pearson Education
3. K Sam Shanmugam – Digital and Analog Communication systems, John Wiley and sons.
4. Lathi B.P., Modern Digital and Analog communications systems – PRISM Indian edition

TERM WORK

1. Term work shall consist of at least eight practicals and assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Filter Theory and applications

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks

Rationale: *Digital Filters are wildly used today in many diverse application areas. Naturally filter design techniques play vital role in DSP applications. Some of these techniques are based on analog domain designing. It is therefore necessary to know different analog & digital filter designing concepts.*

DETAILED SYLLABUS

Filter Analysis in Frequency domain

- Review of Frequency response of IIR filter
- Linear Phase FIR Systems
  - Condition for Linear Phase
  - Magnitude& phase response for Four types of Linear Phase systems
  - Location of zeros

Analog filter designing techniques

- The design process
- The Butterworth filter
- The Chebyshev approximation
- The elliptic approximation
- The Bessel function

IIR Digital filter Design

- Methodology, Analog & Digital domain mapping, Spectral transformations
- Impulse – Invariance Method
- Bilinear transform technique
- Matched Z-Transform technique
- Intuitive approaches

FIR Digital filter Design

- FIR versus IIR filters
- Window-based Design of different types of filters
  - Gibb's Phenomenon
  - Design using different Windows

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- Use of Kaiser Window
- Half-Band FIR filters
- Frequency sampling technique
- Design of optimal linear phase FIR filters
- Structures for implementation of filters

Quantization Effects

- Quantization methods
- Limit cycle oscillations due to Quantization
- Errors in frequency response due to coefficient Quantization

BOOKS

Text Books:

1. A. Antoniou, Digital Filters: Analysis Design and Applications, Tata McGraw-Hill Publication, 2001
2. Ashok Ambardar, Analog and Digital Signal Processing, Thomson Learning Publication, second edition, 2001

Additional Reading:

1. T. J. Cavicchi, Digital Signal Processing, Wiley Publication, 2002
2. S.K. Mitra, Digital Signal Processing, Tata McGraw-Hill Publication, 2001

TERM WORK

1. Term work shall consist of at least six software programs written in C / MATLAB and two assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Elective – I, Image Processing

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: Image processing has grown considerably due to fast computational systems. Many important real life applications in diverse fields are therefore possible. This first course in image processing shall teach basic concepts in the subject.

DETAILED SYLLABUS

Digital image processing systems
Image acquisition, storage, processing, communication and display.

Visual perception
Structure of human eye, image formation in the human eye, brightness, adaptation and discrimination.

Image model
Uniform and non-uniform sampling and quantization.

Discrete 2-D linear processing
Superposition and convolution, unitary transforms, linear processing techniques.

Image transforms
2-D DFT / FFT, Walsh, Hadamard Transforms, Discrete Cosine and Sine transforms, Haar Transform, Slant Transform, Hotelling Transform.

Image enhancement
Contrast manipulation, Histogram modification, noise cleaning, edge sharpening, frequency domain methods like low-pass and high-pass filtering, homomorphic filtering.

Image segmentation
Detection of discontinuity, point line and edge detection, edge linking and boundary detection, thresholding, image interpretation.

Image Compression
Coding redundancy. Psycho-visual redundancy. Fidelity criteria, MSE, fundamental coding theorem. Error -free compression, variable length coding .bit plane coding. Loss- less predictive coding. Lossy predictive coding, Transform coding, DPCM, DM, ADM.

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BOOKS
Text Books:
1. W. Pratt, Digital Image Processing, Wiley Publication, third edition, 2002. 2. Gonzalez & Woods, Digital Image Processing, Pearson Education, Second edition. 3. A.K. Jain, Fundamentals of Image processing, Prentice Hall of India Publication, 1995
Additional Reading:
TERM WORK
1. Term work shall consist of at least six software programs written in C / MATLAB and two assignments covering the topics of the syllabus. 2. A term work test shall be conducted with a weightage of 10 marks.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Elective – I, **Process Control Instrumentation**

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Rationale:

DETAILED SYLLABUS

Introduction to Process Control, Feedback Control, Types of Processes, Performance Characteristics of measuring systems.

Measurement methods of different process parameters like pressure, force, torque, velocity, acceleration (Review).

Fluid flow measurement methods – Measurement of fluid density, viscosity, specific gravity, pH, humidity and liquid level.

Controllers – Modes of control like ON/OFF, proportional, derivative, integral, PD, PI & PID controllers. Selection of a proper control mode for a given process, Pneumatic control mechanisms, electronic controllers, Electronic and Pneumatic signal transmission.

Control valves like globe, pinch, butterfly ball valve etc., characteristics of valves, cavitation and flashing, selection of control valves for a process, valve sequencing.

Introduction to PLC, PLC ladder logic, drawing of ladder diagrams, Programming of PLC.

Generalized data acquisition and data distribution systems, Multichannel DAS, Data Logger.

BOOKS

Text Books:

1. Anderson N.A., Instrumentation for Process Measurement and Control, third edition, Chilton Company, 1980.
2. Johnson C., Process Control Instrumentation Technology, fourth edition,

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Prentice Hall of India, 2001.

Additional Reading:

1. Dunning Gary, Introduction to Programmable Logic Controllers, Delmar – Thomson Learning, 2001.
2. Patranabis D, Principles of Process Control, Tata McGraw Hill, second edition, 2001

TERM WORK

1. Term work shall consist of at least 10 practicals and two assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Microcomputer System Design

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale : A Microcomputer system is made of different components. This subject shall teach the functional units of these components and how to make them work together in a microcomputer system

DETAILED SYLLABUS

The Pentium Processor
Functional units of Pentium processor. Overview of cache operation and cache types. Pentium cache overview. Pentium signals interface. Address bus, data bus, misaligned transfers, Communications with 8, 16, 32 and 64 Bit devices, bus control signals, bus master signals, System test and initialization. System management tools. Reliability and error reporting.

Code cache and Instruction pipeline. Introduction to the prefetcher, Instruction branch prediction, code cache organization and operation, the floating point pipeline.
The data cache and burst bus cycles. Introduction to internal data cache, structure of internal data cache, the bus cycle state machine, anatomy of write hit and miss, inquire cycles. Bus cycle overview, burst cycles, single transfer bus cycle - pipelined and non pipelined, special cycles.

Interrupt acknowledge bus cycle, bus cycle state machine, bus and bus state transition.

PCI Bus
Local Bus concept. Introduction to PCI Bus operation; Introduction to Reflected wave switching, PCI Bus functional signal groups. PCI Bus Arbitration, Arbiter, Arbitration algorithms, hidden bus arbitration, example of arbitration between two masters, bus access latency, PCI read and write transfers, PCI I/O addressing, Interrupt acknowledge. Interrupt routing, Interrupt chaining.

Peripheral Bus Interfaces
The IDE interface, timing specifications, IDE protocol, Model of an IDE Disk Drive. SCSI Bus. SCSI hardware. SCSI Bus Protocol.

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Universal Serial Bus (USB)
Introduction to USB, PC requirements, Bus topology, understanding the host and the peripheral, the development process. USB transfer basics, Elements of a transfer, successful transfers. Transfer types, Control transfer, Bulk transfer, Interrupt transfer, Isochronous transfer, time critical transfers.

BOOKS

Text Books:

1. Tom Shanley et al, Pentium Processor System Architecture, Addison Wesley Press
2. Tom Shanley et al, PCI System Architecture, Addison Wesley Press
3. F. Schmidt, SCSI Bus and IDE Interface, Addison Wesley Press
4. Jan Axelson, USB Complete, Penram Publication, second edition

Additional Reading:

TERM WORK

1. Term work shall consist of at least four practicals and six assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination shall be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Elective – I, DSP Architectures & Systems

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Rationale: Digital Signal Processing has applications in many fields. The DSP algorithms are better implemented on DSP processors having specially tailored architectures. It is therefore essential for a DSP systems designer to understand these processors and apply them in system design.

DETAILED SYLLABUS

Introduction to Programmable Digital Signal Processors
TMS 320C5X
- Architecture
- Assembly language instructions
- Pipelining
- Applications

TMS 320C54X
- Architecture
- Assembly language instructions
- Pipelining
- Applications

An Overview of TMS 320C6X
An Overview of Motorola DSP 563XX Processors

BOOKS

Text Books:

1. B. Venkataramani and Bhaskar, Digital Signal Processors: Architecture, Programming & Applications, Tata McGraw- Hill Publication, 2002.

Additional Reading:

1. A. Bateman & W Yates, Digital Signal Processing Design Wheeler Publication, 1988

TERM WORK

1. Term work shall consist of at least six practicals on actual DSP processors and

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two assignments covering the topics of the syllabus.

2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Elective – I, Wireless communication

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: Rapid increase in the numbers of mobile subscribers and use of mobile networks for multimedia transmission has made wireless technology, the most rapidly evolving field in telecommunications. This subject teaches basics of wireless communication.

DETAILED SYLLABUS

Introduction
Introduction to wireless communication systems.

The cellular concept
Frequency reuse, Hand – off strategies, Interference and system capacity, Tracking and grade of service, Improving coverage and capacity in cellular systems.

Mobile Radio propagation
Large scale path Loss: Reflection, Ground reflection (2 ray model), Diffraction, Scattering, Practical Link Budget – Design using path loss models.
Small scale fading and multipath: Small scale multipath propagation, Parameters of Mobile Multipath channels , Types of small scale fading , Rayleigh and Riceaw Distributions.
Diversity Techniques:

Wireless systems and standards
Analog Cellular systems: AMPS and ETACS – System overview , cell Handling, Air Interface, N – AMPS
Digital cellular system: GSM – Services and Features, system architecture, Radio subsystem channel types, frame structure, signal Processing, Typical call Flow sequences in GSM. CDMA Digital cellular standard - Frequency and channel specifications, forward CDMA channel, Reverse standard channel
Cordless Telephones: CT 2 , Standard , DECT, PACS (Personal access Communication system), PHS (Personal Handy phone system)

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Mobile Data Communications:
Specialized packet and mobile Radio Networks, Circuit switched Data services on cellular Networks, Packet switched Data services on cellular Networks, Data over low power wireless and cordless Networks.

BOOKS

Text Books:

1. Theodre S Rappaport: Wireless Communication – Pearson Education, second edition.
2. Raj Pandya, Mobile and Personal Communication System and Services, Prentice Hall of India

Additional Reading:

1. David J. Goddman, Wireless Personal Communication Systems, Addison Wesley publication.
2. Joachim Tesal, GSM cellular Radio, John Wiley publication.

TERM WORK

1. Term work shall consist of at least eight practicals / assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Project – A

Lectures: - Hrs per week Practical: 4 Hrs per week	Term Work: 25 Marks

Rationale: Project allows the student to work independently to put the knowledge of electronics engineering theory into practice.

DETAILED SYLLABUS

The students of Electronics Engineering degree course are expected to take up a project under the guidance of a teacher in the institute, on any Electronics Engineering problem, to be completed in the Semester VII and Semester VIII. This may include:

- Experimental analysis/ verification,
-Development of design methods and verification,
-Design and fabrication of models,
-Developing software for analysis and/or design or decision making
- Developing a mathematical / empirical model

The students shall work in group with no more than five students in each group.

Basic study through review of literature on the topic selected shall be completed. The scope of the project, identification of necessary data, sources of such data etc. shall be identified. The student group has to prepare a brief report on the work done. The report should include objective of the project, scope of the project, methodology and the review of literature.

TERM WORK

Term work should consist of the above mentioned activities which shall be evaluated and shall carry a weightage of 25 marks

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Power Electronics

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: The subject of Power Electronics shall create understanding and strong basic concepts in power devices and their applications in industry.

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DETAILED SYLLABUS

Power Devices

Construction, ratings, characteristics :- (including SOA Rating) Power transistors , SCR, TRIAC , GTO – SCR, IGBT, MCT.

Drive Circuits

Using BJT, UJT, DIAC. Isolation circuits using an optocoupler and transformer.

Protection circuits

Snubbers , MOVs , di / dt inductor , semiconductor fuses .

Cooling of semiconductor devices

Basic theory - thermal resistance, simple heat sink calculations.
Types of cooling : (a) natural convection (b) forced air cooling (c) liquid cooling
(d) vapour phase cooling .

Half wave and full wave uncontrolled and controlled rectifier circuits

With resistive load and R-L load. Output average and RMS voltages. Effect of freewheeling diode

A.C. phase control circuits

Using BJT, OP-Amps, Special IC's such as TCA 785. Firing scheme for 3 phase supply.

Power Inverters

Series, parallel and bridge inverter (single phase) working, important waveforms, control circuits and applications.

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Choppers

Principle of operation, Jones chopper (working, important waveforms, control circuit and applications).

Motor Controllers

A.C. motor controllers: Induction squirrel cage motor control – voltage control, V / F control, torque – speed characteristics. Control of wound rotor motor. Slip power recovery.

D.C. motor controllers: armature voltage control of separately exited DC shunt motor. IR compensation. Field current control, torque – speed characteristics. Micro controller based control circuit for motor control. (Block diagram and working.)

BOOKS

Text Books:

1. M . Rashid, Power Electronics , Prentice Hall of India Publication

Additional Reading:

1. Ned Mohan , Undeland , Robbins, Power Electronics , John Wiley Publication
2. Landers, Power Electronics, McGraw Hill
3. Dubey G.K. , Electrical Drives, Narosa Press
4. General Electric, SCR Manual
5. M.D. Singh & K.B.Khanchandani, Power Electronics, Tata McGraw Hill, first edition
6. P. C. Sen, Modern Power Electronics, Wheeler Publication.

TERM WORK

1. Term work shall consist of at least 10 practicals and two assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Data Communication and Networking

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Rationale: This subject introduces the fundamental concepts of data network architecture. Starting with the key aspects of transmission, interfacing, link control and multiplexing, it covers the internal mechanisms and network interfaces that have been developed to support data communications over long distance networks and over short distance.

DETAILED SYLLABUS

Introduction
Network , Protocols and standards, Line configuration, Topology, Transmission modes, categories of networks, Internetworks, Transmission media, Transmission Impairments, Performance of Transmission media, The OSI model, TCP/IP, DTE – DCE interface.

Multiplexing
FDM, Synchronous TDM, Statistical TDM, Asymmetric Digital subscriber lines, XDSL.

Data Link Control
Flow control, Error detection – two dimensional Parity checks, Internet checksum, CRC.
Error control, Transmission efficiency of ARQ protocols, HDLC, point to point protocol.

Circuit switching
Circuit switching networks, circuit switches – space division switches, Time – division switches, Time – space – time switches, Routing in circuit switching Networks, control signaling, SS7.

Packet Switching Networks
Network services and internal network operation, packet network topology, Datagram and Virtual circuits, Routing in packet networks, shortest path algorithms – The Bellman – Ford algorithm, Dijkstra's algorithm, other Routing approaches, congestion control.

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ATM and Frame Relay
ATM protocol Architecture, Logical connections, ATM cells, Transmission of ATM cells, ATM Adaptation Layer, Frame Relay, Frame Relay protocol Architecture.

Local Area Network
LAN Applications, LAN architecture, Bus LANs, Ring LANs, Star LANs, Wireless LAN, LAN Bridges, IEEE 802.3 Medium Access control for 10 Mbps and 100 Mbps LAN, Token Ring and FDDI.

ISDN
Architecture, ISDN channels, User Access, ISDN Protocols, Broadband ISDN

BOOKS

Text Books:

1. William Stallings, Data and computer communication – Pearson Education , sixth edition [Topics 2,3,4,6,7,8]
2. Leon Garcia and Widjaja, Communication Networks, Tata McGraw Hill, second edition [Topics 3,4,5]
3. Forouzan, Data Communication and Networking, Tata McGraw Hill, third edition [Topic 1]

Additional Reading:

1. William A Shay – Understanding Data communications and Networks – Thomson Learning.
2. Andrew Tenenbaum, Computer Networks, Prentice Hall of India

TERM WORK

1. Term work shall consist of at least eight practicals and two assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Mechatronics

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale : Mechatronics is a synergistic combination of Mechanical, Electrical and Computer Engineering and Information Technology, which includes control systems as well as numerical methods to design products. This subject shall lay the foundations of this multidisciplinary field of engineering.

DETAILED SYLLABUS

Introduction to Mechatronics

Mechatronics key elements, Mechatronics design process, approaches in Mechatronics

Modeling and Simulation of Physical System

Simulation and Block Diagrams, Analogies and Impedance Diagrams, Electrical Systems, Mechanical Translation Systems, Mechanical rotational System , Electromechanical Coupling, Fluid Systems.

Sensors and Transducers

Introduction to Sensors and Transducers, Sensors for Motion and Position Measurement , Force, Torque, and Tactile Sensors, Flow Sensors , Temperature – Sensing Devices , Ultrasonic Sensors, Range sensors, Active Vibration Control Using Magnetostrictive Transducers, Fiber Optic Devices in Mechatronics

Actuating Devices

Direct Current Motor, Permanent Magnet Stepper Motor, Fluid Power Actuation, Fluid Power Design Elements, Piezoelectric Actuators.

Hardware Components for Mechatronics

Transducer Signal Conditioning and Devices for Data Conversion, Programmable Controllers.

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Signals, Systems, and Controls

Introduction to Signals, Systems, and Controls, System Representation, Linearization of Nonlinear Systems, Time delays, Measures of System Performance, Root Locus and Bode Plots.

Real – Time Interfacing

Introduction, Elements of a Data Acquisition and Control System, Overview of the I/O Process, Installation of the I/O Card and Software, Installation of the Application Software, Examples of interfacing.

Closed Loop Controllers

Continuous and discrete processes , control modes, two step mode, proportional mode, derivative control, integral control, PID controller, Digital controllers, Control system performance, Controller tuning, Velocity Control and Adaptive control.

Advanced Applications in Mechatronics

Sensors for Condition Monitoring , Mechatronic Control in Automated Manufacturing, Artificial Intelligence in Mechatronics , Fuzzy Logic Applications in Mechatronics , Fuzzy Logic Applications in Mechatronics, Microsensors in Mechatronics.

BOOKS

Text Books:

1. Devdas Shetty and Richard A. Kolk, Mechatronics System Design, Thomson Asia Pte. Ltd., Second Reprint, 2001
2. W. Bolton, Mechatronics, Pearson Education Asia, Third Indian Reprint 2001

Additional Reading:

1. David G. Alciatore and Michael B. Histand, Introduction to Mechatronics and Measurement Systems, Tata McGraw Hill, Second Edition, 2003

TERM WORK

1. Term work should consist of at least six practicals and four assignments covering the topics of the syllabus.
2. A term work test must be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Elective – II, Advanced Digital Signal Processing

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: This subject provides a comprehensive treatment of signal processing algorithms for modeling discrete time signals, designing optimum filters and estimating the power spectrum of a random process.

DETAILED SYLLABUS

- Discrete – Time random processes
- Spectral Factorization
  - Minimum phase signals & systems
  - Partial energy & Minimum delay
  - Minimum phase & Minimum delay property
  - Spectral factorization theorem
- Spectral Estimation by Classical Methods
  - The periodogram
  - The modified periodogram
  - Barlett, Welch & Blackman –Tuckey,approach
- Signal Modeling
  - The Least-Squares method
  - The Pade Approximation
- Linear prediction
  - Levinson Recursion
  - Schur Algorithm
  - Lattice realization
- Spectral Estimation by Parametric Techniques
- Wiener filtering
  - FIR wiener filters

BOOKS

Text Books:

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Additional Reading:
1. S. M. Kay, Modem Spectral Estimation, Prentice Hall, 1988 2. S. J. Orfanidis, Optimum Signal Processing: An Introduction, second edition, McGraw-Hill, International, 1990
TERM WORK
1. Term work shall consist of at least 10 practicals / assignments covering the topics of the syllabus. 2. A term work test shall be conducted with a weightage of 10 marks.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Elective – II, Biomedical Instrumentation

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: This subject introduces an interdisciplinary field and shall provide knowledge of the combination of Biomedical Engineering as well as the technology of instrumentation. This subject teaches application of Electronics Engineering to Medicine.

DETAILED SYLLABUS

Study of Human Body
Anatomy and Physiology of the human body, Body System – Skeletal, Muscular, Circulatory, Respiratory, Digestive, Excretory, Nervous, Endocrine, Reproductive.

Study of the Human Cell
Average Human Cell, Transport across the cell membrane and membrane potential — Na+ & K+ transport, Action Potential, Electrical Equivalent Circuit of a cell.

Bio Electrodes, transducers and amplifiers
Electrode – Electrolyte Interface, different electrode types, Stimulating electrodes, Biomedical Amplifiers. Transducers for measurement of physiological events.

Electrocardiogram
Origin of the heart beat and the electrical activity of the heart, the ECG and its analysis, the Einthoven Triangle, Bipolar leads, Unipolar leads, Vector cardiography, Measurement of cardiac output, ECG electrodes, ECG Amplifiers, Cardiac Arrhythmias.

Bioelectric Signals
Study of Characteristics of various Bioelectric Signals such as EEG, EMG, ERG, EOG and their recording,

Signal Measurement
- Measurement of blood pressure, blood flow and cardiac output
- Impedance Plethysmography.
- Measurements in the respiratory system

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Biomedical Instruments
Stimulators, Defibrillators, Pacemakers, Respirators, Bedside Monitor, Audiometer and hearing aids. Oximetry, Ear Oximeter, Pulse Oximeter, Blood Gas Analyzer, Spirometry, Pulmonary Function Analyzers.

Prosthesis
Introduction to Prosthesis.

Electrical safety
Electrical safety of patient and medical equipment.

BOOKS

Text Books:

1. Cromwell L. Weibell & Pfeiffer, Biomedical Instrumentation and measurements, Prentice Hall of India, 1993
2. Khandpur R. S., Handbook of Biomedical Instrumentation, Tata McGraw Hill, second edition, 2003

Additional Reading:

1. Ganong W.F., Review of Medical Physiology, Prentice Hall Inc, USA, 1995
2. Webster J. G. –Medical Instrumentation – Application and Design, Wiley and Sons Inc, third edition, 1999
3. Carr and Brown, Introduction to biomedical equipment technology, fourth edition, Pearson press, 2003

TERM WORK

1. Term work shall consist of at least eight practicals and assignments covering the topics of the syllabus, a visit to a hospital for detailed study and functioning of available Biomedical Instruments.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Elective – II, Embedded Systems and Real Time Programming

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: Embedded systems have permeated all industries and even our homes. They are a combination of hardware and software and run critical areas like communications, transportation and energy systems. This subject shall provide crucial knowledge required to understand, analyze and design embedded systems and real-time programming.

DETAILED SYLLABUS

Introduction to Embedded systems
Software Embedded into a System.

Processor and Memory Organization
Structural Units in a Processor, Processor Selection for an Embedded System, Memory Devices, Memory Selection for an embedded System, Allocation of Memory to program Segments and Blocks and Memory Map of a System, Direct Memory Access, Interfacing Processor, Memories and I/O Devices.

Devices and Buses for Device Networks
I/O Devices, Timer and Counting Devices, Serial Communication using the 'I^2C', 'CAN' and Advanced I/O Buses between the Networked Multiple Devices, Host system or Computer parallel Communication between the Networked I/O Multiple Devices Using the PCI, PCI-X and Advanced Buses.

Device Drivers and Interrupts Servicing Mechanism
Device Drivers, Parallel Port Device Drivers in a System, Serial Port Device Drivers in a System, Device Drivers for Internal Programmable Timing Devices, Interrupt Servicing (Handling) Mechanism, Context and the periods of Context-Switching, Deadline and Interrupt Latency.

Programming Concepts and Embedded Programming in C and C++
Software Programming in Assembly Language (ALP) and in High Level Language 'C', 'C' Program Elements: Header and Source Files and Preprocessor Directives, Program Elements: Macros and Functions, Program Elements: Data Types, Data Structures, Modifiers, Statements, Loops and Pointers, Queues, Stacks, Lists and Ordered Lists, Embedded Programming in C++, 'C' Program Compiler and Cross-

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Compiler, Source Code Engineering Tools for Embedded C/C++, Optimization of Memory Needs.

Program Modeling Concepts for Software-Development Process
Modeling Processes for Software Analysis Before Software Implementation, Programming Models for Event Controlled or Response Time Constrained Real Time Programs.

Software Engineering Practices in the Embedded Software Development Process
Software Algorithm Complexity, Software Development Process Life Cycle and its Models, Software Analysis, Software Design, Software Implementation, Software Testing, Validating and Debugging , Real Time Programming Issues During the Software Development Process, Software Project Management, Software Maintenance, Unified Modeling Language(UML).

Inter-Process Communication and Synchronization of Processes, Tasks and Threads
Multiple Processes in an Application, Problem of Sharing Data by Multiple Tasks and Routines, Inter process Communication.

Real Time Operating Systems
Operating System Services, I/O Subsystems, Network Operating Systems, Real-Time and Embedded System Operating Systems, Interrupt Routines in RTOS Environment: Handling of Interrupt Source Call by the RTOSs, RTOS Task Scheduling Models, Interrupt Latency and Response Times of The Tasks as Performance Metrics, Performance Metric in Scheduling Models for Periodic, Sporadic and Aperiodic Tasks, IEEE Standard POSIX 1003.1b Functions for Standardization of RTOS and Inter-Task Communication Functions, List of Basic Actions in a Preemptive Scheduler and Expected Times Taken at a Processor, Fifteen-Point Strategy for Synchronization between the processes, ISRs, OS Functions and Tasks and for Resource Management.

Hardware-Software Co-design in an Embedded System
Embedded System Project Management, Embedded System Design and Co-design Issues in System Development Process, Design Cycle in the Development Phase for an Embedded System, Uses of Target System or its Emulator and In-Circuit Emulator (ICE), Uses of Software Tools for Development of an Embedded System, Use of Software Tools for Development of an Embedded System, The software build process for embedded systems – Preprocessing, compiling / cross compiling, linking, locating, loading on the target, Uses of Oscilloscopes and Logic Analyzers for System Hardware Tests, Issues in Embedded System Design.

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BOOKS
Text Books:
1. Rajkamal, Embedded Systems – Architecture, Programming and Design, Tata McGraw Hill, first edition, 2003 2. Sriram Iyer and Pankaj Gupta, Embedded Realtime Systems Programming, Tata McGraw Hill, first edition, 2003
Additional Reading:
1. Qing Li and Caroline Yao, Real-time Concepts for Embedded Systems, Cmpbooks Press, first edition, 2003
TERM WORK
1. Term work should consist of at least eight practicals and assignments covering the topics of the syllabus. 2. A term work test must be conducted with a weightage of 10 marks.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Elective – II, Robotics

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Rationale: This course familiarizes students with the concepts and techniques in robot manipulator control, enough to evaluate, choose, and incorporate robots in engineering systems.

DETAILED SYLLABUS

Robotic Manipulation
Automation and Robots, Classification, Application, Specification, Notations.

Direct Kinematics
Dot and cross products, Co-ordinate frames, Rotations, Homogeneous, Co-ordinates, Link co-ordination arm equation, (Five-axis robot, Four axis robot, Six axis robot).

Inverse Kinematics
General properties of solutions tool configuration Five axis robots, Three-Four axis, Six axis robot (Inverse kinematics).
Workspace analysis and trajectory planning work envelop and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

Robot Vision
Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation (Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured Illumination, Camera calibration).

Task Planning
Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp planning, Fine-motion Planning, Simulation of Planer motion, Source and goal scenes, Task planner simulation.

Moments of Inertia.

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Principles of NC and CNC Machines.

BOOKS

Text Books:

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India
2. Fu, Gonzales and Lee, Robotics, McGraw Hill
3. J.J, Craig, Introduction to Robotics, Pearson Education

Additional Reading:

1. Staughard, Robotics and AI, Prentice Hall of India
2. Grover, Wiess, Nagel, Oderey, "Industrial Robotics", McGraw Hill
3. Walfram Stdder, Robotics and Mechatronics,
4. Niku, Introduction to Robotics, Pearson Education
5. Klafter, Chmielewski, Negin, Robot Engineering, Prentice Hall of India
6. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications

TERM WORK

1. Term work should consist of at least 10 practicals and assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VII

SUBJECT: Elective – II, Telecommunication Network Management

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: Telecommunication systems have grown extremely large in size and complexity. Effective management solutions have been in use to run these complex networks efficiently. This subject introduces principles and practice for effective management of telecommunications networks

DETAILED SYLLABUS

Foundations
Network management standards, network management model, organization model, information model, abstract syntax notation I (ASN.1), encoding structure, macros, functional model.

Network management application functional requirements
Configuration management, fault management, performance management, Error correlation technology, security management, accounting management, common management, report management, polity based management, service level management, management service, community definitions, capturing the requirements, simple and formal approaches, semi formal and formal notations.

Telecommunication management network (TMN) architecture
Terminology, functional architecture, information architecture, physical architecture, TNN cube, TMN and OSI.

Common management information service element (CMISE)
CMISE model, service definitions, errors, scooping and filtering features, synchronization, functional units, association services, common management information protocol (CMIP) specification.

Information Modeling for TMN

Rationale for Information Modeling, management information model, object oriented modeling paradigm, structure of management information, managed object class definition, management information base (MIB)

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Simple network management protocol (SNMP):
SNMPv1: managed networks, SNMP models, organization model, information model, SNMPv2: communication model, functional model, major changes in SNMPv2, structure of management information (SMI), MIB, SNMPv2 protocol, compatibility with SNMPv1, SNMPv3: architecture, applications, MIB security, remote monitoring (RMON) SMI and MIB, RMON1 and RMON2.

Network management examples:

ATM integrated local management interface, ATM MIB, M1, M2, M3, M4, interfaces, ATM digital exchange interface management, digital subscriber loop (DSL) and Asymmetric DSL (ADSL) technologies, ADSL configuration management, performance management.

Network management tools:
Network statistics management, network management system, management platform case studies: OPENVIEW, ALMAP.

BOOKS

Text Books:

1. Mani Subramanian, Network Management: Principles and Practice, Addison Wesley, Pearson Education Asia publication
2. Lakshmi Raman, Fundamentals of Telecommunication Network Management, IEEE Communication Society, Prentice Hall of India Edition, 1999
3. Airdarous Salah, Plevyak Thomas, Telecommunication Network Management: Technologies and Implementations, Prentice Hall of India
4. Haojin Wang, Henry Haojin Wang, Haijiang Haojin Wang, Telecommunication Network Management.

Additional Reading:

TERM WORK

1. Term work shall consist of at least 10 practicals and two assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Elective – II, VLSI Design

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Rationale: This subject lays a strong foundation for understanding VLSI circuits and their performance. Design of different CMOS integrated devices is covered in great detail along with testing.

DETAILED SYLLABUS

Circuit Characterization and Performance Estimation
Resistance and capacitance estimation, switching characteristics, CMOS gate transistor sizing, power dissipation, Sizing Routing conductors, Charge sharing designing margining yield and reliability.

System Specification Using Verilog HDL
Basic concepts, structural gate level modeling, switch level modeling, design hierarchies, behavioral and RTL modeling

Arithmetic Circuit in CMOS VLSI
Bit adder circuits, Ripple carry adders, Carry look ahead adders, High speed adders, Multipliers.

Design of Memories and Programmable Logic
The static RAM, SRAM, Dynamic RAM, ROM ARRAYS, Logic ARRAYS.

System Level Physical Design
Large scale physical design, Interconnected Delay Modeling, Crosstalk, Interconnected Scaling, Floor planning & Routing, I/P & O/P Circuit, Power dissipation and consumption, Low power Design considerations.

VLSI clocking and system design
Clocked flipflop, CMOS clock styles, Pipelined systems, Clock generation and distribution, System design considerations.

CMOS Testing
The need for testing, manufacturing test principles, design strategies for test, Chip level test techniques, System level test techniques, Layout design for improved

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testability.

BOOKS

Text Books:

1. Neil H.E. Weste Kamran E Shraghian, Principles of CMOS VLSI Design: A system perspective, Addison Wesley publication
2. John P Vyemura, Introduction to VLSI Circuits and systems, John Wiley & sons
3. Samir Palnitkar, Verilog HDL, A Guide to Digital Design and Synthesis, Pearson Education

Additional Reading:

TERM WORK

1. Term work shall consist of at least 10 practicals and two assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. ELECTRONICS ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Project – B

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Rationale: Project allows the student to work independently to put the knowledge of electronics engineering theory into practice.

DETAILED SYLLABUS

In continuation of semester VII work, the student group shall collect all necessary information and analyze it, build / fabricate a prototype or develop necessary software and / or hardware or work on a mathematical / empirical model. The group shall test the hardware / software or the mathematical model / empirical developed vigorously by known testing methods.

The student group shall prepare and submit a report on the project. The report shall be printed on A4 size paper and hard bound and prepared in academic style. Broadly the report shall have these parts: Introduction, literature review, data collection and analysis, experiments conducted, design, prototype development / software implemented, mathematical / empirical model and conclusions.

Acquaintance with survey and research methods and their usage in conducting a systematic investigation and style of report preparation and presentation shall form basis of evaluation.

TERM WORK

Term work shall consist of the above mentioned activities which shall be evaluated and shall carry a weightage of 25 marks

ORAL EXAMINATION

An oral examination shall be conducted based on the presentation by the group

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Instrumentation Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI
SCHEME OF INSTRUCTIONS & EXAMINATION at
B.E. (Instrumentation Engineering) - (R-2001)

SEMESTER – VII

Sr. No	Subjects	No of periods per week			Duration of Theory Paper in Hrs.	Marks				
		Lectures	Practical	Tutorials		Paper	Term Work	Practical	Oral	Total
1	Advance Control System	4	2	--	3	100	25	---	---	125
2	Project Planning & Engineering	3	2	---	3	100	25	---	---	125
3	Industrial Process Control	3	2	---	3	100	25	---	25	150
4	Digital Signal Processing	4	2	---	3	100	25	---	25	150
5	Elective-I	4	2	---	3	100	25	---	25	150
6	Project- I	---	---	4	---	---	25	---	---	25
Total		**18**	**10**	**4**	---	**500**	**150**	**---**	**75**	**725**

SEMESTER – VIII

Sr. No.	Subjects	No of periods per week			Duration of Theory Paper (Hrs.)	Marks				
		Lectures	Practical	Tutorials		Paper	Term Work	Practical	Oral	Total
1	Biomedical Instrumentation	4	2	---	3	100	25	---	25	150
2	Digital Control System	4	2	---	3	100	25	25	25	175
3	Instrumentation System Design	4	2	---	3	100	25	---	25	150
4	Elective-II	4	2	---	3	100	25	---	25	150
5	Project- II	---	8	---	---	---	50	---	50	100
Total		**16**	**16**	**---**	---	**400**	**150**	**25**	**150**	**725**

**Robotics elective is common with Electronics, Electrical, IT, Computer Engineering branches

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Class : B.E. (Instrumentation)		Semester – VII	
Subject : Advanced Control System			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hrs.	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	---
	Term Work	---	25

Detailed Syllabus :

1: Nonlinear Control System and Analysis.

Definition of nonlinear system, approaches to the analysis and design of nonlinear control systems, common physical nonlinearities, difference between linear and nonlinear systems, characteristics of nonlinear systems,

Phase Plane Analysis: Phase plane method – basic concepts, trajectories, phase portraits, singular points and their classification, limit cycle and behavior of limit cycle. Graphical methods for construction of trajectories – Isocline, Delta, Phase plane analysis of nonlinear systems.

Describing function (DF) Analysis: derivation of general DF, DF for different nonlinearities, application of DF for prediction and stability of limit cycle, Investigation of stability of nonlinear systems.

2: Liapunov Stability Analysis.

Equilibrium state, stability in the sense of Liapunov, Asymptotic stability, stability in the large, graphical representation, Second method of Liapunov, Liapunov Theorem, stability analysis of – Linear systems, nonlinear systems – Krasovskii method, variable gradient method.

3: Adaptive Control System.

Definition of adaptive control system, functions of adaptive control, gain scheduling, model reference, series and parallel scheme, and their industrial applications.

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Structure of a self tuning controller – main components of self tuning controller, on-line system identification, on-line controller design, supervision,

4: Robustness

Robust control system and system sensitivity, analysis of robustness, Systems with uncertain parameters, The design of Robust control systems, design examples, Robust internal model control system.

5: Optimal and Stochastic Control System

Formulation of optimal control problem, performance criteria, stochastic process and linear systems, response of linear continuous time systems to white noise, optimal estimation for linear continuous time systems, optimal Kalman filter, time-invariant state estimator, and stochastic optimal linear regulator.

Assignments:

1) Nonlinear Control System and Analysis – any 4.
   a) Obtain a phase plane portrait of the system represented by second order differential equation by using isocline method.
   b) Draw the trajectory for the system with nonlinear elements – relay, saturation, dead-zone by using isocline method for any initial condition and step input.
   c) Construct the trajectory for system represented by second order differential equation and for any initial condition by using Delta Method.
   d) Draw the trajectory for the system with nonlinear element – relay, saturation, etc. for any initial condition and step input by using Delta Method.
   e) Study the behavior of Limit Cycle with the help of Vander Pol's equation.
   f) Derivation of DF for nonlinearities – relay with saturation, relay with dead-zone, dead-zone and saturation, relay with Hysteresis etc.
   g) Investigate the stability of system with nonlinearites – relay, saturation, dead-zone, hysteresis and existence of limit cycle using DF technique.
2) Liapunov Stability Analysis – any 3.
   a) Verify Sylvester theorem for the definiteness of the Liapunov Function.
   b) Determine the stability of the system and construct the Liapunov function for – Linear Time Invariant system.
   c) By using Krasovaskii method determine the stability of the system and construct the Liapunov function.
   d) By using Variable Gradient method determine the stability of nonlinear system.

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3) Adaptive control – 1.

Study the different schemes of adaptive control and their applications (each one).

4) Robust control – any 1.

   a) Robust control of temperature – using PID controller.

   b) Robust control of process parameters – using design specifications and performance index for step input.

5) Optimal and Stochastic control systems – any 1.

   a) For any servosystem with disturbances, find out optimal estimator and Kalman gain from solution of Riccati equation and discuss the estimator design.

   b) Consider the combined estimation and control problem for the system, minimize the performance index and find control and suggest suitable scheme for the implementation of the control.

Term-Work: Each student shall appear for at least one written test during the term. Journal should consist of at least 10 assignments as per list given above properly recorded and graded as well as assessed test paper. Some or all assignments must be done using simulation software like MATH CAD/MATLAB or similar one. The above term-work will carry 25 Marks. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books :

1) Chang C. Hang, Tong H. Lee and Weng K. Ho, "Adaptive Control", ISA, 1993.

2) Bernard Friedland, "Advanced Control System Design", Prentice Hall Inc., 1996.

3) M. Gopal, "Modern Control System Theory", Wiley Eastern Ltd., New Delhi, 1993.

4) Karl J. Astrom, B. Wittenmark, "Adaptive Control", 2nd Edition, Pearson Education Asia, First Indian Reprint, 2001.

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Reference Books :

1) Shankar Sastry, Marc Bodson, "Adaptive Control", Prentice Hall of India (P) Ltd., 1993.
2) R. C. Dorf, R. H. Bishop, "Modern Control Systems", 8th Edition, Addison Wesley, 1999.
3) K. Ogata, "Modern Control Engineering", Prentice hall of India (P) Ltd., New Delhi, 1984.
4) Petros A. Joannou and Jing Sun, "Robust Adaptive Control", Prentice Hall Inc, 1996.
5) D' Azzo, J. J., and C. H. Houpis, "Linear Control System Analysis and Design", 3rd Edition, McGraw Hill Book Co., New York, 1988.

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Class : B.E. (Instrumentation)		Semester – VII	
Subject : Project Planning & Engineering			
Period / week 1 period of 60 Min	Lectures	3	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	---
	Term Work	---	25

Detailed Syllabus :

1: PROJECT PLANNING: Guidelines for PROJECT preparation – project report and its utility, project compliance report, project report format, concept of project work, function in project planning, PERT, CPM techniques.

2: PROJECT ENGINEERING:

Field Instrument Engineering :

1. Preparation of Instrument Schedule.
2. Preparation of Instrument Data Sheet.
3. Preparation of Tender Document.
4. Tender Evaluation.
5. Technical/Techno commercial Evaluation reports for placement of order.
6. Vendor Engineering review.

Preparation of Instrument installation diagram and Bill of material for instrument Erection and Commission, Factory Inspection.

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3: PROJECT IMPLEMENTATION:

Introduction to Instrumentation Interface with other schedules (e.g. site selection, factory lay ,plant layout ,lighting),trial run,Erection, Testing and Commissioning

2. Counting of analog and digital inputs and outputs.
3. Preparation of Control input/output schedule giving complete details of each tag.
4. Preparation of Logic diagrams.
5. Preparation of closed loop diagrams.
6. Preparation of Mimic diagram.
7. Preparation of junction box schedule.
8. Preparation of cable schedule.
9. Preparation of interconnection schedule.
10. Preparation of cable tray layouts.
11. Diagrams for instrument grounding (Electronic grounding).
12. Vendor engineering review of Control.
13. Factory acceptance test and site acceptance test for Control.

Team-Work: Each student shall appear for at least one written test during the term. The Journal should consist of at least 8 assignments based on above syllabus & industrial visit report relevant to above syllabus. T/W will carry 25 marks, Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books :

1. Project Management: Vasant Desai (Himalaya Publishing House 2nd revised ed. 1999).
2. Industrial Organization and Engineering Economics: Banga and Sharma (Khanna Publishers 20 ed. 1994).
3. Industrial Management : M.E. Tukaram Rao (Himalaya Publishing House 2nd revised ed. 1999).
4. Projects Planning (Analysis, Selection, Implementation and Review): Prasanna Chandra (TMH 4th ed. 5th reprint 1996).
5. Andrew Williams: Guide Lines – I, II, III

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Class : B.E. (Instrumentation)		Semester – VII	
Subject : Industrial Process Control			
Period / week 1 period of 60 Min	Lectures	3	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1. **Interaction and decoupling in MIMO system:** relative gain analysis and its application.
2. **Process Control System.**

Boiler controls: Combustion control, Drum level control, Furnace pressure control.

Furnace control: Start- up heaters, fired reboilers, process heaters and vaporizers.

Distillation column: Basic features of composition control, control of overhead composition, bottom composition and both product composition, pressure control.

Heat exchangers: Types of heat exchangers, various control schemes for heat exchangers, bypass control.

Crystallizers control: Process of crystallization, types of crystallizers control of evaporating crystallizer, cooling of crystallizers, vaccum crystallizers.

Dryer control: Process of drying, types of dryers, control of batch dryers, continuous dryers.

Evaporator control: Types of Evaporator, control system for Evaporator, steady state model for Evaporator.

Reactor control: Reactor characteristics, various schemes of temperature control of reactors.

pH control: Nature of pH process, two sided feedback control of pH, cascade control of PH, feed forward-feedback control of pH, ratio control of pH.

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Compressor control: Surge characteristics of compressor, compressor surge control valves, overhead controls.

3 **Process control for Industries.**

Petroleum Industry: Description of process, Generalized block diagram of overall refinery from crude oil to saleble products.

Pharmaceutical Industry: Description of process, measurement hardware in Pharmaceutical Industry. Analyzers, Controllers and display in Pharmaceutical Industry. Typical control systems in Pharmaceutical Industry viz. control of chemical reactor, fermentation control system.

Food Industry: Description of process, measurement hardware in food industry. Analyzers, Controllers and display in food industry. Typical control systems such as computer controlled bakery, corn starch, syrup and sugar production controls.

Iron and steel Industry: Description of process, measurement hardware in Iron and steel Industry. Analyzers, Controllers and display in Iron and steel Industry. Typical control systems VIZ: Blast furnace stove combustion control system, strand casting, mould level control, wastewater treatment.

4. Safety in Instrumentation control systems.

Area and material classification, technique used to reduce explosion hazards, intrinsic safety, installation of intrinsically safe systems.

Term-Work: Each student shall appear for at least one written test during the term. Journal should consist of 6 assignments graded as well as assessed test paper and Report of Industrial Visit. The Report should consist of

I) Complete Flow Sheet From any of the industries listed in Chapter 3.

II) Process and Control Simulation on Distillation Column and Heat Exchanger etc

The term-work will carry 25 Marks. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

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Text Books :

1. W.L.McCabe and Julian Smith "Unit operation and chemical engineering" Mc-GrawHill- fifth edition.

2. Bela G. Liptak " Instrument engineers handbook- Process control" Chilton book company- 3rd edition.

3. Bela G. Liptak " Instrumentation in process industry" Chilton book company-1st edition.

Reference Books :

1) M. Chidambaram, "Complete Contro; of Processes", Narosa Publishing House.

2) Douglas M. Concidine " Process industrial instruments and controls handbook" Mc-GrawHill- 4th edition.

3) George T. Austian " Shreve's chemical process industries" Mc-GrawHill- fifth edition.

4) George Stephenopoulos, "Chemical process control", PHI-1999.

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Class : B.E. (Instrumentation)		Semester – VII	
Subject : Digital Signal Processing			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1. **Brief introduction** to Discrete time signals and systems, difference equations, Fourier series & Transform, Z-Transform, theorems, properties etc. Introduction to WAVELETS.
2. **Flow graph & matrix representation of Digital filters :** Signal flow graph representation of digital networks, matrix representation of digital networks, basic network structures for IIR, transposed forms, basic network structures for FIR systems, parameter quantisation effects, Tellegen's theorem for digital filters and its applications.
3. **The Discrete Fourier transform :** Representation of periodic sequences, the discrete Fourier series, sampling, Fourier representation of finite duration sequences, the Discrete Fourier Transform, properties of the DFT, Linear convolution using the DFT, two dimentional DFT.
4. **Computation of the Discrete Fourier Transform :** Goertzel's algorithm, Decimation in frequency (DIF) algorithms, Decimation in time (DIT) algorithms, FFT algorithms for a N composite number, general computational considerations in FFT algorithms, Chirps Z transform algorithm.
5. **Digital filter design techniques :** Design of IIR digital filter from analogue filters, computer aided design of FIR digital filters, properties of FIR digital filter using windows, computer aided design of IIR filters, comparison of IIR and FIR filters.

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6. **Discrete Hilbert transform:** Real and imaginary part sufficiency for casual sequences, minimum phase condition ,Hilbert transform relations for the DFT and the complex sequences.
7. **Introduction to Digital hardware :** Digital signal processor series Texas 320, Motorola 56000, Analog devices ADSP 2100,special purpose hardware for Digital filtering and signal generation, IIR, FIR hardware, cascaded IIR, FIR, application to speech ,Radar, CT scanner and Digital touch tone receiver.

Experiments: (1 to 6 Using C, or C++ and verify the results using MATLAB)

1. Program for finding linear convolution.
2. Program for finding circular convolution.
3. Program for finding linear convolution using circular convolution.
4. Program for finding correlation (auto and cross).
5. Program for finding DFT's. & IDFT.
6. Implementation of FFT algorithms (DIT, DIF) etc.
7. Program on filter designing.(FIR) (Using MATLAB only)
8. Program on Filter Designing (IIR) (Using MATLAB only)
9. Minimum two assignments based on structure realizations (IIR, FIR).
10. Study of any DSP processor series and their differences.

Term Work:

It should include report on atleast 8 practicals performed and assignments given. The teacher concerned shall give atleast one class test. The answer paper duly evaluated shall be presented as a part of the term work. This will be presented to the examiners to be given marks of maximum of up to 25. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books :

1) A.V.Oppenhiem & R.W. Scheifer ,"Discrete signal processing", (PHI) 1999
2) Johny Johnson,"Introduction to D.S.P.", (PHI), 1996
3) Rabnier Gold ,"Theory and application of DSP", (PHI EEE edi.) 1996
4) Proakis and Manoliakis," Digital signal processing", (PHI 3rd) 1997

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Reference Books :

1) Sanjit. K. Mitra," Computer aided approach to DSP ",TMH, 1998
2) A Antonion, "Digital filter analysis,design and application", TMH pub. 2ed. 1993
3) B. Vankataramani & M. Bhaskar, "Digital Signal Processors", Tata McGraw Hill, 2002.
4) Emmauel C. Ifeachor & Barrie W. Jervis, "Digital Signal Processoning", Pearson Education, 2nd edition, 2000.
5) Ashok Ambardar, "Analog and Digital Signal Processing" Thomson Learning, 2nd edition, 1999.
6) Thonas J. Cavicchi, "Digital Signal Processing",Jhon Wiley 2000.

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Electives

Class : B.E. (Instrumentation)		Semester – VII	
Subject : Advanced Instrumentation			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1. **Introduction to DCS** – Evolution of DCS, DCS flow sheet symbols, Functional block diagram of DCS.
2. **Introduction to Hierarchical Control and memory** : Task listing, Higher & Lower Computer level tasks.
3. **Supervisory computer tasks and DCS configuration** – Supervisory Computer functions, Control techniques, Supervisory Control Algorithm, DCS & Supervisory Computer displays, advanced control Strategies, Computer interface with DCS.
4. DCS data highways, field buses, MAP/TOP and network protocols.
5. **SCADA Systems** – Remote sensing terminal units, control /master control station and system interfacing, Man Machine Interface, Alarms and applications of SCADA.
6. **Biological Neural Networks**: Neuron physiology, Neuronal Diversity, Specifications of the Brain, Eye's Neural Network.
7. **Artificial Neural Networks**: Neural attributes, modeling, basic model of a neuron, learning in artificial neural networks, characteristics and parameters of ANNs, ANN topologies, learning algorithms, ANN discrimination ability.
8. **Neural Network Paradigms**: MC Culloch- Pitts Model, Preceptron, ADALINE and MADALINE models, Winner- Takes- all learning algorithm, back propogation

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learning algorithm, adaptive resonance theory paradigm, Hopfield model, real time models.

9. **Fuzzy Logic:** Prepositional logic, the membership function, Fuzzy logic, Fuzzy rule generation, defuzzyfication of fuzzy logic, time dependent fuzzy logic, temporal fuzzy logic, Application of TFL in communication system.
10. **Fuzzy- Neural Networks:** Fuzzy artificial neural networks, Fuzzy- neural example, neuro- fuzzy control and applications of fuzzy logic, Neural network and fuzzy- neural networks.

Term-Work: Each student shall appear for at least one written test during the term. Journal should consist of 8 assignments and graded as well as assessed test paper. The term-work will carry 25 Marks. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books :

1) Bela G. Liptek, "Instrument Engineer's Hand Book – Process Control", Chilton Company, 3rd Edition, 1995.
2) Stamatios V. Kartalopoulos, "Understanding Neural Networks And Fuzzy Logic", PHI- 2002.

Reference Books :

1) Nei & Linkon, "Fuzzy – Neural control", PHI-1998.
2) Klir & Yuan, "Fuzzy sets and Logic", PHI- 2002.
3) Bart Kosko, "Neural Networks and Fuzzy Systems", PHI- 2002.
4) C. F. Luger and W. A. Stubblefield, "Artificial Intelligence and Design of Expert system", Addison Wesley- 1986.
5) Technical Manuals for different DCS's.

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Class : B.E. (Instrumentation)		Semester – VII	
Subject : Optimization Techniques			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1: Introduction.

Definitions and meaning of optimization, need of optimization, conventional versus optimum design process, optimization problem formulation – statement of an optimization problem, terminology, design variables, cost function, constraints, Lagrange multipliers, iteration, convergence, Classification of optimization problem.

2: Concepts of Optimum Design.

Fundamental concepts – local and global minimum, quadratic form, necessary and sufficient conditions, Unconstrained Optimum Design Conditions – optimality conditions – for functions of single variable and several variables, Constrained Optimum Design Problems – necessary conditions: equality constraints, inequality constraints,

3: Linear Programming Methods.

Definition of linear programming problem, basic concepts, Graphical Method, Linear Programming Terminology, Simplex Method – concepts of simplex method, derivation, algorithm, Duality in Linear Programming. Engineering Applications.

4: Optimization Methods.

General algorithm for constrained and unconstrained minimization methods – descent step size, convergence and rate of convergence of algorithm, one-dimensional minimization – problem definition, reduction of a single variable, numerical methods to compute step size – Equal Interval Search (Line Search) Golden section search, Polynomial interpolation – Quadratic Interpolation, Cubic Interpolation.

Gradient of a function, properties of gradient vector, Steepest-Descent, Conjugate-gradient (Fletcher-Raves), Quasi-Newton, Broydon Fletcher Goldfrab and Shanno

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(BFGS), Devidon-Fletcher-Powell (DFP), Least square, Gauss Newton, Engineering applications.

Basic concepts related to algorithm for constrained problem, Constrained status at a design point, potential constraint strategy, decent function and convergence of an algorithm, linearization, sequential Quadratic Programming (SQP), Quadratic Programming Sub-problem, Constrained Steepest-Descent Method, Constrained Quasi-Newton Method, Engineering applications.

Assignments: Each student shall do 10 assignments and at least one Case – Study based on practical engineering problem. Some of these assignents must be done using simulation software like MATH CAD/ MATLAB/ SCILAB etc. Case study can be on any one from the following.

1) Boiler
2) Distillation Column
3) Unit operation
4) Dryer.

Term-Work: Each student shall appear for at least one written test during the term. Journal should consist of 10 assignments + 1 Case Study properly recorded and graded as well as assessed test paper. The term-work will carry 25 Marks. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books:

1) S. S. Rao, "Optimization", 2nd edition
   New Age International (P) Ltd., Publishers, New Delhi, 1995.
2) Jasbir S. Arora, "Introduction to Optimum Design",
   McGraw Hill Book Company, New York, 1989.
3) T. E. Edger and D. M. Himmeblaue, "Optimization of Chemical Processes",
   McGraw Hill International Editions, 1989.

Reference Books:

1) Kalyanmoy Deb, "Optimization For Engineering Design",
   Prentice Hall of India (P) Ltd., New Delhi, 1998.
2) Ashok D. Belegundu, "Optimization concepts and applications i Engineering", Pearson Education, 2002.

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Class : B.E. (Instrumentation)		Semester – VII	
Subject : Power Electronics & Drives			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1. Review of Power Semiconductor Devices: Power Diodes, Power BJT, Power MOSFET, SIT & IGBT. Review of Thyristor SCR, TRIAC, GTO, SITH, MCT & LASCR.

2. Heating and Cooling of Power Semiconductor Devices: Losses, Thermal resistance, Transient thermal resistance, model of heating, different, types of cooling techniques.

3. Protection: - Selection Criteria for Protective devices used for protection against Overcurrent, Overvoltage, dv/dt & di/dt.

4. Series and Parallel connection of thyristors: - Series operation, triggering arrangement for series connection, optically coupled triggering scheme, slave trigger circuits. Parallel connection of thyristors, methods of improving current division like current dividing choke etc. Requirements for triggering parallel thyristors.

5. Controlled rectifier: Design of 3 phase HW & FW controlled rectifier with R, RC, RL & RLE load with & without Freewheeling diode. Filters for 3 phase Rectifier & its design.

6. Inverters: - review of Inverters. Line commutated Inverters, DC link Inverters. Current source Inverters, Bridge and Half bridge Inverters. Bridge Circuit with Mc-Murray-Bedford Commutation. Three phase Bridge Inverters. Reduction of harmonics of Inverter output.. High frequency inverters. HVDC Transmission

7. Induction Motor Drive: - Characteristics of IM, Control Methods, Voltage fed drive, Current fed drive, Quasi Square wave, PWM (using BJT/ IGBT) ,Square wave drive,

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Static Kramer Drive Vector control drive, Power Factor & current waveform analysis for above methods , Comparison of performance of Variable Frequency Drive, Characteristics of the motor with frequency compensation via encoder feedback. Motor control using flux -vector philosophy.

8. DC Motor Drive Control: Brushed / Brushless DC Motor Drive - Methods of controlling using constant voltage & constant current technique - integration into a complete servo system.

9. Stepping Motor Drive: - Thyristorised stepping motor drive, open loop switching amplifiers.

10. Study of Industrial Motor Drives using Microcontrollers like 8051 or similar.

List of experiments:

1) 3-phase HW and FW rectifier with different types of loads.
2) 3-phase Half Controlled Converter fed D.C.Motor Drive and Study of Torque Speed with and without feedback.
3) Study of different types of Inverter circuits.
4) Study of High Frequency Inverter circuit.
5) Induction Motor Control using Current fed drive and voltage fed drive
6) PWM Drive for Induction Motor using IGBT.
7) Speed Control of Brushless D.C. Motor
8) Stepper Motor Controller using Thyristor
9) Microcontroller Based Closed loop Induction Motor Drive
10) Atleast two circuit simulations based on Pspice / Matlab or similar software

Term Work:- Term work will consist of at least eight experiments and one class-test based on the above syllabus. Laboratory work recorded in journals and assignment given by teacher duly graded shall be counted as term work. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

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Text Books:

1. P. C. Sen," Power Electronics", TMH- 1997.
2. G.K.Dubey, S. Doradla, A. Joshi., Sinha ," Thyristorised Power Controllers", Wiley Eastern- 1993.
3. W. Shepherd, Hulley & Liang ," Power Electronics & Motor control", Cambridge Unv.Press 1998.

Reference Books:

1) M.D.Singh K.B. Khanchandani ," Power Electronics", TMH 1998
2) Raymond Ram Shaw ," Power Electronics", ELBS- 1987.
3) B.W. Williams ," Power Electronics ", ELBS –1992.
4) V.Subramaniam ," Power Electronics". New Age – 1997.
5) C.W.Lander ," Power Electronics", McGrawHill- 1993.
6) Ned Mohan, T.M. Undeland , W.P. Robbins ," Power Electronics", 1996.
7) B.K. Bose ," Modern Power Electronics &AC Drive", Prentice Hall- 2002.
8) 11. Philips Krein ," Elements of Power Electronics", Oxford Unv. Press- 1998
9) D.W. Hart ," Introduction to Power Electronics", PHI- 1997.
10) Bimal K. Bose, "Modern Power Electronics and AC Drives", Pearson Education 2002.

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B.E. Instrumntation ENGINEERING
FOURTH YEAR semester VIII

SUBJECT: Elective – II, Robotics

Lectures: 4 Hrs per week **practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Rationale: This course familiarizes students with the concepts and techniques in robot manipulator control, enough to evaluate, choose, and incorporate robots in engineering systems.

DETAILED SYLLABUS

Robotic Manipulation
Automation and Robots, Classification, Application, Specification, Notations.

Direct Kinematics
Dot and cross products, Co-ordinate frames, Rotations, Homogeneous, Co-ordinates, Link co-ordination arm equation, (Five-axis robot, Four axis robot, Six axis robot).

Inverse Kinematics
General properties of solutions tool configuration Five axis robots, Three-Four axis, Six axis robot (Inverse kinematics).
Workspace analysis and trajectory planning work envelop and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

Robot Vision
Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation (Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured Illumination, Camera calibration).

Task Planning
Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp planning, Fine-motion Planning, Simulation of Planer motion, Source and goal scenes, Task planner simulation.

Moments of Inertia.

Principles of NC and CNC Machines.

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BOOKS

Text Books:

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India
2. Fu, Gonzales and Lee, Robotics, McGraw Hill
3. J.J, Craig, Introduction to Robotics, Pearson Education

Additional Reading:

1. Staughard, Robotics and AI, Prentice Hall of India
2. Grover, Wiess, Nagel, Oderey, "Industrial Robotics", McGraw Hill
3. Walfram Stdder, Robotics and Mechatronics,
4. Niku, Introduction to Robotics, Pearson Education
5. Klafter, Chmielewski, Negin, Robot Engineering, Prentice Hall of India
6. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications

TERM WORK

1. Term work should consist of at least 10 practicals and assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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Class : B.E. (Instrumentation)		Semester – VII	
Subject : Project - I			
Period / week 1 period of 60 Min	Lectures	---	
	Practical	4	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	---	---
	Practical	---	---
	Oral Examination	---	---
	Term Work	---	25

The students are expected to take up a project under the guidance of a teacher from the institute / expert from the industries, to be completed in Sem: VII and Sem: VIII

This may include

- Experimental analysis / verification.
- Development of design methods and verification.
- Design and fabrication of a model or a circuit.
- Developing a software for analysis and / or design or decision making during engineering and management Practice.

The students may be asked to work individually or in a group having not more than four students in a group.

Basic study through review of literature on the topic selected shall be completed in Sem. VII. The scope of the project, identification of necessary data, source of such data etc. should be submitted as report. The report should include objective of the project, scope of the project, methodology and the review of the literature.

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A Term-Work examination shall be conducted at the end of the Sem. VII. Due weightage will be given to the report and its presentation.

Class : B.E. (Instrumentation)		Semester – VIII	
Subject : Biomedical Instrumentation			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hrs.	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1: Human Body System Overview

Structure of cell, respiratory system, nervous system, nerve muscle physiology, circulatory system.

2: Cell Activity and Origin of Bio-potential

Origin of Biopotential, Electrical activity of cell, Action Potential and its propagation, Origin of EMG, EEG, ECG, ERG and EOG.

3: Measurement of Biochemical and Bioelectric potential

Biochemical measurements – pH, PO_2, PCO_2, Different types of electrodes, electrode – electrolyte interface, biopotential amplifier and its characteristics, measurement of biopotential using EEG, EMG and ECG (Block diagram based).

4: Cardiovascular Measurements

Blood Flow, Blood Pressure, Plethysmograph and their types, Cardiac Output, Oxymeter. Heart sound measurement.

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5: Therapeutic Instruments.

Pacemaker, Defibrillator, Heart Lung Machine, and Dialysis System, Surgical Machine, Incubator, Ventilator.

6: Imaging Techniques.

X-Ray Generation and X-Ray Machine, CT – Scanning, Ultrasound Imaging, Magnetic Resonance Imaging, Nuclear Medicine (Gamma Camera) and their applications.

7: Significance of Electrical Danger.

Physiological effect of electrical current, Shock Hazardous and accident prevention.

Experiments:

1. To study ECG.
2. To study EMG.
3. To study EEG.
4. TO study Phonocardiaograph.
5 To measure blood pressure.
6 To study heart rate indicator.
7 To study X – Ray machine.
8 To study Dialysis machine.
9 To study plethysmograph.
10 To measure heart rate.

Term-Work: Each student shall appear for at least one written test during the term. Journal should consist of at least 6 Experiments/Assignments properly recorded and graded as well as assessed test paper. The term-work will carry weightage of 25 marks. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books :

1) Leslie Cromwell, "Biomedical Instrumentation and Measurements", 2nd Edition, Pearson Education, 1980.
2) R. S. Khandpur, "Biomedical Instrumentation", TMH, 1994.

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Reference Books :

1) Richard Aston, "Principles of Biomedical Instrumentation and Instruments", 1991.
2) Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", PHI/Pearson Education, 4th edition 2001.
3) John G. Webster, "Medical Instrumentation", John Wiley and Sons, 1999.

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Class : B.E. (Instrumentation)		Semester – VIII	
Subject : Digital Control System			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	25
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1: Introduction

Advantages of digital control systems, examples of discrete data and digital control systems.

2: Signal Conversion & Processing

Digital signals and coding, data conversion and quntization, sample and hold devices, sampling period considerations, sampling as impulse modulation, sampled spectra and aliasing, reconstruction of analog signals, **zero order hold,first order hold,frequency domain characteristics**, principles of discretization- impulse invariance, finite difference approximation of derivatives,rectangular rules for integration.

3: Representation of digital control systems

Linear difference equations, pulse transfer function, input-output model, examples of first order continuous and discrete time systems, signal flow graph applied to digital systems, mapping between S-plane and Z-plane. Bilinear transformation

4: Stability of Digital Control Systems in z-domain

Jury's method, R. H. Criteria root locus technique, frequency response method.

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5: Time domain analysis -

Comparison of time response of continuous data and digital control system. Steady state analysis of digital control systems.Effect of sampling period on transient response characteristic.

6: State space Analysis

Discrete time state equations, state diagram, similarity transforms eigen values, eigen vectors, first and second companion form, diagonalisation, Jordan Canonical form, solving discrete time state equation, state transition matrix,Discretization of continuous time system.
Liapunov's stability analysis, definitions, theorem, concept of equilibrium state.

7: Pole placement and observer design -

Concept of reachability, Controllability, Constructability and observability. Design of controller via pole placement method. State observer design, dead beat controller design, Concept of duality.

Term-Work:

Each student shall appear for at least one written test during the term. Journal should consist of 10 Assignments/Experiments out of which 5 must be done with the help of simulation software MATLAB/MATH CAD/PSPICE/SCILAB or similar one. Term-Work will carry weightage of 25 marks. Distribution of marks: 10 Marks for Journal , 10 Marks for Test and 5 marks for attendance.

Text books:

1. M. Gopal, "Digital Control and State Variable methods", Tata McGraw Hill, 2nd edition Match 2003.
2. K. Ogata, "Discrete time control systems" Pearson Education Inc., 1995.
3. B. C. Kuo, "Digital control systems" Saunders College Publishing, 1992.

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Reference Books :

1) Richard J. Vaccaro, "Digital Control" McGraw Hill Inc., 1995.
2) Ashish Tewari, "Modern Control System design with Matlab", John weily, Feb. 2002.
3) Joe H. Chow, Dean K. Frederick, "Discrete Time Control Problems using Matlab", Thomson Learning, 1st edition 2003.
4) Eronini Umez, "System Dynamics and Control", Thomson Learning, 1999.
5) Franklin Powel, "Digital Control of Dynamic Systems", Pearson Education, 3rd edition, 2003.

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Class : B.E. (Instrumentation)		Semester – VIII	
Subject : Instrumentation System Design			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1. Design of Transducer:

An overview of static and dynamic performance characteristics of instruments. Design considerations for transducers such as thermocouple, RTD, orifice plates, rotameter, LVDT etc. Calibration and installation procedure for thermocouple, RTD, etc.

2. Design of Control Valve:

Review of flow equations. Valve selection and sizing for liquid service, gas or vapor service, flashing liquids, mixed phase flow. Control valve noise. Control valve cavitations. Actuator sizing.

3. Design of Instrument Air Systems:

Sizing criteria. Air supply source, compressor systems. Air distribution system. Control room air supply and air handling. Design of safety relief valves and rupture discs.

4. Design and Architectural Overview of Programmable Logic Controller: Input output system- discrete I/O modules, analog I/O modules, Special Purpose Modules, Intelligent I/O modules, Communication modules. Basic and advanced PLC

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programming- PLC programming standards, Ladder diagram Language and instruction set, advanced function block instructions, structured text language, function block diagram language, sequence function chart language. PLC system design and Applications.

5. Electronic product design: System Engineering, documentation, human interface such as ergonomics, aesthetics. Packing and enclosures, Grounding and shielding, front panel and cabinet design of an electronic product.

Term-Work: Each student shall appear for at least one written test during the term. Journal should consist of 6 assignments/practicals graded as well as assessed test paper. The term-work will carry 25 Marks. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books :

1. Nakra and Chaudhary, "Instrumentation Measurements and analysis", TMH-1992
2. Bela G. Liptek, "Instrument Engineer's Hand Book – Process Control", Chilton Company, 3rd Edition, 1995.
3. Andrew Williams, "Applied instrumentation in the process industries", 2nd Edition, Vol. 3, Gulf publishing company.

Reference Books :

1) R. W. Zape, "Valve selection hand book third edition", Jaico publishing house, Les Driskell, "Control valve sizing", ISA.
2) Thomas A. Hughes, "Programmable controllers " , Second Edition , ISA.
3) Kim R Fowler, "Electronic Instrument Design", Oxford University- 1996. Manual on product design: IISc C.E.D.T.
4. Harshvardhan, "Measurement Principles and Practices", Macmillan India Ltd-1993

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Electives II

Class : B.E. (Instrumentation)		Semester – VIII	
Subject : Image Processing			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1. **Introduction:** Definition of image , generation of image, steps in image processing, elements of digital image processing systems, image enhancements, restoration and analysis.
2. **Digital Image Fundamentals:** Elements of visible perception, image model, sampling and quantization, relationships between pixels, imaging geometry.
3. **Image Transforms:** Introduction to D.F.T., 2-D.F.T., F.F.T., other seperable image transforms (walsh, hadamard, discrete cosine, haar, slant, KL)
4. **Image Enhancements:** Point operations, histogram modeling, spatial filtering-smoothing, sharpening, low pass, high pass, homomorphic filtering.
5. **2-D systems and mathematical preliminaries:** Introduction and definitions, matrix theory, random signals, spectral density function, results from estimation and information theory.
6. **Image Restoration:** Image observation models, inverse and wiener filtering, F.I.R. wiener filters, filtering using image transforms, least squares filters, generalised inverse, S.V.D. and interactive methods, recursive filtering, causal models,digital processing of speckle images, maximum entropy restoration.

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7. **Image Segmentation:** Detection of discontinuities, age linking and boundary detection, thresholding region oriented segmentation, use of motion in segmentation.
8. **Image Data Compression:** Introduction, pixel coding, predictive techniques (PCM, DPCM, etc), transform coding theory of images, hybrid coding and vector DPCM.

LIST OF EXPERIMENTS :

1. Program for 2-d convolution.
2. Image rotation scaling and translation.
3. Program for 2-d correlation.
4. Program for 2-d F.F.T.
5. Program for Discrete cosine transform.
6. Program for K L transform.
7. Program for Histogram equalization & Histogram specification.
8. Program for Mask operation (Spatial filtering).
9. Program for edge detection.
10. Program for Thresholding.
11. Function for determining boundary descriptors, like boundary length and curvature.

Term-Work: Each student shall appear for at least one written test during the term. Journal should consist of 8 practicals graded as well as assessed test paper. The term-work will carry 25 Marks. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books :

1. R. C. Gonzalez, "Image Processing" Pearson Education 2nd edition, 1999.
2. A. K. Jain, "Fundamental of Digital Image Processing", PHI 2nd edition, 1995.
3. W. K. Pratt, "Digital Image Processing", John Wiley and Sons, 1994.

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Reference Books:

1) C. Phillips, "Image Processing in C", BPB Publication, 1995.
2) B. Chanda, D. Dutta Majumdar, "Digital Image processing", PHI, 2000.
3) Emmauel C. Ifeachor and Barry W. Jervis, "Digital Signal Processing", Pearson Education, 2nd edition, 2000.
4) Don Pearson, "Image Processing" (The ESSEX series in Telecommunication and information systems, McGraw Hill International ELTL engg. series), 1991.
5) Johnny Johnson, "Introduction to DSP", PHI – 1996.
6) Proakis, "DSP" , PHI 1997.
7) Rabnier Gold, "Theory and Application of DSP", PHI, 1996.
8) Milan Sonka, Vaclav Hlavac, "Image Processing analysis and machine vision", Thomson Learning, 2nd edition, 1999.

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Class : B.E. (Instrumentation)		Semester – VIII	
Subject : Nuclear Instrumentation			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1. **Radioactivity :** General Properties of Nucleus, Radioactivity ,Nature of Nuclear Radiation's, Characteristic properties of radioactive radiation's, Properties of Alpha, Beta, and Gamma rays, Natural and artificial radio-activity. Radioactivity Laws, Half life period, radioactive series, Isotopes and Isobars,Various effects-photoelectric, Compton scattering and pair production, stopping power and range of charged nuclear particles.
2. **Radiation detectors :** Techniques for weak signal detection, Detectors for Alpha, beta and gamma rays, Detector classification – Ionisation chamber, Regions of multiplicative operation, Proportional counter, Geiger Muller counter-volt ampere characteristics, Designing features, Scintillation detectors (Photomultiplier tube-types, dark currents, scintillators, pulse resolving power) , efficiency of detection, SNR improvement, Solid state detectors (Lithium ion drifted - Si-Li, Ge-Li, Diffused junction, surface barrier)
3. **Electronics and Counting systems** : Pre-amp., main amplifiers, Discriminators, Scalars and count rate meters, Pulse shaping, pulse stretchers, Coincidence circuits, photon counting system block diagram, factors influencing resolution of

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gamma energy spectrum, Energy resolution in radiation detectors, single and multichannel analysers **(MCA)**,pulse height analysers**(PHA)**.

4. **Application in Medicines:** Gamma camera- design, block diagram, medical usage. Radiation uptake studies- block diagram and design features. Nuclear Instrumentation for health care, Radiation Personnel Health Monitors like neutron monitors, Gamma Monitors, Tritium monitors, Iodine monitors and PARA(particulate activity radiation alarms).

5. **Applications in Industry:**
   Basic Nuclear Instrumentation system- block diagram, Nuclear Instrumentation for laboratory. Personal monitors like Thermo Luminescence Detectors (TLD), Dosimeters, Teletectors, which are used to assess the radiation exposure to the radiation plant workers. Nuclear Instrumentation for power reactor. Nuclear Instrumentation for Toxic fluid tank level measurement, Underground Piping Leak detection, weighing, thickness gauges, water content measurement etc. Agriculture applications like food irradiation.

Term-Work: Each Student shall appear for at least one written test during the term. Journal should consist of at least 8 assignments/practical based on above. syllabus properly graded and recorded, as well as assessed test paper. The term-work will carry weightage of 25 marks. Distribution of marks: 10 Marks for Journal, 10 Marks for Test and 5 Marks for attendance.

Text Books:

1. G. F. Knoll, "Radiation Detection & Measurement", 2nd edition, John Wiley & Sons, 1998.
2. P.W.NICHOLSON, "Nuclear Electronics", John Wiley, 1998.
3. S. S. Kapoor & V. S. Ramamurthy, "Nuclear Radiation Detectors", Wiley Eastern Limited, 1986.

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Reference Books:

1. Gaur & Gupta, "Engineering Physics", Danpat Rai & Sons, 2001.
2. Irvin Kaplan, "Nuclear Physics", Narosa, 1987.
3. M.N.Avdhamule & P.G.Kshirsagar, "Engineering Physics", S.Chand & Co., 2001.
4. R. M. Singru, "Introduction to Experimental Nuclear Physics", Wiley Eastern Pvt. Ltd., 1974.
5. Hand Book of Nuclear Medical Instruments, TMH Publishing New Delhi, 1974.

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Class : B.E. (Instrumentation)		Semester – VIII	
Subject : Optimal Control Systems			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1: Introduction: The basic concepts of Optimization, Formulation of optimal control problem, Performance criteria.

2: Calculus of Variation: Minimization of Functions, minimization of Functionals, Fixed end point and variable end point problems, Formulation of variational calculus problem using Hamiltonian method.

3: Approaches for Minimization of Performance Index:

Pontryagin's Minimum Principle: Derivation and its applications to specific class of optimal control problems.

Dynamic Programming: Principle of optimality, The equation of Bellman, Application to Discrete and continuos systems. Hamilton – Jacobi equation, Relationship between the minimum principle and Dynamic Programming.

4: Linear Regulator Problem: Optimization of Linear Systems with quadratic performance index – Matrix Riccati Equation, Tracking Problem.

Two Point Boundary Value (TPBV) Problem: Steepest-Decent Method and Flecher-Powell Method.

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Assignments: Each student shall perform at least 10 assignment based on above syllabus. Some or all assignments must be performed by using simulation software like MATH CAD/MATLAB/SCILAB.

Term-Work: Each student shall appear for at least one written test during the term. Journal should consist of 10 assignments properly recorded and graded as well as assessed test paper. The term-work will carry 25 Marks. Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books:

1) D. Kirk, "Optimal Control – An Introduction",
   Prentice Hall, Inc., Englewood Cliff, N. J., 1970.
2) M. Gopal, "Modern Control System Theory",
   Wiley Eastern, 1982.
3) Anderson B. D. O. and J. B. Moore, "Linear Optimal Control",
   Prentice Hall, Englewood Cliff, N. J., 1971.

Reference Book:

1) Athens and Faib,"Optimal Control".

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Class : B.E. (Instrumentation)		Semester – VIII	
Subject : Virtual Instrumentation			
Period / week 1 period of 60 Min	Lectures	4	
	Practical	2	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	---	---
	Oral Examination	---	25
	Term Work	---	25

Detailed Syllabus :

1. **Review of virtual instrumentation** : Historical perspective, advantages, block diagram and architecture of a virtual instrument.
2. **Data flow techniques** : Graphical programming in data flow, comparison with conventional programming.
3. **Instrumentation general purpose buses** : GPIB/IEEE 488 concepts, Embedded system buses- PCI,EISA, CPCI, USB & VXI.
4. **Addon peripheral cards, Selection and Applications**– ADC, DAC, DIO, DMM, wave form generator.
5. **Introduction to labview software and Addon Toolsets.**
6. **Virtual instrumentation programming techniques** : VI and sub- Vis, loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.
7. **Applications of Virtual Instrumentation-** Process control applications, Temperature Data Acquisition System, and Motion control employing stepper motor.

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Term-Work: Each student shall appear for at least one written test during the term. Journal should consist of 6 assignments and mini project based on above syllabus properly recorded and graded as well as assessed test paper. The term-work will carry 25 Marks Distribution of marks: 10 Marks for Journal 10 Marks for Test and 5 marks for attendance.

Text Books :

1) Gary Johnson ,"Lab VIEW graphical programming", 2nd Edition, McGrawHill, 1997.
2) Lisa K. Wells and Jeffrey Travis" Lab VIEW for everyone", PHI , 1997.
3) Skolkoff "Basic concepts of Lab VIEW 4" , PHI , 1998.

Reference Books :

1) S.Gupta, J.P.Gupta, "PC interfacing for Data Acquisition & process control",ISA, 2nd Edition,1994.
2) Technical Manuals for DAS Modules of Advantech and National Instruments.
3) L.T. Amy, " Automation system for control and Data Acquisition", ISA, 1992.

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Class : B.E. (Instrumentation)		Semester – VIII	
Subject : Project - II			
Period / week 1 period of 60 Min	Lectures	---	
	Practical	8	
	Tutorial	---	
		Hours	Marks
Evaluation System	Theory Examination	---	---
	Practical	---	---
	Oral Examination	---	50
	Term Work	---	50

Further to Sem. VII work, the students / group of the students shall collect all necessary information and analyze it. The students / group shall prepare and submit report on the project. It shall be typewritten on A4 size paper, hard-bound and prepared in the academic style. Broadly the report shall have four parts: Introduction, literature review, data collection, experiments conducted, software implementation etc.

Acquaintance with survey and research methods and their use in conducting a systematic investigation and style of report preparation and presentation shall form the basic of evaluation.

An oral examination shall be conducted at the end of the Sem. VIII.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. Electronics

&

Telecommunication Engineering

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI

I. SCHEME OF INSTRUCTIONS AND EXAMINATIONS

at

B.E. (Electronics and Telecommunication Engineering)

(R-2001)

(Revised Scheme Considering 60 Minutes' Period Instead of 45 Minutes' Period as per AICTE Guide – lines)

Semester – VII

Sr. No.	Subject	Scheme of Instruction			Duration of paper hours	Scheme of Examination				
		Lect/ Week	Pract/ Week	Tuto/ Week		Paper	Term work	Pract.	Oral	Total
1	*Digital Communication	3	2	-	3	100	25	-	25	150
2	Mobile Communication System	4	-	1	3	100	25	-		125
3	Microwave Devices and circuits	4	2	-	3	100	25	-	25	150
4	Discrete Time Signal Processing	4	2	-	3	100	25	-	25	150
5	Elective I	4	2.	-	3	100	25	-	25	150
6	Project – A	-	-	4			25	-		25
	Total	19	8	5		500	150		100	750

* Subject common with Electronics Engineering branche.

Elective -I (Any one)

1) Image Processing (Pr)
2) Data compression and encryption (Pr)
3) Radar Engineering (Tut)
4) Microwave Integrated Circuits (Tut)
5) Simulation of communication systems (Tut)

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Semester – VIII

Sr. No.	Subject	Scheme of Instruction			Duration of paper hours	Scheme of Examination				
		Lect/ Week	Pract/ Week	Tuto/ Week		Paper	Term work	Pract.	Oral	Total
1	Satellite Communication	4		2	3	100	25		25	150
2	Optical Fiber Communication	4	2	-	3	100	25		25	150
3	Computer Communication Networks	4	2	-	3	100	25		25	150
4	Elective II	4	-	2	3	100	25		25	150
5	Project – B	-	8	-	-		50		50	100
	Total	**16**	**12**	**4**		**400**	**150**		**150**	**700**

Elective II (Any one)

1) Wireless network (Tut)
2) Digital Voice Communication (Tut)
3) Telecommunication network management (Tut)
4) Microwave amplifier and oscillator design (Tut)
5) Optical networks (Tut)
6) Internet communication engineering (Tut)

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II. Elective list in VII and VIII semesters

Semester VII

Elective – I

1. Image Processing (Pr)
2. Data compression and encryption (Pr)
3. Radar Engineering (Tut)
4. Microwave Integrated Circuits (Tut)
5. Simulation of communication systems (Tut)

Semester VIII

Elective – II

1. Wireless network (Tut)
2. Digital Voice Communication (Tut)
3. Telecommunication network management (Tut)
4. Microwave amplifier and oscillator design (Tut)
5. Optical networks (Tut)
6. Internet communication engineering (Tut)

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Digital Communication			
Periods per week 1 Period of 60 min.	Lecture	3	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25

Detailed Syllabus

1. **Information theory:**
Entropy, Shannon Theorem, Shannon Hartley theorem

2. **Baseband Transmission:**

Discrete PAM Signals, power spectra of discrete PAM signals, intersymbol interference, Nyquist's criterion for distorrtionless baseband transmission, Pulse shaping, line codes, correlative coding, eye diagram, equalization.

3. **Digital Modulation:**

Representation of bandpass modulated signal, vector space representation, Gram, Schmidt procedure, signal energy and correlation, ASK, FSK, PSK, DPSK, M-ary PSK, M-ary FSK, QPSK, OQPSK, MSK, QAM- Introduction, Modulation, demodulation, signal space diagram, spectrum, bandwidth efficiency, power efficiency, probability of error, applications, carrier and timing recovery circuits.

4. **Baseband Detection:**

Detection of binary signals – Matched filters, decision threshold in matched filters, error probability, maximum likelihood receiver structure, correlation realization of matched filter.

5. **Error Control Systems:**

Overview, power and bandlimited channels, optimum decoding, decoded error rate.

6. **Error Control Block Codes:**

Introduction, code rate and code distance, some algebraic concepts, generator matrix of a linear block code, systematic form of G, parity check matrix of a linear block code, decoding mechanism, hamming codes, extended hamming codes, shortened hamming codes, systematic form of H matrix, cyclic codes, generator matrix for cyclic codes, polynomial multiplication and division, systematic cyclic codes, practical systematic encoders, binary BCH codes, shortened cyclic codes, cyclic redundancy check (CRC)codes, interleaving, Non algebraic decoding of cyclic codes, Meggit decoding, decoding shortened cyclic codes, burst detection, burst correction (error trapping), application areas.

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7. **Convolutional codes:**

Introduction, generator polynomial and optimal codes, puncturing code trellis, free distance, Viterbi decoding, hard decision Viterbi decoding, decoding window, soft decision Viterbi decoding, code spectra, recursive systematic codes, code transfer function, application areas.

8. **Spread Spectrum Techniques:**
Basic techniques, direct sequence spread spectrum, frequency hop spread spectrum, spreading sequences- m-sequences, gold sequences, Walsh Hadamard sequences, variable-length orthogonal codes, correlation of sequences, PSD of DS spread spectrum, performance of DS/QPSK in tone interference, DS spread spectrum on frequency selective fading channels, error probability for DS CDMA on AWGN channels.

Review:

Mathematical definition and proof of sampling theorem for base band and band pass signals, flat top samples and their spectrum, signal distortion. PCM – Principles, bandwidth, channel capacity, DPCM – Principles, Quantizer design, predictor design, coding gain, Adaptive DPCM – Principle, Delta Modulation (DM).

List of Experiments:

1. Measurement of bit error rate
2. Measurement of coding gain
3. Study of generation of cyclic codes
4. Measurement of bandwidth efficiency of QAM
5. Study of equalizer's performance parameters
6. Study of eye diagram using oscilloscope.
7. Study of QPSK waveform using digital oscilloscope
8. Measurement of Bandwidth efficiency of QPSK
9. Study of MSK generation and detection.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on experiments (at least eight from the list of suggested experiments) and assignments along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on experiments – 15 marks.
Written Test – 10 marks.

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V. **Text Books:**

1. Digital Communications – Simon Haykin,
   John Wiley & Sons publication
2. Coding Techniques: An Introduction to Compression and Error Control – Graham wade,
   Palgrave
3. Principles of Mobile communications 2nd Edition – Gordon Stuber
   Kluwer Academic publication

VI. **Reference Books:**

1. Digital Communications 2nd Edition – Bernard Sklar
   Pearson Education Asia publication
2. Communication Systems – B. P. Lathi,
   BS Publications (Hyderabad)

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Mobile Communication System			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	1	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	-
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

   Introduction to wireless communication systems

2. **The cellular concept:**

   Frequency reuse handoff, interference, trunking and grade of service, improving the capacity of cellular systems

3. **Mobile radio propagation:**

   Large scale path loss, reflection, ground reflection, model (2 ray model), diffraction, practical link budget design using path loss models, small scale fading and multi-path, small-scale multi-path propagation, parameter of multi-path channels, types of small scale fading, Raleigh and ricean distribution, diversity.

4. **Analog cellular mobile system:**

   AMPS and ETACS system (overview call handling, air interface, N-AMPS)

5. **Digital cellular mobile system:**
   GSM-services, features, system architecture, radio subsystem, channel types, frame structure, signal processing security aspects, network operations.

6. **Low power wireless communication systems:**

   Cordless telephone, CT2, DECT, PHS, PACS

7. **CDMA digital cellular standard (IS-95):**

   Frequency and channel specifications, forward and reverse CDMA channel

8. **Mobile terminals:**
   Over view, types, radiated power, functional architecture, encryption, subscriber identity module,

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9. **Global mobile satellite system:**
Introduction to iridium system, global star system, ICO system, telederic system

10. **Third generation mobile communication:**
System IMT-2000, Introduction, radio aspects, network aspects.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments covering all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Wireless Communications – Theodore S. Rappaport
Prentice Hall of India, PTR publication

2. Wireless Personal Communications Systems – David J. Goodman
Addison Wesley publication

3. GSM Cellular Radio – Joachim Tesal
John Wiley publication

VI. **Reference Books:**

1. Mobile and personal communication systems and services – Raj Pandya
Prentice Hall of India publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Microwave Devices and Circuits			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

Microwave bands, microwave characteristics, microwave system, traditional, industrial and biomedical applications, microwave hazards.

2. **Transmission line theory:**

Circuit representation of transmission line, transmission line equations, sinusoidal excitation of transmission line, impedance and its transformation, Simth Chart and its applications, impedance matching techniques.

3. **Microwave Transmission lines:**

Co-axial line, rectangular and circular wave guides, introduction to strip lines, microstrip lines and co-planar wave-guides.

4. **Wave guide components:**

Transmission line resonators, Rectangular and circular cavity resonators, introduction of s-parameters,
Hybrid junctions, Directional couplers, circulators, isolators, wave-guide terminations, Attenuators, Phase-shifter

5. **Microwave tubes:**

Reflex klystrons, Multi cavity klystron, Helix TWT, Coupled cavity TWT, Backward wave oscillator, magnetron, Forward wave cross field Amplifiers.

6. **Microwave semiconductor devices:**

Point contact diodes, Schottky barrier diodes, PIN diodes, varactor diodes, tunnel diodes, Gunn devices, IMPATT diode, parametric devices, Detectors and Mixers.

7. **Microwave measurements:**

VSWR, Frequency, Power, Noise, Q Factor, Impedance, Attenuation, Dielectric Constant, antenna Gain.

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LIST OF EXPERIMENTS:

1. Measurement of power using Bolo meters
2. Measurement of attenuation by substitution method
3. Measurement of impendence using slotted wave guide
4. Measurement of scattering parameters
5. Measurement of noise
6. Measurement of frequency using slotted wave guide .
7. Measurement of impedance using reflectometer
8. Measurement of wavelength using reflectometer
9. Measurement of gain of horn antenna form radiation pattern

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on experiments (at least eight from the list of suggested experiments) along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on experiments – 15 marks.
Written Test – 10 marks.

V. Text Books:

1. Microwave engineering passive circuits - Peter A. Rizzi
   PHI Publication
2. Microwave Devices and circuits - Samuel Liao
   PHI Publication
3. Microwave Engineering - David Pozar
   John Wiley and Sons publication
4. Microwave Engineering and Applications - O.P. Gandhi
   Pargamon Press publication

VI. Reference Books:

1. Basic Microwave Techniques and laboratory manual - M. L. Sisodia, G. S. Raghuvanshi
   Wiley eastern Limited publication
2. Electromagnetic Field theory fundamentals - Guru & Hisiroglu
   Thomson Learning publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Discrete Time Signal Processing			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Transform analysis of LTI systems:**

Frequency response of LTI systems, phase distortion and delay, all pass systems, minimum, maximum mixed phase systems, linear phase filters, causal generalized linear phase system (pole zero plots) symmetric anti-symmetric filters low pass, high pass, band pass filters, digital resonator, comb filters, notch filters, all pass filters, digital sinusoidal oscillator.

2. **Discrete fourier transform:**

DFT and its properties, linear filtering based on DFT, frequency analysis of signal using DFT, long data filtering overlap and save, overlap and add method.

3. **Discrete cosine transform (DCT):**

Definition of DCT, DCT-1 and DCT-2, relationship between DFT and DCT-1 and DCT-2, energy compaction property of DCT-2, applications of DCT

4. **Computation of DFT:**

Fast fourier transform radix 2, radix 4, application of FFT algorithm, efficient computation of DFT of 2N point real sequences, linear filtering, correlation, Goertzel algorithm, chirp Z transform,
DIT-FFT, DIF, FFT, IFFT split radix FFT degradation from finite word length, effects of quantization, round off noise in FFT and IFFT

5. **Design of filters:**

Design of FIR filters – windowing method frequency sampling method, optimum equiripple linear phase FIR, FIR differentiator, optimum approximation of FIR filters, Hilbert transformers, relationship between no. of coeff and filters, characteristic raised cosine transition filter, Design of IIR filters – Impulse invariance, bilinear transformation, butter worth, chebyshev filter I, chebyshev II, frequency transformation low pass to high pass, band pass, band reject filters. Design of digital filter based on least square method (FIR,IIR).

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6. **Structures for discrete time systems:**

FIR structures (direct form, cascade form, frequency sampling and lattice), structures for linear phase filters, structures for IIR systems, direct form (cascade, parallel, lattice and lattice ladder),basic structure of phase shifters, effect of coefficient quantization in IIR and FIR systems, effect of round off noise in digital filters analysis of the direct form IIR structures, and scaling in fixed point implementation of IIR systems, analysis of a cascade IIR structures, and FIR structures.

7. **Digital ladder filters:**

Properties of two port circuits, simulated ladder filters, switched capacitor filters, wave filters, lattice filters, comparison elements

8. **Introduction to programmable digital signal processors:**

Multiplier and multiplier accumulator modified bus structures and memory access scheme in P-DSPs, multiple access memory, multi-ported memory, VLIW architecture, pipelining, special addressing modes, in P-DSPs, on chip peripherals.

List of Experiments:

1. Magnitude and phase response of a system.
2. Pole zero diagram and phase response of a linear phase filter.
3. Computation of DFT and at least one application.
4. Discrete cosine transform and its application
5. Design of Butterworth IIR filter.
6. Design of chebyshev IIR filter.
7. Design of FIR filter.
8. Design of digital filter using least square method.
9. Real time signals and its processing using digital signal processors.
10. Implementation of multi-rate signal processing.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on experiments (at least eight from the list of suggested experiments) along with a graded answer paper shall be submitted as term work.

The distribution of term work will be as follows:

Report on experiments – 15 marks
Written Test – 10 marks

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V. **Text Books:**

1. Digital Signal Processing – John Proakis
   Prentice Hall of India Publication

2. Discrete time signal processing – Alan V. Oppenheim & Ronald W. Scheuffer
   Prentice Hall of India Publication

3. Digital Signal Processors – B. Venkatramani, M. Bhaskar
   Tata Mc-Graw Hill Publication.

VI. **Reference books:**

1. Digital Processing of signals – Maurice Bellanger
   John wiley Publication

2. Digital Filters – Analysis and Design – A. Antonion
   Tata Mc-Graw Hill Publication

3. Digital Signal Processing – Iffecho R.
   Pearson Education Assia Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (1): Image Processing			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

Digital image representation, steps in image processing, elements of digital image processing systems.

2. **Digital Image Fundamentals:**

Elements of visual perception, simple image model, sampling and quantisation, basic relationships between pixels, basic transformations

3. **Image Transforms:**

Review of DFT, two-dimensional DFT and its properties, walsh transform, Hadamard transform, discrete cosine transform, the Harr transform, the slant transform, the hotelling transform.

4. **Image Enhancement:**

Spatial domain methods, frequency domain methods, enhancement by point processing, spatial filtering, enhancement in the frequency domain, generation of spatial masks from frequency domain specification, colour image processing.

5 **Image Compression:**

Fundamentals, image compression models, using information theory for image compression, error free compression, lossy compression, image compression standard.

6. **Image segmentation:**

Detection of discontinuities, edge linking and boundary detection, thresholding, region oriented segmentation, the use of motion in segmentation

7. **Image Representation and description:**

Representation schemes, boundary descriptors, regional descriptors, morphology, relational descriptors

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List of Experiments:

1. Read on input image and manipulate its resolution in the spatial and gray domains.
2. Arithmetic and logical operations on images.
3. Image rotation, scaling, translation
4. Image Transforms –I For a 4X4 image, determine its forward and inverse transforms and compare the inverse transforms with the original image data.
5. Image Transforms -II
6. Histogram and Histogram equalization of an image.
7. Smoothening filters
8. Sharpening filters
9. Compression codes
10. Image differentiation
11. Thresholding
12. Functions to determine boundary descriptors like boundary length, curvature
13. Functions to determine regional descriptors like area, perimeter, compactness, Eular number
14. Functions to compute texture descriptors in an image.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on experiments (at least eight from the list of suggested experiments) along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on experiments – 15 marks.
Written Test – 10 marks.

V. Reference Books:

1. Digital Image Processing – Ganzalez R. C,
   Pearson Education Asia Publication
2. Image processing, Analysis, and Machine vision – Milan Sonka, Vaclav Hlvac, Roger Boyle
   Thomson Learning publication
3. Fundamentals of Image Processing - Anil K. Jain
   Prentice Hall of India Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (2): Data Compression and Encryption			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Data Compression and Encryption:**

Need for Data Compression, Lossy / loss less compression, symmetrical compression and compression ratio, run length encoding (RLE) for text and image compression, relative encoding and its applications in facsimile data compression and telemetry, scalar quantization.

2. **Statistical Methods:**

Statistical modeling of ingormation source, coding redundancy, variable size codes prefix codes, Shannon-Fano coding, Huffman coding, adaptive Huffman coding, arithmetic coding and adaptive arithmetic coding, text compression using PPM method.

3. **Dictionary Methods:**

String compression, sliding window compression, LZ77, LZ78 and LZW algorithms and applications in text compression, Zip and Gzip, ARC and
Redundancy code.

4. **Image compression:**

Loss less techniques of image compression, gray codes, two dimensional image transforms, discrete cosine transform and its application in lossy image compression, quantization, zig-zag coding sequences, JPEG and JPEG-LS compression standards, pulse code modulation and differential pulse code modulation methods of image compression, video compression and MPEG industry standard.

5. **Audio Compression:**

Digital Audio, Lossy sound compression, M-law and A-law compounding, DPCM and ADPCM audio compression, MPEG audio standard, frequency domain coding, format of compressed data.

6. **Conventional Encryption:**

Security of information, security attacks, classical techniques, Caesar cipher, block ciper principles, data encryption standard, key generation for DES, block cipher principle, design and modes of operation, S-box design, triple DES with two three keys, introduction to international data encryption algorithm, key distribution.

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7. **Number Theory and public encryption:**

Modular arithmetic, Fermat's and Euler's theorems, Chinese remainder theorem, discrete logarithm, principles of public key cryptosystems, RSA algorithm, key management, Diffie-Hellman key exchange, elliptic curve cryptography.

8. **Message Authentication:**

Authentication requirements and functions, message authentication codes (MAC), hash functions and their security, hash and MAC algorithms, digital signatures and authentication protocols, digital signature standard and algorithms.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on experiments (at least eight) and assignments along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on experiments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Data Compression - David Salomon,
   Springer Verlag Publication

2. Cryptography and Network Security – William Stalliings
   Pearson Education Asia Publication

3. Introduction to Data Compression – Khalid Sayood
   Morgan Kaufmann Publication

VI **Reference Books:**

1. The Data Compression book – Mark Nelson
   BPB Publication

2. Applied Cryptography – Bruce Schnecer
   John Wiley & Sons Inc. Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (3): Radar Engineering			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

   Rader set, radar frequencies and radar applications.

2. **Radar Equation:**

   Range performance, minimum detectable signal, receiver noise, transmitter power, pulse repetition frequency, pulse duration, system losses, and propagation effects.

3. **Radar Targets:**

   Radar cross-section, black scatter cross section, complex target cross section fluctuations, frequency agility effects on target detection and tracking.

4. **CW, MTI & Pulse Radars:**

   CW radars, FMCW radar, MFCW radar, MTI radar, Pulse Doppler radar – principles, operation performance, limitations and applications

5. **Radar Clutters:**

   Surface clutter radar equations, sea clutter, land clutter, effects of weather on radar angles echoes.

6. **Tracking radars:**

   Sequential lobing, conical scan tracking mono-pulse tracking.

7. **Navigational & Remote Sensing Radars;**

   Airport radars, meterological radars, airborne radars, Doppler navigation, remote sensing radars, pattern synthesis, phased array

8. **Landing Systems & Hyperbolic Navigation:**

   Instrument landing systems, ground controlled approach, radio altimeter, microwave landing system, loran – A, measurement delay, loran-C, DECCA.

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IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Introduction to Radar System – M. I. Skolnik
Mc-Graw Hill publication

2. Radar Systems and Radio Aids to Navigation – A. K. Sen & A. B. Bhattacharya
Khanna publication.

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (4): Microwave Integrated Circuits			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Hybrid MICs :**

   Definition, characteristics, comparison with conventional circuits, fields of application and limitations and criteria for the choice of substrate material, thin film hybrid circuits, thick film hybrid circuits, artwork, mask making, photolithography, resistor stabilization, sawing, brazing process, wire bonding.

2. **Monolithic MICs:**

   Definition, substrate structure, doping by ion implantation ohmic contact, metal resistive layers, gate metal, dielectric second level metal, dielectric and air bridge vias, substrate vias, final wafer process steps.

3. **Micro strip Lines:**

   Planar wave guides, non-TEM propagation, line impedance definitions, quasi-static approximations, quasi-static line parameters, micro strip open circuits and gaps, micro strip corners, step changes in width, dispersion analysis, micro strip characteristic impedance, symmetric T junction, full wave analysis of micro strip propagation, LSE and LSM potentials, spectral domain analysis, dispersion relation for open micro strip, spectral domain impedance analysis, dispersion relation for open micro strip, spectral domain impedance analysis, Green's functions, millimeter wave modeling of micro strip lines.

4. **Coupled Line Propagation:**

   Wave equations for coupled lines, propagation models, coupled line parameters, coupled line parameter variations with frequency, directional couplings, Lange coupler coupled line pair treated as a four port, coupled line pair operated as a two port assuming 0e = 0o, low pass filter design assuming 0e =0o, coupled line pair analysed to a two port 0e not equal to 0o, narrow band filter using coupled resonator, narrow band coupled line filters, suspended substrate strip lined filters, suspended substrate strip line filter design using method 1 and method 2.

5. **Slot Lines :**

   Analysis, design consideration, transitions and applications.

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6. **Coplanar Waveguide:**

   Analysis, design considerations and coplanar line circuits.

7. **Devices :**

   GaAs FET, HEMT, gunn diode, varactor diodes, PIN diodes, YIC resonators, dielectric resonators & their application in oscillator mixer and amplifiers.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as term work.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Text Books:

1. Microstrip Circuit Analysis – David H. Schrader , Prentice Hall PTR, New Jersey 07458.
2. Microstrip Lines and Slot Lines- K.C. Gupta, R. Garg and I.J. Bahl , Artech House.
3. MIIC Design : GaAs FETs and HEMTs- Peter Ladbrooke , Artech House.
4. Foundations for Microstrip Circuit Design -T.C. Edwards, John Wiley and Sons

VI. Reference Books:

1. MIC and MMIC Amplifier and Oscillator Circuit Design- Allen Sweet, Artech House.
2. Handbook of Microwave Integrated Circuits- Reinmut K. Hoffman , Artech House.

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Class: B.E. (Electronics And Telecommunication Engg.)		Semester VII	
Sub: Elective I (5): Simulation of Communication Systems			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Basics of Simulation Modeling :**

System model and Simulation, Physical and Mathematical models. Analytical solutions and simulation output. Continuous and Discrete simulation models.
Discrete event simulation: Components and organization of discrete event scheduling and time advance approaches
a) Simulation of a single server queuing systems
b) Simulation of an Inventory system
Problem statement, program organization and logic, simulation program, simulation output and Analysis of result

2. **Complex system Simulation :**

Steps in simulation study, combined discrete continuous simulation, Monte Carlo Simulation. List processing in Simulation, storing list, linked storage allocation, simple C based Simulation language Simlib. Single server queueing Simulation, Simlib program steps and Simulation output

3 **Simulation software :**

Classification of Simulation software general purpose vs Application oriented Simulation packages. Modeling approaches, common modeling elements, entities attributes, resources and queries. Validation of Simulation model.
Features of Simulation software, animation and dynamic graphics, statistical capabilities, documentation, output reports and graphics, general purpose Simulation package: Arena, Object Oriented Simulation: Modsim III.

4 **Random process:**

Random variables, probability density functions and probability distribution functions. Random members and their properties, Randomness in message arrival time, type and length etc Review of sampling theorem for band limited signal and its representation using MATLAB, generation of random variables for specified probability density function. Gaussian process in communication system, generation of a multivariable gaussian process and its Simulation using MATLAB, Low and Band pass process Simulation.

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5 **Analog modulation :**

Amplitude modulation (double sided, single sided and vestigial side band type) of band limited message signal and its modulation, frequency analysis of AM signals. MATLAB Simulation of AM signals Angle modulation (Phase and Frequency) MATLAB Simulation of frequency modulation showing the spectra of message and modulation signals, comparison of demodulated output signals with the original message signal

6 **Digital signal transmission (Base band and band limited) :**

Additive white Guassian noise optimal receiver of AWGN channel, Probability of error. MATLAB Simulation of the above. Monte Carlo Simulation of binary communication system employing correlators of matched filters.
Transmission through band limited channels, power spectrum of pulse amplitude modulation, channel distribution, MATLAB Simulation of band limited channel, modeling as a linear filters (FIR or IIR), characterization of Inter symbolic interface based on transmitter and receiver filters, Communication system design for low ISI, Linear equalization and their design, equalizer design using MATLAB.

7 **Digital Transmission via Carrier Modulation :**

carrier amplitude modulation (ASK), Carrier Phase Modulation (PSK), Differential phase modulation (DPSK) and demodulation, Quadrature, amplitude modulation and demodulation, Carrier frequency modulation (FSK) and demodulation, MATLAB Simulation of above methods

8 **Source coding and channel coding:**

Source coding : Huffman coding, Quantization, pulse code modulation, MATLAB scripts for the above.
Channel coding : Linear block codes, cyclic block codes, Implementation of the above using MATLAB

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Text Books :

1 Simulation Modelling and Analysis – Averill M. Law & W. David Kelton
McGraw Hill International services

2 Contemporary Communication systems using MATLAB – John G. Proakis & Masoud Salehi
Brooks Cole Thomson Learning Publishers

VI. Reference Books :

1 Discrete Event System Simulation – Jerry Banks
Pearson Education International Series Publishers
2. Simulation of Communication Systems – Jeruelaim Philips Balaban
AT & T Bell Lab publ.
3. Simulation Modeling & Analysis – Aberilla David Eltron

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Satellite Communications			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction:**

   General background, frequency allocations for satellite services, basic satellite system, system design considerations, applications.

2. **Satellite Orbits:**

   Introduction, laws governing satellite motion, orbital parameters, orbital perturbations, Doppler effects, geostationary orbit, antenna look angles, antenna mount, limits of visibility, Earth eclipse of satellite, sun transit outage, inclined orbits, sun-synchronous orbit, launching of geostationary satellites.

3. **Wave Propagation and Polarization:**

   Introduction, atmospheric losses, ionospheric effects, rain attenuation, other impairments, antenna polarization, polarization of satellite signals, cross polarization discrimination, ionospheric depolarization, rain depolarization, ice depolarization.

4. **Satellite Antenna:**

   Antenna basics, aperture antennas, parabolic reflectors, offset feed, double relflector antennas, shaped reflector systems.

5. **Link Design:**

   Introduction, transmission losses, link power budget equation, system noise, carrier to noise ratio for uplink and downlink, combined uplink and downlink carrier to noise ratio, inter modulation noise

6. **Communication Satellites:**

   Introduction, design considerations, lifetime and reliability, spacecraft sub systems, spacecraft mass and power estimations, space segment cost estimates.

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7. **Earth Stations:**

Introduction, design considerations, general configuration and characteristics.

8. **Multiple Access Techniques:**

Introduction, FDMA, TDMA, FDMA/TDMA, operation in a multiple beam environment, CDMA, multiple access examples

9. **Non Geostationary Orbit Satellite Systems:**

Introduction, reasons, design considerations, case study, example of systems.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Text Books:

1. Satellite Communications – Dennis Roddy – 3rd edition, Mc-Graw Hill publication

2. Satellite Communications systems – M. Richharia – 2nd edition Mc Millan publication.

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Optical Fiber Communication			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Overview Of Optical Fiber Communications:**

   Communication system applications in the electromagnetic spectrum, elements of on optical fiber transmission link, advantages of optical fiber communication

2. **Light Propagation in Optical Fiber:**

   Fiber types, rays and modes, ray theory transmission, electromagnetic mode theory for optical propagation, single mode and multimode fibers, linearly polarized models.

3. **Fiber Optics Technology:**

   Fiber materials, fiber fabrication, fiber optic cables, couplers, splices, connectors

4. **Signal Degradation in Optical Fibers:**

   Alternation, dispersion, bit rate and bandwidths, mode coupling.

5. **Optical Sources and Detectors:**

   Related semiconductor physics, leight emitting diodes, laser diodes, their characteristics, modulation circuits, optical detection principles, quantum efficiency, responsively, response time photo detector noise, PIN and Avalanche photodiodes.

6. **Optical Receiver Operation:**

   Noise, Receiver capacitance, receiver structures, pre-amplifiers

7. **Optical Fiber Systems:**

   Link power budget, rise time budget, analog systems, digital systems, coherent systems – homodyne and heterodyne detection, multiplexing.

8. **Optical Fiber Measurements:**

   Measurement of attenuation, dispersion, refractive index profile, numerical aperture, fiber diameter, OTDR

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List of Experiments:

1. Analog fiber optic system
2. Digital fiber optic system
3. Measurement of numerical aperture
4. Measurement of attenuation
5. Measurement of pulse spreading
6. Multiplexing in fiber optic system
7. Light source characteristics
8. Measurements using OTDR

IV. Term Work:

Each student has to appear for at least two written test during the term. Report on experiments (at least six from the list of suggested experiments) along with a graded answer paper shall be submitted as term work.

The distribution of term work will be as follows:

Report on experiments – 15 marks
Written Test – 10 marks

V. Text Books:

1. Optical Fiber Communication – John Senion
   Prentice Hall of India Publication
2. Optical Fiber Communication – Gred Keiser
   Mc- Graw Hill Publication

VI. Reference Books:

1. Fiber Optic Communication – Djafar K. Mynbarv, Lowell L. Scheiner
2. Optical Fiber Communication – Selvarajan, Subartkar, T. Srinivas
   Tata Mc-Graw Hill Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Computer Communication Networks			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	2	
	Tutorial	-	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Communication networks and services:**

Network functions and network topology, basics of message switching, packet switching, circuit switching and cell switching.

2. **Application and layered architectures:**

Layering architecture, the OSI reference model, unified view of layers, protocols and services, overview of TCP/IP architecture, TCP/IP protocol.

3. **Telephone Network:**

Frequency division and time division multiplexing, synchronous optical network (SONET) and SONET multiplexing, space division and time division circuit switches, Telephone Network, integrated services digital network, network channel signaling and routing control.

4. **Peer to peer protocols:**

Peer to peer protocols and service models, service models, end to end requirements and adaptation functions, end to end versus hop by hop. ARO protocols, stop and wait ARQ, go-back-N ARQ, selective repeat ARQ, transmission efficiency of ARQ protocols, sliding windows flow control, timing recovery for synchronous services, reliable stream service, data link controls, HDLC data link control, point to point protocol, statistical multiplexing.

5. **Local area networks:**

Multiple access communications, local area networks (LAN) structure, the medium access control sub layer, the logical link control layer, random access, ALOHA, slotted ALOHA, CSMA, CSMA/CD, scheduling approaches to medium access control, reservation systems, polling, token passing rings, comparison of random access and scheduling medium access controls, IEEE 802.3 standards for 10Mbps and 1000 Mbps LANs, repeaters and hubs, LAN bridges, transparent bridges, source routing bridges, mixes media bridges, LAN switches, spanning tree algorithm.

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6. **Packet switching networks:**

Network services and internal network operation, packet network topology, connectionless packet switching, virtual circuit packet switching, routing in packet networks, routing algorithm classification, routing tables, hierarchical routing, link state versus distance vector routing, shortest path algorithms, the Bellman-ford algorithm, Dijkstra's algorithm, other routing approaches.

7. **Frame relay and asynchronous mode (ATM):**

Frame relay protocol architecture, frame relay call control, user data transfer network function, congestion control, ATM architecture, logical connection, ATM cells, transmission of ATM cells, ATM adaptation layers, ATM traffic management and Qos, FIFO and priority queues, fair queuing, congestion control, open loop control, closed loop control.

8. **TCP/IP:**

The Internet Protocol (IP), IP packet, IP addressing, subnet mask, classless interdomain routing (CIDR), address resolution, reverse address resolution, IP fragmentation and reassembly, ICMP, User Date gram Protocol (UDP), Transmission Control Protocol (TCP), TCP Reliable stream service, TCP operation, TCP protocol, Dynamic Host Configuration Protocol (DHCP), mobile IP IPv6, internet routing protocols, routing information protocols, open shortest path first protocol, border gateway protocol, multicast routing, reverse path broadcasting, internet group management protocol, reverse path multicasting, distance vector multicast routing protocol.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on six experiments along with a graded answer paper shall be submitted as term work.

The distribution of term work will be as follows:

Report on experiments – 15 marks
Written Test – 10 marks

V. Text Book:

1. Communication Networks – Leon Garcia, Indra Widjaja
   Tata Mc-Graw Hill publication

2. Data and Computer Communication – William Stallings
   Pearson Education publication

3. Computer Network – Larry L. Peterson
   Morgan Kaufmann

VI. Reference Books:

1. Data Communication and Networks – Forouzan,
   Tata Mc-Graw Hill publication

2. Telecommunication Networks - Scwartz
   Addison Wesley publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (1) Wireless Networks			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **An overview of 2nd and 3rd generation air interfaces:**

   Introduction, PCS Standardization, major attributes of CDMA systems, 3 G systems

2. **CDMA IS – 95 Call Processing:**
   Introduction, CDMA call processing state, CDMA registration, authentication.

3. **Soft handoff and power control in CDMA:**

   Introduction, types of handoff, Pilot sets, search windows, handoff parameters, handoff messages, handoff processing setup and end of soft handoff, pilot set maintenance

4. **Reverse and Forward link Capacity of a CDMA system:**

   Introduction, Reverse parameters in CDMA, multi-cell networks, inter-cell interference, reverse link capacity, cell loading, cell radius, Erlange capacity of a single cell, forward link capacity, CDMA cell size, Forward and reverse link balance, forward link budget.

5. **CDMA 2000 System:**

   Introduction, layering structure, logical channels used by PLICF, physical layer, forward link physical channels, forward link features, reverse physical channels, media access control and LAC sub-layer data services, mapping of logical channels to physical channels, evolution of CDMA one to CDMA 2000 systems.

6. **Wireless Local Loop:**

   Introduction, user requirement for a WLL system, WLL systems, WLL architecture, capacity of a CDMA WLL, W-CDMA WLL, Air-loop WLL system

7. **Wireless Application protocol, Bluetooth**

   Introduction, Wireless Application protocol, goals of WAP, WAP programming model, WAP architecture, Bluetooth, Blutooth protocol stack, Bluetooth link types, Bluetooth security, network connection establishment in Bluetooth, error connection in Bluetooth, network topology on Bluetooth, Bluetooth usage models, application of WAP and Bluetooth.

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IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

- Report on assignments – 15 marks.
  Written Test – 10 marks.

V. Text Book:

1. Wireless Network Evolution 2 G to 3 G - Vijay K. Garg
   Prentice Hall PTR publication

2. Mobile and Personal Communication Systems and Services – Raj Pandya
   Prentice Hall of India Publication

3. Mobile Communications – Schiller
   Addison Wesly Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (2): Digital Voice Communication			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Telephony Background:**

Analogue networks, switching systems, transmission systems, modulation, multiplexing, signaling, subscriber loop design, calculating resistance Limit, calculating loss limit, voice digitization, pulse code modulation (PCM), time division multiplexing, high order PCM multiplex systems, traffic analysis, traffic characterization, arrival and holding time, loss systems, lost calls, network blocking probabilities, delay systems, measurement of traffic congestion, lost calls and grade of service, availability. Handling of calls, infinite and finite traffic sources, probability distribution curves, erlange and Poisson traffic formulas.

2. **Digital switching and networks:**

Space division switching, time division switching, time space time (TST) switch, space time space (STS) switch, comparison of TST and STS switches, network synchronization, control and management, timing, timing inaccuracies, network synchronization, network control, network management.

3. **Integrated service digital network (ISDN):**

ISDN overview, conceptual network, ISDN protocol structure and standards, ISDN interfaces and functions, transmission structure, user network interface, ISDN protocol architecture, ISDN connection, addressing, internetworking, ISDN physical layer: basic rate user network interface, primary rate user network interface, U interface, ISDN data link layer: LPAD protocol, terminal adaptation, bearer channel data link control, ISDN network layer: basic call control, control of supplementary services, signaling system no. 7 (SS7): signaling date link level, signaling link level, network level , ISDN signaling connection control part, ISDN user port, broadband ISDN(B – ISDN): (B – ISDNS) standards, architecture protocol reference model , B-ISDN, physical layer.

4. **Access Technologies:**
High-speed digital subscriber loops (DSL), ADSL, HDSL, VDSI, wireless local loop (WLL).

5. **Voice over IP:**

TCP/IP protocol family, internet protocol (IP) header, IP addressing, internet control manage message protocol (ICMP), transport protocol, quality of service on IP, Ethernet frame, LAN queing, resource reservation protocol (RSVP), multi protocol label switching, real time protocol

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(RTP), session initiation protocol (SIP). H. 323 standard media gateway control protocol, voice over IP gateway case studies, voice coding, properties of speech, waveform coding, vocoding, hybrid coding, telephony, signaling call set up, local loop. PBX interfaces.

6. **Voice over other packet networks:**

Voice over frame relay (VoFR), frame relay frame format, frame length handling, fragmentation, frame prioritization, frame loss handling, echo cancellation, silence suppression telephony signaling, VoFR standard, voice over ATM, ATM cell format, ATM protocol stack, ATM adaptation layer, IP over ATM, frame relay over ATM.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Digital Telephony – John C. Bellamy
2. ISDN and Broadband ISDN with Frame Relay and ATM – William Stalling.
   4th Edition, Pearson education Asia publication
3. Voice & Data Interworking – Gil Held
   Tata McGraw Hill publication.

VI. **Reference Books:**

1. IP Telephony – Oliver Hersent, David Gurle & Jean – Pierre Petit.
   Edition: 2001, Pearson Education Asia publication
2. Voice over packet networks – David J. Wright.
   John Wiley Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (3): Telecommunication Network Management			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Foundations:**

Network management standards, network management model, organization model, information model abstract syntax notation 1 (ASN.1), encoding structure, macros, functional model.

2. **Network management application functional requirements:**

Configuration management, fault management, performance management, Error correlatio technology, security management, accounting management, common management, report management, polity based management, service level management, management service, community definitions, capturing the requirements, simple and formal approaches, semi formal and formal notations.

3. **Telecommunication management network (TMN) architecture:**

Terminology, functional architecture, information architecture, physical architecture, TNN cube, TMN and OSI

4. **Common management information service element (CMISE):**

CMISE model, service definitions, errors, scooping and filtering features, synchronization, functional units, association services, common management information protocol (CMIP) specification.

5. **Information Modeling for TMN:**

Rationale for information modeling, management information model, object oriented modeling paradigm, structure of management information, managed object class definition, management information base (MIB)

6. **Simple network management protocol (SNMP):**

SNMPv1: managed networks, SNMPmodels, organization model, information model, SNMPv2: communication model, functional model, major changes in SNMPv2, structure of management information (SMI), MIB, SNMPv2 protocol, compatibility with SNMPv1, SNMPv3, architecture, applications, MIB security, remote monitoring (RMON) SMI and MIB, RMON1 and RMON2.

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7. **Network management examples:**

ATM integrated local management interface, ATM MIB. M1, M2, M3, M4, interfaces, ATM digital exchange interface management, digital subscriber loop (DSL) and asymmetric DSL (ADSL) technologies, ADSL configuration management, performance management.

8. **Network management tools:**

Network statistics management, network management system, management platform case studies: OPENVIEW, ALMAP.

IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Text Books:

1. Network Management: Principles and Practice – Mani Subramanian, Addison Wesley, Pearson Education Asia publication.
2. Fundamentals of Telecommunication Network Management – Lakshmi Raman IEEE Communication Society, Prentice Hall of India Edition 1999
3. Telecommunication Network Management: Technologies and Implementations – Airdarous Salah, Plevyak Thomas. Prentice Hall of India

VI. Reference Books:

1. Telecommunication Network Management – Haojin Wang Mc- Graw Hill Professional Publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (4): Microwave Amplifier and Oscillator Design			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **S – Parameters:**

   Definition and use with amplifiers

2. **Noise in linear 2 port:**

3. **Microwave transistor s- parameters and tuning elements:**

   Microwave bipolar transistor, DC Biasing, impedance matching, example of transistor s-parameters and noise parameters.

4. **Amplifier Design:**

   One stage

5. **High Power Amplifier Design:**

   Device modeling and characterization, optimum loading, single stage design, multistage design.

6. **Oscillator Design:**

   Compressed Smith chart, series and parallel resonance, resonator, 2-port oscillator design, Negative resistance from transistor model oscillator, Q and output power, noise in oscillators, analytical approach to optimum oscillator design using S-parameters, non linear oscillator model, oscillator design using non linear CAD tools.

7. **Microwave Mixer Design:**

   Diode Mixer theory, single diode mixer, balanced mixer, FET mixer theory, balanced FET mixers

8. **Microwave Control Circuit Design:**

9. **Microwave Rectifier and detector design:**

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IV. Term Work:

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. Reference Books:

1. Microwave Circuit Design – George D. Vendelin, Anthony M. Pavio & Ulrich L. Rehde John Wiley & Sons publication

2. Radio Frequency and Microwave Electronics – Matthew M. Radmanesh Pearson Education Asia publication

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (5): Optical Networks			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Optical Amplifiers:**

   Stimulated emission, Spontaneous emission, erbium- doped fiber amplifiers, praseodymium doped fiber amplifiers, semiconductor optical amplifiers, noise accumulation and network size restriction.

2. **Optical Filters:**

   Overview, Silica waveguide type filters, bulk type filters, another filters.

3. **Photonic Switches:**

   Time Division Switching (TDS), Wave Division Switching (WDS), fast – packet switching, multi dimensional switching system, OTDM, broadcast OTDM networks

4. **First Generation Optical networks:**

   SONET/SDH, computer interconnects, metropolitan area networks, layered architecture, high speed local area networks (LAN), single and multi-hop optical FDM local area networks, WDM and DWDM.

5. **Broadcast and select networks:**

   Topologies, Media Access Control (MAC), protocols, testbeds

6. **Wavelength Routing Networks:**

   Optical layer, mode designs, network design and operation, optical layer cost trade offs, routing and wavelength assignment.

7. **Virtual Topology Design (VTD):**

   Virtual Topology design problems, combined SONET / WDM problem, integer linear programming formulation, regular virtual topologies, implementation in broadcast and select networks.

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8. **Access networks:**

Network architecture overview, access networks – HFC & FTTC, Optical access network architecture.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Reference Books:**

1. Optical Networks – Rajiv Ramaswami, Kumar N. Sivarajan
Hartcourt Asia PTE Limited publication.

2. Optical FDM Network technologies – Kiyoshi Nasu
Artech House Inc. publication.

3. Photonics in switching , Vol II – Edited by John E. Midwinter,
Academic Press publication

4. Optical Networking & WDM – Walter Goralski
Tat Mc-Graw Hill publication.

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III.

Class: B.E. (Electronics And Telecommunication Engg.)		Semester VIII	
Sub: Elective II (6): Internet Communication Engineering			
Periods per week 1 Period of 60 min.	Lecture	4	
	Practical	-	
	Tutorial	2	
		Hours	Marks
Evaluation System	Theory Examination	3	100
	Practical	--	-
	Oral Examination	--	25
	Term work	--	25
Detailed Syllabus			

1. **Introduction to TCP / IP:**

TCP/IP networking model, layer functions, TCP/IP protocols, services, sockets and ports, encapsulations, differences between ISO and internet layering.

2. **Internetworking layer:**

Internet protocol (IP) datagram header fields and their functions, Internet control message protocol, IP address classes, brodadcast, multicast and special addresses, network space and host space, subnets and supernets, private IP addresses, classless inter domain routing (CIDR), CIDR subnet addressing, variable length in CIDR subnet addressing.

3. **Transport layer:**

User datagram protocol (UDP) header fields and their functions, pseudo header, transmission control protocol (TCP), need for stream delivery, properties of reliable stream delivery, TCP header fields, ports, connections, end points, passive and active open, segment, stream and sequence numbers, variable window size and flow control, out of band data, checksum, acknowledgement and retransmission, round trip samples, Karn's algorithm, timer back off, response to delay variation and congestion, TCP state machine, connection establishment.

4. **Domain name system (DNS):**

Internet domain name, mapping domain name and address, domain name resolution, efficient translation, caching, DNS server message format, compresed name format, abbreviation of name, inverse mapping, pointer queries.

5. **Dynamic host configuration protocol (DHCP):**

IP address management with DHCP, standard address discovery process, address renewal process, address release process, DHCP packet structure.

6. **IP Routing:**

Table driven routing, next hop routing, default routing, the IP routing algorithm, distance vector protocol, link state protocol, routing characteristics, convergence, split horizon, poison reverse, time to line, areas, autonomous system, border routers, routing information protocol (RIP), open shortest path first (OSPF), border gateway protocol (BGP), internet control message protocol

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(ICMP), ping, echo request and reply message format, congestion and datagram flow control, source quelch, route discovery.

7. **TCP / IP Security:**

IP security (IPSec.), authentication header (AH), encapsulating security payload (ESP), mutable header fields, tunneling, firewalls and internet access, firewall implementation, packet filtering, proxy access through firewall, network address translation (NAT), port mapped NAT.

8. **IP Version6 (IPv6):**

IPv6 address format and types, routing considerations, packet header fields and their functions, auto configuration, quality of service, security, mobile users.

9. **Voice and Video over Internet:**

Voice digitization standards for voice over IP, code excited linear predictive coders (CELP), G.729, G.723.1 and G.728 standards, telephony and internet approaches for voice over IP, digital video, MPEG-2, MPEG-4, MPEG-6, H.323 architecture, H.323 protocol stack, gatekeeper, admission and status operations, internet multimedia protocols, RTP, Real time control protocol, RSVP, IP multicast, MBONE.

IV. **Term Work:**

Each student has to appear for at least one written test during the term. Report on eight assignments on all the topics along with a graded answer paper shall be submitted as termwork.

The distribution of term work will be as follows:

Report on assignments – 15 marks.
Written Test – 10 marks.

V. **Text Books:**

1. Internetworking with TCP / IP, Vol. I – Douglas Comer
Prentice Hall of India publication

2. IP Telephony – Oliver Hersent, David Gurle & Jean Pierre Petit. Edition - 2001
Pearson Education Asia publication

VI. **Reference Books:**

1. Advanced Internet Technologies – Uyless Black
Prentice Hall of India publication

2. Guide to TCP /IP – Laura A. Chappell, Ed. Tittel
Thomson Learning publication

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Enclosure to Item No._____

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Revised Scheme & Syllabus

for

B. E. (Biomedical Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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SUBJECT WISE DETAILED SYLLABUS

Class: B.E. Biomedical Engineering		**Semester: VII**	
Sub: Industrial Inplant Training - Industry / Hospital			
Periods per week 1 period of 60 mins	Duration - 20 Weeks	Industrial Supervision: 6 HRS. / Week	
		Hours	*Marks*
Evaluation System	Theory Examination	--	--
	Practical	--	--
	Oral Examination	--	100
	Term Work	--	100

Term work: Term work will consist of a report based on Industrial inplant training, weekly reports in form of typed and bound report suitably graded by the supervisor.

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Class: B.E. Biomedical Engineering		Semester: VIII	
Sub: ADVANCED BIOMEDICAL INSTRUMENTATION			
Periods per week 1 period of 60 mins	Lecture	3	
	Practical	2	
	Tutorial		
		Hours	*Marks*
Evaluation System:	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	50
	Term Work	--	25
Detailed Syllabus:	1. Physiotherapy, Electrotherapy and Radiation Therapy Equipments: Basic principle, working and technical specifications of Shortwave Diathermy, Ultrasonic therapy unit, Infrared and UV lamps, Nerve and Muscle Stimulator, Radiation and Physical therapy Units. 2. Surgical Instruments: Surgical Diathermy unit, electrodes used for surgery, modes of operation and Safety aspects. Surgical Diathermy Analyzer. Operation table and lights. 3. Ventilators and Respiration therapy equipment. 4. Cardiac Pacemakers: Modes of operation, leads and electrodes. Power supply sources. External and Implantable Pacemakers. Performance aspects of Implantable Pacemakers. 5. Cardiac Defibrillator: DC defibrillator, modes of operations and electrodes. Performance aspect of dc defibrillator. Implantable defibrillator and defibrillator analyzer. 6. Hemodialysis Machine: Basic principle of dialysis. Different types of dialyser membranes. Portable type. 7. Neonatal Monitoring. 8. Lasers applications in Biomedical Engineering. 9. Telemedicine concepts and its application. 10. Heart rate variability measurement and applications. 11. Endoscopy and its applications.		

Term work: Term work will consist of at least six laboratory Experiments based on the above syllabus. Test and Assignments / seminars be suitably graded by teacher and attached in the journal.

Text Books:

1. Handbook of Biomedical Instrumentation: R. S. Khandpur. (PH Pub)
2. Medical Instrumentation, Application and Design: J. G. Webster. (John Willey)

Reference Books:

1. Encyclopedia of Medical Devices and Instrumentation: John G. Webster. Vol I, II, III, IV (PH Pub)
2. Introduction to Biomedical Equipment Technology: Carr - Brown. (PH Pub)
3. Various Instruments Manuals.

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Class: B.E. Biomedical Engineering		Semester: VIII	
Sub: BIOLOGICAL MODELLING AND SIMULATION			
Periods per week 1 period of 60 mins	Lecture	3	
	Practical	2	
	Tutorial	--	
		Hours	*Marks*
Evaluation System:	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	50
	Term Work	--	25
Detailed Syllabus:	1. Open and Closed loop systems, basic concepts of feedback control systems, stability criteria, speed of response. 2. Physiological Modeling: Modeling Technology and .Techniques, linear modeling, Distributed-parameter versus Lumped parameter models, Models with combinations of system elements compartmental modeling and inverse problem. Modeling of physiological systems like Circulatory system and Respiratory system. 3. Thermoregulatory system: Thermoregulation, Controller model, model validation and variations. 4. Neuromuscular system: Stretch reflex, control of joint angle by antagonist muscles, two control mechanism, golgi tendon organs, experimental validation of the models, parkinsons syndrome. 5. Models of Human movement: Four Eye movement, Quantitative eye movement models, and techniques for validating models, parameter estimation, linearising the model. 6. Model of neurons: Hodgkin - Huxley model, Iron wire model.		

Term work: Term work will consist of test / assignments / seminars based on above syllabus. Test and Assignments / Seminars be suitably graded by teacher and attached in the journal

Text Books and Reference Books:

1. Bioengineering, Biomedical, Medical and Clinical Engg. - By A. Teri Bahil.
2. Mathematics and Computers in Biomedical Applications - by J. Elseafedel, C. Delisi.
3. Encyclopedia of Medical Devices and Instrumentation: John G. Webster. Vol I, II, III, IV (PH Pub)

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Class: B.E. Biomedical Engineering		Semester: VIII	
Sub: PRINCIPLES OF IMAGE PROCESSING			
Periods per week 1 period of 60 mins	Lecture	3	
	Practical	2	
	Tutorial	--	
		Hours	*Marks*
Evaluation System:	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	50
	Term Work	--	25
Detailed Syllabus:	1. Image acquisition, processing, Communication, display, and Visual perception: Structure of the human eye, Image formation in the eye, Brightness, adaptation and discrimination. Image model: Uniform and Non-uniform sampling, quantization. 2. Image Transforms: Fourier transforms, FFT, Discrete cosine transforms, Walsh, Harr transforms 3. Image Enhancement: Contrast manipulation, Histogram modification, noise cleaning, edge sharpening, Frequency domain methods, Low pass and high pass filtering, homomorphic filtering 4. Image Segmentation: Detection of discontinuity, Point Line and Edge detection, and Edge linking and boundary detection, Threshold, Hough Transforms. 5. Image compression: Fundamentals, Image compression models, Error free compression, Lossy compression, Compression standards GIF, TIFF, and JPEG. 6. Representation and descriptions: Boundary descriptors, region descriptors, morphology-dilation, erosion, opening, closing, hit or miss filter. 7. Biomedical Application: Computer Tomography (Radon Transform, Back Projection Operator), MRI Images, processing of Radiograph, Angiogram, Sonography including doppler Technique. The applications of the above for processing of images such as brain, kidney, liver, thyroid Glands etc.		

Term work: Term work will consist of at least six laboratory Experiments based on the above syllabus. Test and Assignments / Seminars be suitably graded by teacher and attached in the journal.

Text Books:

1. Digital Image processing: Rafael C. Gonzalez and Richard E. Woods (Addison Wesley Pub)
2. Fundamentals of Digital Image Processing: Anil K. Jain (PHI Pub)

Reference Books:

1. Digital Image processing: William Pratt (John Wiley)

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Class: B.E. Biomedical Engineering		Semester: VIII	
Sub: ELECTIVE A: NUCLEAR MEDICINE.			
Periods per week 1 period of 60 mins	Lecture	3	
	Practical	2	
	Tutorial	--	
		Hours	*Marks*
Evaluation System:	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	50
	Term Work	--	25
Detailed Syllabus:	1. Introduction to Nuclear Medicine (Birds Eye View). 2. Nuclear Medicine Instrumentation: Radiation detectors, gas filled detectors, scintillation detectors, and pulse height analysis, gamma ray spectrometry. Functional block diagram of counting systems, measurement of radioactivity, invivo and invitro. 3. Invitro Assays: Principles of Radioimmunoassays, quality assurance in RIA and other related Techniques. 4. Radiopharmacy: Introduction to hospital radio pharmacy, ideal characteristics of radiopharmaceuticals, radio nuclide generators. 99Mo - 99mTc generators, preparation of 99mTc labeled radiopharmaceuticals. Mechanism of localization of Radiopharmaceuticals in Nuclear Medicine. 5. Radiation safety and protection: Concepts of radiation safety. External radiation hazards and prevention, shielding, time, distance. Internal radiation exposure: Injection, inhalation, and ingestion. Biological effects of acute and chronic radiation exposure. Disposal of radioactive biological waste materials. 6. Computers in Nuclear Medicine: Its role as data storage, retrieval. Quantitative Nuclear Medicine - Image reconstruction and quality assurance. 7. Recent trends in Nuclear medicine: Disease specific radiopharmaceuticals and newer concepts in nuclear medicine.		

Term work: Term work will consist of reports of visits arranged at Nuclear Medicine Centers in hospitals and assignments / seminars based on the above syllabus. Test and Assignments / Seminars be suitably graded by teacher and attached in the journal

Text Books and Reference Books:

1. Medical Radiation Physics - edited by William Hendee. (Academic Press)
2. Instrumentation in Nuclear medicine - edited by G. Hine - Vol I and II.(Academic Press)
3. Clinical Scintigraphy - edited by P. M. Johnson and L. Freeman - Vol I, II and III. (John Wiley)

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Class: B.E. Biomedical Engineering		Semester: VIII	
Sub: ELECTIVE B: HOSPITAL MANAGEMENT AND INFORMATION SYSTEMS			
Periods per week 1 period of 60 mins	Lecture	3	
	Practical	2	
	Tutorial	--	
		Hours	*Marks*
Evaluation System:	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	50
	Term Work	--	25

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Detailed Syllabus:	1) Organizations & Basic Techniques of Managements. Types of Organizations or establishments. (Commercial, non-commercial-companies, shops, hospitals & medical services, trusts/charitable organizations, home etc). Basic principles of managements-Need & Methods Areas of applications in various organizations with particular reference to hospitals, nursing homes medical centers etc. Applications /Use of computers in managements or computerization in management. 2) Non-medical or Engineering services in hospitals –overview. General maintenance in hospital –overview Civil, Electrical, AC & R, Biomedical & Communication, Utilities (like Systems for Sterilization, Medical Gas supplies, Laundry, Incinerator, Water supply & Sanitary systems, Lifts/Elevators etc.), and Security & Fire Fighting services. Waste management -with particular ref. To Biomedical waste (Hazards, Risk factors, Precautions/care, Methods etc.) Other supportive services -house keeping etc. 3) Biomedical Engineering dept./services. Basic concept (need & advantages) & responsibilities. Identification of responsibilities. Setup and requirements- Infrastructure- space / location, Man-power, Office & Workshop facilities (Administration / Operation setup, tools & equipments, records & documentation, inventory of instruments / equipments / systems- Manuals, database engineering stores (spares etc).) Identification of instruments / equipments / systems & logging / labeling. (Medical, Laboratory / Analytical, Communication and others) Understanding basics of operation & applications of Instrument / system. Maintenance techniques: Concept of preventive maintenance - scheduling implementation (performance test and calibration) & tracing record. Break down / corrective maintenance - understandings problem & its root cause, trouble-shooting techniques, precautions / care, logging record. Applications of computer in BME Services. 4) Evaluation of instruments / equipments / systems. Basic configuration, add on peripherals & cost of repairs & maintenance. Preparation of statement for comparison / product evaluation and also final purchase agreement etc. Preparation of terms & conditions for maintenance contract. Up- gradation possibilities & effective cost. Disposal / substitution. Salvage / condemn procedure. Waste management -with particular reference to biological / biomedical waste (Concept, procedures, hazards & risk factors involved.) 5) Applications / use of computers in biomedical engineering services – office management, documentation of all records. Maintenance of computers / computerized equipments or systems. 6) Maintenance of communications systems and instruments, PA/ paging systems, Documentation / reprographic equipments (photo-copying machine), items used for entertainment (TV, VCR, Ect)

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Term work: Term work will consist of test, assignments and Seminars based on the above syllabus, be suitably graded by teacher and attached in the journal.

Text Books and Reference Books:

1) Computers in Medicine. R.D. Lele. (TMH Pub)
2) Hospital planning, Design and Management: Kundrs G.D, S. Gopinath, A.Katakam (Private Pub Bangalore)
3) Hospital Care and Hospital Management AICTE Journel Vol.1, 2,3 by Dr.Kalanidhi. (AICTE Pub Bangalore)

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Class: B.E. Biomedical Engineering		Semester: VIII	
Sub: ELECTIVE D: TELEMEDICINE			
Periods per week 1 period of 60 mins	Lecture	3	
	Practical	2	
	Tutorial	--	
		Hours	*Marks*
Evaluation System:	Theory Examination	3	100
	Practical	--	--
	Oral Examination	--	50
	Term Work	--	25
Detailed Syllabus:	1) Introduction: Concept of Telemedicine, Elements of typical Telemetry system. Implementation in diagnosis health care 2) Information Systems: Acquisition of patient data, data compression, and data display, interpretation and remote accessibility. 3) Telemetry Systems and methods, mobile equipments, Satellites and its applications. 4) Internet and Applications in distance health care. 5) Video conferencing for health care diagnosis, decision-making, digital camera and its applications. 6) Artificial intelligence systems in health care and diagnosis. 7) Teleradiology. 8) Teletherapy. 9) Telepathology. 10) Telemedicine training to personnel for diagnosis and health care.		

Term work: Term work will consist of laboratory work, Seminar and assignments based on the above syllabus. Tests, laboratory work. Seminar reports and assignments be suitably graded by the teacher and attached in the Journal.

Textbooks and References Books:

1) E-health, Telehealth and Telemedicine - A guide to start-up and success.
Marlene M Meher et al (Jessey - Bass health Services)
2) Essentials of Telemedicine and Telecare - A.C. Morris (Paper Back) (Academic Press)
3) Guide to Medical Informatics, the Internet and telemedicine-Enrico Coiera (Paper back) (National Academic Press - Washington)
4) Telemedicine: A guide to Telecommunication in health care. - Institute of Medicine. (National Academic Press - Washington)
5) Harris Corporation - Guide to telemedicine.

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Class: B.E. Biomedical Engineering		Semester: VIII	
Sub: PROJECT WORK			
Periods per week 1 period of 60 mins	Project work:	6 HRS. / W	
		Hours	*Marks*
Evaluation System:	Theory Examination	--	--
	Practical	--	--
	Oral Examination	--	50
	Term Work	--	50

Term work: Term work will consist of Project work carried out in the laboratory / Industry / Hospital. A typed report based on the project work carried out be suitably graded by a Guide.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Chemical Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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SCHEME OF INSTRUCTIONS AND EXAMINATION
UNIVERSITY OF BOMBAY

COURSE: B.E. (CHEMICAL ENGINEERING) SEMESTER: VII
YEAR : B.E.

Sr. No.	Subject	Scheme of Instructions 1 Hr. periods			Duration of papers Hrs.	SCHEME OF EXAMINATION				
		Lecture	Practical	Tutorial		Theory Paper	Term-work/ Assign-ment	Practical	Oral	Total
7.1	Chemical Process-II	3	-	2	3	100	25	-	-	125
7.2	Process Engineering	2	-	2	3	100	25	-	-	125
7.3	Instrumentation & Process Control	4	3	-	3	100	25	25	-	150
7.4	Chemical Reaction Engineering	4	3	-	3	100	25	25	-	150
7.5	Entrepreneurship & Management	2	-	-	2	75	-	-	-	75
7.6	Project – A	-	-	2	-	-	25	-	25	50
7.7	Elective- II	3	-	2	3	100	25	-	-	125
	TOTAL	18	6	8	-	575	150	50	25	800

Elective-I:(1)Biochemical Engineering (2)Polymer Engineering (3)Food Process Engineering(4)Petrochemical & Refining Technology

COURSE: B.E. (CHEMICAL ENGINEERING) SEMESTER: VIII
YEAR : B.E.

Sr. Sno.	Subject	Scheme of Instructions 1 Hr. periods			Duration of papers Hrs.	SCHEME OF EXAMINATION				
		Lecture	Practical	Tutorial		Theory Paper	Term-work/ Assign-ment	Practical	Oral	Total
8.1	Environmental Engineering	3	3	-	3	100	25	25	-	150
8.2	Project Engineering & Management	3	-	2	3	100	25	-	-	125
8.3	Industrial Safety	3	-	2	3	100	25	-	-	125
8.4	Process Simulation & Design	3	3	-	3	100	25	-	-	125
8.5	Elective-III	3	-	2	3	100	25	-	-	125
8.6	Project –B	-	6	-	-	-	100	-	50	150
	TOTAL	15	12	6	-	500	225	25	50	800

Elective-II: (1)Multiphase Reactors Design(2)Energy System Design (3)Adsorptive Process Design (4)Membrane Process Design

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.1 CHEMICAL PROCESSES - II

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS

1. Introduction **3 hrs.**

An overview of the present day organic chemical processing in India including perspectives on agro and other raw material resources available as starting materials for industries such as : * Vegetable Oils & Animal Fats * Natural Waxes / resins * Sugar and Alcohol Industry * Starch Industry * Paper and Pulp Manufacturing Industry * Essential Oils and Flavour Ingredients Industry * Food and Agro products

2. Basic Building Blocks of Petrochemical Industry **9 hrs.**

* Treatment of Crude Oils and the products therefrom * Refining vs. Cracking * Manufacture of Ethylene, Propylene, Butenes, Butadiene, Benzene - Toluene - Xylene, Isomerization of Xylenes, Separation of Xylene Isomers

3. Synthesis of Important Heavy Organic Chemicals & Intermediates **14 hrs.**

* Styrene * Cumene * Phenol * Purified Terephthalic Acid * Acetaldehyde and Acetic Acid * Caprolactum * Vinyl Chloride * Chlorobenzene * Nitrobenzene

4. Synthesis of Polymers **8 hrs.**

* Polyehtylene : LDPE, LLDPE and HDPE; * Polyester Fibre * Nylon * PVC

5. Overview of Other Industrially Important Products **6 hrs.**

* Paints, Varnishes and Lacquers * Soaps and Detergents * Dyes and Intermediates * Agrochemicals * Pharmaceuticals : Penicillin * Speciality chemicals such as Perfumery Chemicals, Electronics Grade Chemicals, Speciality Polymers

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Important Notes regarding Content of Instruction

While discussing the manufacturing process, the following areas should be highlighted so that the relevance and application of the various subjects covered in the B.E. course can be underscored :

- Chemistry, stoichiometry and alternative routes / raw materials involved
- Byproducts and purification / separation techniques
- Flow diagram and its concordance with the chemical and purification steps / chemical engineering principles
- Thermodynamic, kinetic and catalyst considerations for the process conditions adopted
- Energy Considerations and Conservation Measures adopted
- Chemical and Engineering aspects of the process design / Key equipment design and materials of construction
- Safety and Environmental engineering aspects of the process of manufacture

TERM WORK:

1. Tutorials: A minimum of four mandatory visits to chemical process industry is to be treated equivalent to a total of 26 hours of tutorials. The faculty members are expected to accompany the students.
2. Each student must prepare a four page report on each visit stressing on the process, environmental, safety measures, major equipment, process control equipment (if any) etc. while highlighting the new information obtained.
3. The performance of the students during the visit and evaluation of the report together with an average of a minimum of two tests should contribute towards term work.

TEXT BOOKS

1. Austin, G. T., "Shreve's Chemical Process Industries", 5 th Edition, McGraw Hill International Edition, latest edition.
2. Pandey G. N., "A text Book of Chemical Technology", Vol. I & II, Vikas Publications, 1984
3. Rao, G. N. and Sittig, M., Dryden's Outlines of Chemical Technology for 21 st Century", East West Press, latest edition
4. Bhaskarrao, B. K., "A Text on Petrochemicals", Khanna Publishers, 2 nd Edition 1993 or latest

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REFERENCES

1. Heaton, C.A., "An Introduction to Industrial Chemistry", Leonard Hill, 1984
2. Ibid, "The Chemical Industry", ibid, 1986
3. Thompson, R., "Modern Inorganic Chemicals Industry", Royal Society of chemistry, 2 nd Ed., 1994
4. Kirk-Othmer's " Encyclopaedia of Chemical Technology", John Wiley & Sons Inc., 4 th Ed., 1990
5. Ullmann's "Encyclopaedia of Industrial Chemistry", VCH, 1985
6. Pletcher, D., and Walsh, F. C., "Industrial Electrochemistry", Chapman & Hall, 1990
7. Groggins, P. H., "Unit Processes of Chemical Syntheses", McGraw Hill Inc. Latest edition

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.2 Process Engineering

LOAD PER WEEK:	LECTURES	: 2 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

Scope: The subject intends to expose the students to the techniques involved in Preliminary process selection. Flow sheet synthesis. Selection of process steps & grouping in synthesis separation & inter-connection. Sizing of major equipment and costing. Control strategy. Development of P & ID. Mass & Energy Balances. Utility selection & Energy optimisation.

1. Preliminary Process selection: Economic evaluation. Environmental footprint. Safety analysis & controllability. Flexibility. (1 Hrs)
2. Selection of Process Steps. Identification of individual process steps. Grouping into reactor, separators, reactor and recycle modules, interconnection modules.(1 Hrs)
3. Flow sheet synthesis: Development of alternative routes. Selection criterion for modules. Selction of reactor modules. Selection of separation modules. Determination of flow sheet based on heuristics. Batch vs Continuous process. (4 Hrs)
4. Control strategy for process Selection of most suitable parameters to be controlled for equipments listed under 7 below. Development of P & ID (Text book 4).(3 Hrs)
5. Safety Instrumentation and Multiple redundancy systems. (2 Hrs)
6. Mass & Energy Balances: Physico-chemical specification of each stream. Detailed Mass & Energy balance around major equipment listed in 7 below. (4 Hrs)
7. Sizing & Costing of Major Equipment. (Short cut methods of sizing only) Reactors, Heat Exchangers, Multiple effect evaporators, Distillation equipment, Gas-Liquid and Liquid-Liquid Contacting Equipment, Crystallizers, Drying equipment, Filtration equipment, Selection and sizing of pumps and compressors. (8 Hrs)
8. Utility selection: Process requirement & selection of utility such as refrigerant, chilled water, cooling water, steam, hot oil, Dowtherm boilers, molten salt baths, flue gases. Strategies for heat exchange between process streams. (3 Hrs)

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TERM WORK

1. A minimum of 10 assignments should be performed at regular intervals. The assignments may be designed to apply the learned techniques for the following unit process. Sulphonation of liquid substrates. Nitration. Halogenation. Oxidation. Liquid phase Gas phase Hydrogenation Aminoxidation.
2. The performance of the students should be evaluated based on each assignment giving suitable weightage to punctuality and contents.
3. Point nos 1 and 2 above should along with an average of a minimum of two tests should contribute towards term work.

TEXT BOOKS

1. "Conceptual Design of Chemical Processes". J. M. Douglas, McGraw Hill International Editions, 1988.
2. Strategy of Process Engineering, John D. F. Rudd & C.C. Watson. Wiley & Sons International, 1968.
3. Chemical Engineering Design Project, M.S. Ray & M.G. Sneesby, Gordon & Breach Science publication, 2nd Edition 1998.
4. Chemical Process Control, George Stephanopoulos, Eastern Economy Edition, Prentice Hall of India Pvt Ltd (Chapters 23, 24 and 25),
5. Systematic Methods of Chemical Process Design. Loren T Biegler, Grossman E. I., Westerberg, A.W. Prentice Hall Intl Edition, 1997.

REFERENCE BOOKS

1. Perry J. H. and Chilton, Perrys Chemical Engineering Handbook, 6th Edition, McGrw Hill, 1984 (or a later edition when available).
2. Walas, S. M. Phase equilibria in Chemical Engineering, Butterworth, Boston 1985.
3. Schweitzer, P. A., (Ed), Handbook of Separation Techniques for Chemical Engineers, McGraw Hill, New York, 1988
4. Walas, S. M., Chemical Process Equipment: Selection and design, Butterworth, London, 1989.
5. Sieder, W. D., Seader J. D. and Lewin D. R., Process Design Principles: synthesis analysis and evaluation John Wley and Sons, 1998.

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.3 Instrumentation and Process Control

LOAD PER WEEK:	LECTURES	: 4 Hrs.
	PRACTICALS	: 3 Hrs.
	TUTORIALS	: Nil.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: 25 Marks
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 150 Marks

DETAILED SYLLABUS

1. **Introduction:** Motivation for process control. Concept of feedback control. Process dynamics in time, Laplace and frequency domains. Concepts of stability and optimal control. (4 hrs.)
2. **Chemical Process Instrumentation:** General performance characteristics of Instruments. Transducers and their classification Electrical passive and electrical active. Elastic, Resistance, capacitive and inductive transducers for temperature, level, flow and pressure measurements; other special types of instruments such as ultrasonic flow meter, pyrometer and review of flow meters. (10 hrs.)
3. **Control Valves:** Types of valves. Inherent and effective valve characteristics. Selection and sizing of valves. (2 hrs.)
4. **Process Dynamics:** Models of first and second order systems and their transfer functions. Linearization of non-linear systems. Response to step, ramp, sinusoidal, pulse, and impulse inputs. Systems in series-interacting and non-interacting. (10 hrs.)
5. **Modes of Control:** On-off control Proportional, Integral, Derivative modes and their combinations. Open-loop behavior of controllers. (2 hrs.)
6. **Transient Response:** Closed -loop transfer functions. Transfer functions for Servo and Regulatory problems. Transient behavior of closed-loop systems. (4 hrs.)
7. **Stability of Control Systems:** Bounded input bounded output stability. Routh's stability criteria (2 hrs.)
8. **Root Locus:** Concept of root-locus. Rules for plotting root-locus diagrams. (4 hrs.)
9. **Frequency Response:** Frequency response analysis. Bode and Nyquist stability criteria. Gain margin and Phase margin in controller tuning. Performance criteria- IAE, ISE, IATE. Zeigler - Nichols and Coon-Cohen rules. (6 hrs.)

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10. **Digital Control Systems:** Fundamentals of digital control, A/D converters, D/A converters Introduction to the Z-transform. Direct digital control and Distributed control systems. (4 hrs.)
11. **Advanced Control Strategies:** Ratio Control, Cascade control, adaptive control etc. (2 hrs)
12. **Applications of Process Control:** Control Strategy for distillation column, reactor, Heat exchanger (2 hrs.)

TERM WORK

1. A minimum of four assignments should be given at regular intervals.
2. The following parameters should be considered for laboratory performance evaluation. a. Punctuality, b. diligence, c. contents of journal (originality of discussions)
3. Point nos 1 and 2 above and the average of a minimum of two tests should account for term work.
4. Each and every experiment should conclusively demonstrate/verify the theory. Experimental results should corroborate with theoretical/estimated/reported values. The students should explain variations between observed and expected results based on technical grounds and systematic error evaluations. Each experimental report should contain a discussion of the results obtained.
5. A minimum of ten experiments distributed equitably with respect to the syllabus should be performed. *A suggested list is as follows: 1.*Dynamics of a temperature measuring system. 2. Dynamics of a liquid level tank. 3. Dynamics of a mixing process. 4. Dynamics of an under-damped second order system. 5. Dynamics of non-interacting first order systems in series. 6. Dynamics of interacting first order systems in series. 7. On-off controller. 8. Proportional controller. 9. Proportional + integral controller. 10. PID controller. 11. Tuning of P, PI, and PID controllers for chemical engineering process systems.

TEXT BOOKS

1. Stephanopoulos, G., Chemical Process Control Prentice Hall of India., 1990.
2. Coughanowr., Process Systems Analysis and Control
3. William L. Luyben, Process Modeling, Simulation and Control for Chemical Engineers McGraw Hill International Edition., 1990
4. Nakra B.C., and K.K Choudhary., Instrumentation, Measurement and analysis. Tata McGraw Hill, 1985
5. James B. Riggs Chemical Process Control.
6. Principles of Industrial Instrumentation D. Patranabis Tata-McGraw Hill

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REFERENCE BOOKS

1. Considine, Process/ Industrial instruments and Control Handbook. McGraw Hill, 1993.
2. B. Wayne Bequette Process Control Modelling, Design and Simulation Prentice Hall of India Pvt. Ltd.
3. B. Liptak, (Editor in Chief) Instrument Engineers' Handbook Butterworth Heinemann

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.4 Chemical Reaction Engineering

LOAD PER WEEK:	LECTURES	: 4 Hrs.
	PRACTICALS	: 3 Hrs.
	TUTORIALS	: Nil.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: 25 Marks
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 150 Marks

DETAILED SYLLABUS:

1. **Introduction:** Ideal batch reactor and concept of batch time Flow reactors and concept of space time/ space velocity and holding time/ residence time. Ideal Mixed Flow Reactor (MFR) and Plug Flow Reactor (PFR). (2 hrs)
2. **Design for single reactions:** Single reactor – performance of reversible and irreversible first order / Pseudo first order, second order reactions for MFR , PFR. Graphical and analytical techniques. Combination of reactors- PFR in series/ Parallel, unequal sized MFR in Series, performance of the above for first and second order reacions. Recycle reactor and Auto catalytic reaction. Problems based on semibatch reactor and recycle reactors are to be solved. (14 hrs)
3. **Design for Complex Reactions:** Irreversible reactions in series/ Parallel with same/ different order in various combination. Reversible Reactions in series/ parallel applications. (4 hrs)
4. **Temperature and Pressure Effects:** Single reaction – Endo/ Exotherm effects. Effect of temperature on thermodynamic equilibria and heats of reaction. Effect of temperature on reactor performance for adiabatic and non adiabatic operation. Case of exothermic reactions in mixed reactors. Optimum temperature progression. Multiple Reactions – Effect on product distribution. Temperature and scale effect on productivity of reactor. Various problems based on the design of non – isothermal reactors are to be solved by using various numerical methods. (8 hrs)
5. **Non – ideal Flow Reactors:** Concept of Residence Time Distribution, Segregation, micro and macro mixing in reactors. Methods of obtaining RTD – E, F, C curves mathematical and Experimental Techiques. Models of non -ideal flow – Dispersion model for the case of small or large extent of dispersion. Effect of dispersion on conversion for general irreversible reaction case. Tanks in series model – Effect of number of tanks on conversion for general irreversible reaction case. Recycle model. Multi parameter models. Diagnostic methods of analysis of flow patterns in reactors.

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Discussion Role of micro & micromixing & segregation in ideal (MFR, PFR) and non ideal reaction cases. (8 Hrs)

6. **Non – Catalytic Fluid Solid Reaction In Flow Reactors:** (Excluding the portion covered under Reaction Kinetics) Applications to design of continuous solid flow reactors. Various design considerations. Application of fluid bed reactors anf theirdesigr consideration. Heat transfer effect. (4 hrs.)
7. **Solid Catalyzed Fluid Phase Reactor:** Phenomena observed in operation of packed. Fluid bed slurry, and such reactors. Product distribution in multiple & complex reactions. Thermal Effects. Phenomenon of stability, unstability and Runaway and its analysis. Strategies for stable operations of reactors. Design considerations of fluid/ solid catalytic reactors, incl. Fluid bed reactors. (5 hrs.)
8. **Design of gas / liquid and liquid / liquid and gas / liquid solid** heterogeneous reactors_Bubble heterogeneous reactors, cocurrent & counter-current flow packed bed reactor. (5 hrs.)

TERM WORK

1. A minimum of four assignments should be given at regular intervals.
2. The following parameters should be considered for laboratory performance evaluation. a. Punctuality, b. diligence, c. contents of journal (originality of discussions)
3. Point nos 1 and 2 above and an average of a minimum of two tests should account for term work.
4. Each and every experiment should conclusively demonstrate/verify the theory. Experimental results should corroborate with theoretical/estimated/reported values. The students should explain variations between observed and expected results based on technical grounds and systematic error evaluations. Each experimental report should contain a discussion of the results obtained.
5. A minimum of ten experiments distributed equitably with respect to the syllabus should be performed. *A suggested list is given below:*
    1. Study of CSTR for first – order reaction.
    2. Study of PFR for first – order reaction.
    3. Study of PFR for second – order reaction.
    4. Study of CSTR for second – order reaction.
    5. Study of CSTR combination for first – order or second order reaction.
    6. Study of PFR - CSTR combination for second – order or second order reaction.

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7. Study of RTD in CSTR.
8. Study of RTD in PFR.
9. Study of RTD in packed bed for impulse change
10. Study of RTD in heliical / spiral coil.
11. Study of RTD by step change.

Note: For experiment no. 1 to 6 the following are to be performed: i) Conversion for various flow rates. ii) Verification and comparison of the size of the reactors from experimental data by using formulae as well as graphical method. For experiments 7 to 11 Comparison of all types of curves.

TEXT BOOKS:

1. Smith, J. M. " Chemical Reaction Engineering"3 /e, Tata McGraw Hill, 1980.
2. Levenspiel, D. "Chemical Reaction Engineering", Wiley Eastern, 2/e, 1972.
3. Fogler, H. S. "Elements of Chemical Reaction Engg." PHI, 1972.

REFERENCE BOOKS:

1. Walas, " Reaction Kinetics For Chemical Engineers" McGraw Hill, 1959.
2. Doraiswamy & Sharma, " Heterogeneous Reaction" Vol. 1 & 2, John Wiley, 1984.
3. Walas, " Chemical Reaction Engineering" Handbook of solved problems, Gordon & Breach , 1995, s 74.
4. Froment, G.F. & Bischoff, K. B., " Chemical Reactor analysis and design wiley series in Chem Engg. ; 2 nd ed..

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.5 Entrepreneurship and Management

LOAD PER WEEK:	LECTURES	: 2 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: Nil.
EVALUATION SYSTEM:	Theory Examination	:2 Hrs., 75 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: --
	TOTAL	: 75 Marks

Detailed Syllabus:

1	Definitions of entrepreneurship, concept of entrepreneur and entrepreneurship, Characteristics of entrepreneurship. Who is an ideal entrepreneur? - elaboration.
2	The entrepreneurial culture: Aspect of entrepreneurship, environment for entrepreneurship. Culture: Elements of culture, business culture & culture of Society, entrepreneurial culture, cultural change. Socio Economic origins of entrepreneurship, barriers of entrepreneurship, Factors affecting entrepreneurship.
3	Classifications and types of entrepreneurship: Classification depending on: type of business, technology, motivation, growth. Stages of development.
4	Entrepreneurial traits and motivation: Creation of a Dream, entrepreneurial initiative, characteristics of an entrepreneur, qualities of an entrepreneur, entrepreneurial skills. Entrepreneurship: sources of supply and motivation. Growth of entrepreneurs, entrepreneurial functions.
5	Project Development: Project, Stages of project, Project development cycle. Search for an idea, preliminary screening, project identification, project formulation, SWOT analysis, project report. Project Appraisal: market, technical, financial, economic, social, ecological, and organizational. Tools of analysis: time- value of money, compounding and discounting, break-

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	even analysis, profitability, pay-back period, net present value, social cost-benefit analysis. Sources and types of finance.
6	Present scenario ofIndian Industries and entrepreneurs, government policies to promote entrepreneurship. Institutions in aid of entrepreneurs. Finance for entrepreneurs: Sources and types of finance. Small industries related to chemical engineering, steps for starting a small scale industry . Selection of types of organization, ownership types: Solo, Proprietorship, Partnership, Private company, Public Limited company.
7	Project accounting: Generally accepted accounting principles, book keeping, double entry system and ledger, preparation of income statement and balance sheet.
8	Management: Concept of management, objective, basic functions of management, emergence of management thought, Brief description of contribution by Fredrick Taylor, Henry Fayol, Elton Mayo and Gilbreth. Principles of organization, forms of organization: Line. Line and Staff, Functional and matrix.

1. Prasanna Chandra, Projects: preparation, appraisal, budgeting & implementation, Tata McGraw Hill.
2. Vasant Desai, Dynamics of entrepreneurial development & management, Himalaya Publishing House.
3. S.Anil Kumar et aI, Entrepreneurship Development, New Age International (P) Ltd.
4. Koontz, O'Donell & Weirich, Management, McGraw Hill.
5. R. Hisrich,& M.P. Peters, Entrepreneurship, Tata McGraw Hill.
6. Entrepreneurship Devepolment, Colombo Plan Staff College of Technical Education, Tata McGraw Hill.

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.6 Project - A

LOAD PER WEEK:	LECTURES	: Nil.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: --
	Practical Examination	: --
	Oral Examination	: 25 Marks
	Term Work	: 25 Marks
	TOTAL	: 50 Marks

Detailed Syllabus:

1. Project topics for Semester VII are allotted at the beginning of the semester. The specific project topic can be of any one of the following categories :

A. Design of a process system for the manufacture of a product

B. Experimental work leading to development / refinement of a process resulting in a product / service

C. Design of a process system to achieve a specific, engineering objective

2. A teacher / faculty member will be assigned as a supervisor to the project. While it is desirable to allot project each to individual students, the maximum number of students in a group should not exceed 3 (three).
3. For students in a group, the project should be so split up as to assign individual team members specific subtasks for which that member will be uniquely responsible and on which the performance of the member will be assessed.
4. The project work will typically consist of the following (based on type of the project) :

A. Critical survey of literature on the subject/topic covering books, encyclopaedia, patents and journals

B. Setting up of experimental apparatus, design of experiments, setting up analytical facility / protocol / procedure, data processing plan post experimentation

C. Field work including visiting manufacturing industries / EPC companies for collecting relevant information for the project task

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5. Each student group is required to prepare a detailed typed report consisting of maximum 60 pages A4 size, inclusive of index, abstract, illustrations, charts, P & ID and other diagrams, flow sheets, photographs, etc.

TERM WORK:

1. Term work evaluation of this work will be based on monthly progress review. The monthly report filed by each student will be considered for grading the term work.
2. The student will make an oral presentation of his report to his peers and a panel of at least three teachers including the Supervisor. The assessment of this oral presentation will carry 40% marks of term work.
3. The project oral of 25 marks is to be conducted as per rules by an approved internal and an external examiner.

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.7 Elective -II: (i) Biochemical Engineering

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS:

1. **Introduction to Biochemical Engineering** :_Difference between a Chemical & Biological Reaction process. Steps in a Typical Biochemical process. Role of a Chemical Engineer in designing a Biochemical process (1 Hrs)

2. **Introduction to Microbiology and Biochemistry** : The protist kingdom and classification. Structure of cell - functions of cell components. Comparison between prokaryotic, Eukaryotic, gram +ve & gram -ve cells. Hierarchy of cellular organisation. Lipids & Polysaccharides - their role in cell architecture. Types of Nucleotides -RNA & DNA -genetic codes. Amino acids -General structure, peptide bond, hydrogen bonding & pK 1 & pK2 & pKR values. Proteins - Structure of proteins, classification based on functions, Process of gene expression -Transcription & Translation Control of Protein synthesis in cells, (Induction & Repression) (5 Hrs)

3. **Cell Growth. Metabolism and Energetics :_**Mitotic Multiplication. Factors affecting cell growth, requirements for cell growth & Medium formulation. ATP, NAD & FAD - energy storing mechanism. Respiration - aerobic (TCA) & anaerobic mechanism. Carbon metabolism -EMP & shunt pathways. Transport across cell membrane -Active, Passive & Facilitated. Stoichiometry of cell growth & product formation, Yield coefficient ,elemental balance, degree of reduction, heat generation. Introduction to metabolic flux analysis. (6 Hrs)

4. **Cell Growth Kinetics:** Growth Cycle- Phases for Batch Culture. Microbial growth kinetics: Monod's Equation, Estimation of kinetic parameters using batch culture and continuous culture experiments. Modifications to account for endogenous & maintenance kinetics. Other forms of growth models -- Tessier, Moser & Contois Malthu's law, Logistic curve, Structured models-Compartmental models equations,

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Equations of metabolic models. (8 Hrs)

5. **Enzyme Engineering:** Types of enzymes: intracellular& extra cellular, Hydrolytic, Protolytic & Esterases, Enzyme cofactors & their importance. Difference between a enzymatic & whole cell process. Enzyme immobilization - Chemical & Physical methods, Advantages & limitation. Kinetics of enzyme catalyzed reactions : (i)Michaelis Menten Kinetics (ii)Methods for determining rate parameters, Lineweaver - Burk Plot. Eadie Hofstee, Hanes plot. (iii) Reversible reactions, Multiple substrates, (iv) cofactor activation, (v) Substrate activation & inhibition, (vi) Types of Enzyme inhibition reversible & irreversible, Competitive, Noncompetitive, uncompetitive and mixed. (vii) Effect of pH, Temperature and other environmental factors, viii) Types of deactivation and deactivation kinetics.

(Numerical examples and derivation of kinetic expressions based on mechanisms)

Kinetics of immobilized enzyme (i) Effect of external mass transfer limitation. (ii) Effect of internal diffusion limitation (iii) Both external & intraparticle controlling. (10 hrs)

6. **Bioreactor Engineering :** Fed Batch Reactor Analysis. CSTR'S for enzyme catalyzed reaction. CSTR'S for cell culture (steady state), CSTR with recycle. Description of typical aspects of aerobic fermenter, Description of alternate bioreactor configurations, Sterilization Reactors - Batch & continuous sterilization. Numerical Examples. (05 Hrs)

7. **Special Product Recoverv Ooerations :** i) Chromatography ii) Membrane Separation -Microfilteration, Ultrafilteration, Reverse Osmosis iii) Electrophoresis, iv) Aqueous two phase separation. (02 Hrs)

8. **Genetic Engineering & Recombinant DNA** Technology and **Tissue Culture techniques** (03Hrs)

TERM WORK:

1. A minimum of 10 assignments should be given at regular intervals. Suggested topics for tutorials are: Numericals from Topics 3-6 mentioned in syllabus. Derivationn of kinetic expressions for various types of enzymatic reaction (Multiple substrates, Cofactor activation, Substrates activation etc.) A report and presentation on topics such as *Large scale production of Enzymes * Production of antibiotics Penicillin * Production of HFCS * Production of Ethanol * Production of single cell protein * Production of Vitamin B12 *Biological Waste Water Treatment etc.
2. The performance of the students should be evaluated based on each assignment giving suitable weightage to punctuality and contents.
3. Point nos 1 & 2 above should account and an average of a minimum of two tests should account for term work.

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TEXTBOOKS

1. Michael Schuler, Fikret Kargi , "Bioprocess Engg- Basic concepts", Prentice Hall of India Pvt. Ltd. New Delhi 2002.
2. Bailey, J. E. and Ollis, D.F. "Biochemical Engineering Fundamentals" 2 nd ed. Mcgraw Hill ed. New York 1988.
3. Lehninger, A. L. , "Principles of Biochemistry", Worth Publishers, New York, 1982.
4. Levenspiel, 0., "Chemical Reaction Engineering", 2 nd Ed. John Wiley & sons. Inc. New York, 1982
5. Balasubramanian & Bryce, "Concepts in Biotechnology".
6. Coulson and Richardson "Chemical Engineering VOl III" , Third Edn. Elsevier Science Publication.
7. Aiba, S. Humprey, A. E. & Mills, N. F. "Biochemical Engineering" 2nd Edn. Academy Press Inc. New York, 1977.

REFERENCE BOOKS

1. Stenier, R. Y., Dondoroff, M. and Adelburg, E. A. "The microbial world" 4 th ed. Prentice hall Inc. N.J. 1975
2. Atkinson, B. and Mavitana , F., " Biochemical Engineering & Biotechnology Handbook", Macnylillan Publishers Ltd. Surrey, England, 1983.
3. Atkinson, B., "Biochemical Reactors", Pion Ltd. London 1974.

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.7 Elective -II: (ii) Polymer Engineering

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS:

1. **Introduction:** (3 Hrs.)

Defining polymers; Basic chemistry of polymers; Classification and types; Bonding in polymers, Molecular weight and Molecular Weight Distribution; Thermoplastic /Thermosetting polymers, Elastomers, Resins, Adhesives, Coatings, Fibers, Composites; Solvents, Solutions, Blends, Melts; Additives, Fillers; Examples of industrial and high-performance polymers.

2. **Step-growth(condensation) polymerization** (3 Hrs.)

Features; Definition of functionality; Functionality principle; Derivation of Carother' s Equation; Effect of stoichiometric imbalance on molecular weight; Mechanism; Kinetics.

3. **Free-radical addition(chain-growth) polymerization** (6 Hrs.)

Mechanism; Kinetics of homogeneous polymerization; Experimental determination of rate of polymerization; Instantaneous average chain lengths; Temperature dependence of rate and chain length; Gel effect or Autoacceleration; Kinetic chain length; Chain transfer; Inhibitors and Retarders.

4 **Ionic and coordination chain(addition)polymerization** (2 Hrs.)

General features of ionic-chain addition polymerization; Mechanism and kinetics of cationic polymerization; Mechanism and average degree of polymerization; Kinetics of anionic polymerization; Mechanism and kinetics of coordination Polymerization.

5. **Copolymerization** (6 Hrs)

Basic concept~ Technical significance~ Steady-state assumptions in free-radical Copolymerization~ The co-polymer equation~ Instantaneous molar composition Of copolymer formed;Monomer reactivity ratios: Significance and method of Determination~ Types of copolymers; Variation of composition with conversion; Average

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copolymer composition; Cumulative composition of copolymer~ Mechanisms; Kinetics~ Block and graft copolymers.

6. **Polymerization Systems** (6 Hrs.)

Design criteria~ Bulk polymerization(quiescent and stirred)~ Solution polymerization; Suspension polymerization~ Emulsion polymerization; Smith-Ewart kinetics; Deviations from the Smith-Ewart kinetics; Interfacial polycondensation; Comparison of the various processes~ Advantages and disadvantages; Heat transfer and mixing in polymerization *reactors.*

7. **Characterization of Molecular Weight** (2 Hrs)

Types of average molecular weight; Molecular weight and degree of polymerization; Polydispersity and Molecular Weight Distribution in polymers~ Common techniques for measurement of average molecular weights; Viscometry, End-group analysis, Gel permeation chromatography.

8. **Polymer rheology and morphology** (2 Hrs.)

Definition of rheology ; Newtonian and non-Newtonian fluids~ Flow curves; Apparent Viscosity; Power law; Viscoelasticity; Free volume or molecular hole concept; Definition of morphology; Requirements for crystallinity; Effects on mechanical and optical properties.

9. **Polymer degradation** (2 Hrs.)

General types: thermal, mechanical, oxidative, hydrolytic, ultrasonic, high-energy radiation~ photodegradation; Antioxidants and Stabilizers.

10. **Polymer Processing** (8 Hrs)

Blow molding~ Injection molding~ Compression molding; Extrusion; Calendering~ Sheet forming or Thermoforming; Casting; Coating: Powder-coating technique; Fluidized-bed coating technique~Laminating; Fiber spinning; Bi-axial orientation; Reinforced reaction injection molding; Filament winding; Pultrusion~ Design considerations with polymers~ processing characteristics~ Engineering challenges in processmg.

TERM WORK:

1. A minimum of 10 assignments should be given at regular intervals.
2. The performance of the students should be evaluated based on each assignment giving suitable weightage to punctuality and contents.
3. Point nos 1 & 2 above should account and an average of a minimum of two tests should account for term work.

TEXTBOOKS:

1. Gowarikar, V.R. et. al " Polymer Science ," Wiley Eastern, 1984.
2. Rodriguez, F., " Principles of Polymer Systems." 2 / e , Hemisphere (McGraw Hill), 1982.

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3. Ghosh, P, " Polymer Science & Technology of Plastics & Rubbers." Tata McGraw Hill, 1990.
4. Crawford R. J. " Plastic Engineerin," Paragaman (Maxwell Macmillan International), 1987.

REFERENCE BOOKS:

1. Encyclopedia of Polymer Science & Engineering ', Wiley, 1988.
2. Rosen, S.L. *Fundamental Principles of Polymeric Materials,* 2nd ed., John Wiley & Sons, Inc., 1993.
3. McCrum, N.G. et. al. *Principles of Polymer Engineering,* 2nd ed., Oxford Sciences; 1997.
4. Rodrigues, F. *Principles of Polymer Systems,* McGraw-Hill Book Co., 1970.
5. Bhatnagar, M.S., *A Textbook of Polymers,* Vol. 1, S.Chand & Co. Ltd., New Delhi, 2004.
6. Bhatnagar, M.S. *A Textbook of Polymers,* Vol. II, S.Chand & Co.,Ltd., New Delhi, 2004

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.7 Elective -II: (iii) Food Process Engineering

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

1. **Introduction:** Current status of the Indian a) Agriculture, b) Food Industry, c) Food. Processing Industry. Market opportunities for the Indian Processed Food Industry. Engineering challenges in the Food Processing Industry: Product and Process development. Major challenges in India. R & D opportunities within the Food Industry. (2 Hrs)

2. **Basic Food Biochemistry and Microbiology.** Food Constituents: Water, Proteins, Carbohydrates, Lipids, Vitamins, Minerals, Flavors, Nutritional & sensory characteristics, Food fortification. Water activity Enzymes: Production from microorganisms and application in food processing Lipid oxidation Growth of microorganisms and food spoilage D & z values Food Safety. Indian laws regulating Foods and Food Processing (3 Hrs)

3. **Ambient Temperature Processing:** Raw material preparation Size reduction of solid fibrous foods and in liquid foods. Emulsification and Homogenization. Theory and Equipment. Mixing and Forming. Theory and Equipment. Extraction & expression Membrane concentration Fermentation: Theory, Types, Equipment, Effect on Foods (8 Hrs)

4. **Heat Processing using steam or water: Theory, Equipment, Effect on Foods** Blanching Extrusion Pasteurization Heat Sterilization In-container Ultra high-temperature(UHT)/aseptic processes (8 Hrs)

5. **Heat Processing using hot air: Theory, Equipment, Effect on Foods** Dehydration Baking & Roasting (3 Hrs)

6. **Heat Processing using hot oils: Theory,Equipment,Effect on Foods:** Frying (2 Hrs)

7. **Heat Processing by direct and radiated energy: Theory,Equipment,Effect on Foods** Dielectric heating: Microwave, (2 Hrs)

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8. . **Processing by removal of heat: Theory, Equipment, Effect on Foods** Chilling Freezing Freeze drying and freeze concentration (5 Hrs)

9. Food Preservation & Storage Food contamination Modified Atmosphere Storage (MAS) Hurdle Technology (2 Hrs)

10 **Post Processing Applications** Packaging. Modified-atmosphere packaging (MAP) Coating and enrobing Filling and sealing of containers (5 Hrs)

TERM WORK:

1.A minimum of 10 assignments should be given at regular intervals. Suggested topics for tutorials are: Numericals on Pasteurization Heat Sterilization Chilling Freezing Freeze drying Freeze concentration Membrane concentration. Manufacturing & Processing of the following topics should be covered Fruit Juice Processing, Canned Food, Jam & Jelly, Oil seed processing, Alcoholic beverages, Milk & milk products; Milk powder, Cheese, Ice-cream, Tea, coffee, cocoa, Soya products, protein isolates and concentrates, Bread, biscuit, confectionery(hard-boiled sweets & chocolates)

1. The performance of the students should be evaluated based on each assignment giving suitable weightage to punctuality and contents.
3. Point nos 1 & 2 above and an average of a minimum of two tests should for term work.

TEXT BOOK:

1. Fellows, P., Food Processing Technology: Principles and Practice, 2nd ed., Woodhead Publishing Ltd., England, 2000.

REFERENCE BOOKS:

2. Toledo, R., Fundamentals of Food Process Engineering, 2nd ed., CBS Publishers & Distributors, New Delhi, 1997.
3. Sharma, K., et.al., Food Process Engineering, Theory and Laboratory Experiments,John Wiley and Sons Inc., Canada, 2000.
4. Pandey and Srivastava, Chemical Process Technology, Vol. 2
5. Singh, R.P., & Heldman, D.R., Introduction to Food Engineering, 3rd ed., Academic Press, UK, 2001.
6. Lelieveld, H.L.M., et.al., Hygiene in Food Processing, Woodhead Publ. Ltd., England, 2003.
7. Subbulakshmi, G. & Udipi, S.A., Food Pr ocessing & Preservation, New Age International Pvt. Ltd., India, 2001.
8. Valentas, K.J. et.al., Food Processing Operations and Scale-up, Marcel Dekker, NY, 1991
9. Tamb, I.A. and Singh, R.P., Food Storage Stability, CRC Press, 1998.

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

7.7 Elective -II: (iv) Petrochemical and Refining Technology

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

SCOPE : The subject intends to expose the students to the following. Formation of Petroleum & origin. Petroleum processing data. Fractionation of Petroleum. Treatment techniques & Products specification. Thermal & Catalytical Processes. Asphalt Technology.

DETAILED SYLLABUS:

1. Origin Formation & Composition of Petroleum. Origin & Formation Of Petroleum. Reserves & Deposits Of World. Types Of Crude & Indian Crude Types.Exploration – Reverse, Raw Materials & Transportation. (5Hrs)
2. Refinery Products & Feed Stocks. Overall Refinery Flow. Low Boiling Products. Gasoline specifications. Fuels: - Distillate Fuels, Jet Fuels, Automotive Diesel Fuels. Oils: - Heating Oils, Residual Fuel Oils. Crude Oil Properties. Composition Of Petroleum Crude suitable For Asphalt Manufacture. Crude Distillation Curves. Petrochemical feedstocks. (10 Hrs.)
3. Fractionation of Petroleum. Dehydration & Desalting Of Crudes. Heating Of Crudes – Pipe Still Heaters. Blending Of Gasoline. (5 Hrs.)
4. Treatment Techniques & Products Specifications. Fraction-Impurities. Treatment of Gasoline Treatment of Kerosene Treatment of Lubes. Wax & Purification. (7 Hrs.)
5. Catalytic Cracking & Thermal processes. Fluidised – Bed Catalytic Cracking, Catalytic Reforming. Coking Hydrogen Processes-Hydrocracking, Hydrosulpherization, Hydro-Treatment. Alkylation processes Isomerisation Processes Polymer Gasoline (7 Hrs.)
6. Asphalt Technology. Source Of Asphalt. Air Blowing Of Bitumen Upgradation Of Heavy Crudes. (4 Hrs.)
7. International and Indian scenarios of supply & demand for about last 10 years and emerging trends of Key petrochemicals: *Acetylene, ethylene, propylene, butene/ butadiene, * pentene, n-hexane, cyclo-hexane n-heptane, i-octane, carbon black * Benzene/

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toluene/ xylene(o,m,p)/ styrene/ cumene/ phenol, PTA, caprolactum, vinyl chloride, chlorobenzene, nitrobenzene,. * Tetrachloroethane, ethyl oxide, mono-ethylene glycol, mono vinyl acetylene, * Acetone, acetaldehyde, acetic acid, acetic anhydride, diacetone alcohol, isophoron * Ethylene dichloride, trichloroethylene, fluoroethanes, *Alpha methyl styrene, fumaric acid, maleic anhydride, phthalic anhydride, * Naphthalene, cyclohexane, aniline, adipic acid, (Manufacturing processes are covered in Chemical Process –II and not included here). (2 Hrs)

TERM WORK:

1. A minimum of 10 assignments involving a report based on literature survey and an oral presentation to the class during tutorial sessions are envisaged. Suggested topics for tutorials are: Upgradation Techniques for petroleum products. Recent development in refining processes. Synthetic Zeolites used in FCC. Pollution due to refinery Scope of Petrochemical Industry. Indian petrochemical Industry. Various Testing methods of Petrochemical Product. Various gases obtained for the refinery & their uses. Etc
10. The performance of the students should be evaluated based on report and presentations.
3. Point nos 1 & 2 above and an average of a minimum of two tests should account for term work.

TEXT BOOKS:

1. "MODERN PETROLEUM REFINING PROCESSES." B.K Bhaskara Rao

REFERENCE :

1." PETROLEUM REFINERY ENGINEERING " 4 Th ed., McGraw - Hill By W.L. Nelson.
2. " PETROLEUM CHEMISTRY AND REFINING". Edited by – James G. speight, Taylor & Francies.
3. " CHEMICAL PROCESS INDUSTIRES. " AUSTIN, G.T. Shreves.
4. Encyclopedia of Chemical Processing & Design by John J. McKetta;; Marcel Dekker, Inc;
5. Chemical Weekly for Supply & Demand figures and current prices and price trends

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

8.1 Environmental Engineering

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: 3 Hrs.
	TUTORIALS	: Nil
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: 25 Marks
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS:

1. **Introduction:** Importance of environmental pollution control, eoncept of Ecological Balance, Role of hydrological and nutrient cycles of environment, pollution control aspects, Environmental legislation & Regulations, Industrial Pollution Emissions and Indian standards- Environmental legislations- water (prevention and control of pollution) act, Air (prevention and control of pollution) act.

2. **Water pollution :** Classification, sources and effect of water pollutant on human being and ecology, eutrophication, dissolved oxygen depletion, natural aeration. Sampling, measurements & standards of water quality- DO, BOD, COD, TOC, nitrogen, phosphorus, alkalinity, suspended solids, MLSS, ML VSS etc.

3.**Waste water treatment :** Pretreatment: Bar Racks, Grit chambers, Comminutors, equilization (theory) Primary Treatment: Settling tanks & their sizing. Secondary Treatment: Trickling filters, Rotating biological contactors (design theory), Activated sludge process, (with design problems) Tertiary treatment - Advanced Methods for suspended solids and dissolved salts, chemical oxidation methods, Advanced Biological treatments, methods for recovery of value from effluent treatment.

4. **Air Pollution :** Air pollutants, sources & effect on man and environment, acid rain, smog, , greenhouse effect, Ozone depletion, global warming. Stability, inversion, atmospheric dispersion, The Gaussian Plume model, Air pollution sampling and measurement -Ambient air sampling, stack sampling, Analysis of air pollutants - SOz, nitrogen oxides, CO, ozone & hydrocarbons, HzS.

5. **Air Pollution Control :** Equipment, system, and processes for (a) Particulate pollutants - Gravity settler, Cyclones, bed filters, bag filters, ESP, Scrubbers etc. (b) Gasious pollutants - Dry & wet Scrubbing, absorption, adsorption, Catalytic conversion. Source Correction Methods for air pollution control.

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6. **Waste management:** Solid waste including plastic waste Nuclear Waste Hazardous Waste

7. **Noise Pollution :** Noise-Pollution -measurements & control, effect on man & environment.

TERM WORK:

1. A minimum of four assignments should be given at regular intervals one must include the study of pollution control in selected process industry.
2. The following parameters should be considered for laboratory performance evaluation. a. Punctuality, b. diligence, c. contents of journal (originality of discussions)
3. Point nos 1 and 2 above along with an average of a minimum of two tests should account for term work.
4. Each and every experiment should conclusively demonstrate/verify the theory. Experimental results should corroborate with theoretical/estimated/reported values. The students should explain variations between observed and expected results based on technical grounds and systematic error evaluations. Each experimental report should contain a discussion of the results obtained.
5. A minimum of ten experiments distributed equitably with respect to the syllabus should be performed. *A suggested list is as follows:* 1.Determination of dissolved oxygen in waste water. 2. Determination of phenol in wastewater. 3.Determination of COD 4.Determination of metal in waste water (any One) 5. Determination of Chlorides in given water 6.Determination of turbidity of given sample 7.Measurement of Oils & Grease in given sample. 8.Measurement of particulate matter in air 9.Measurement of Sound level. 10. Determination of BOD

TEXT BOOKS :

1. Rao C. S. "Environmental Pollution Control Engineering" , Wiley Eastern.
2. Davis M. L., Cornwell D.A. "Introduction to Environmental Engineering" 2/e, McGraw Hill- 1991.
3. Mahajan S. P. "Pollution Control in Process Industries" Tata McGraw Hill Publishing Company ltd.
4. Peavy, H. S., Rowe, D.R., Tchobanoglous G. , "Environmental Engineering" Mcgraw Hill, 1985.
5. Master, "Introduction to Environmental Engineering & Science" Prentice Hall of India.

REFERENCE BOOKS:

1. Metcalf et.al. "Waste Water Treatment, Disposal & Reuse" 3/e, Tata McGraw Hill.
2.Chandalia, S.B., Rajgopal, D. "Environmental Perspectives of Chemical Industries."

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

8.2 Project Engineering and Managaement

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS:

1. **Introduction:** Definition *of* project, Project management, Project Life cycle, Project types, Project over runs. The project manager: Role & Responsibilities Demands on PM. (4 Hrs.)
2. **Project initiation:** Feasibility reports of various types, Project selection criteria &. Numeric models of the project seection1ike: ROR, NPV. IRR, Profitability index (Numerical problems included), Technology selection criteria, site selection criteria. Project Licensing, Basic &. Detailed Engineering. guarantees, Liabi1ities, Risk, insurance.Project budgeting. (8 Hrs)
3. **Project c1earances:** Various Laws &. regulations. List of various clearances, intellectua1 property rights, Patents need for clearances & its influence on project management, LOI. (3 Hrs)
4. **Project organization:** Various forms like pure project, matrix, and mixed type. Project team, responsibilities of various members (2 Hrs)
5. **Project planning: WBS &:** responsibility charts, Contracts *of* various types, role *of* contractor, sub-contractor, consultant, selection criteria & appointment procedure. (4 Hrs)
6. **Project scheduling & execution:** CPM. PERT. GANTT charts, LOB, resource al1ocation, material management, ABC analysis, VED analysis, EOQ, CAT & RAT (numerical problems included). (10 Hrs)
7. **Project monitoring &. contro1:** Time &. cost control tools &. techniques, fund f1ow control various types of estimates. Project qua1ity control- Importance of environmental &. Safety aspects, role of communication in monitoring & control. (4 Hrs)
8. **Project management systems** (2 Hrs)
9. **Project termination:** Commissioning. start UP. stabilization. close out. (3 Hrs)

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TERM WORK:

1. A minimum of 10 assignments involving a report based on literature survey and an oral presentation to the class during tutorial sessions are envisaged. Suggested topics for tutorials are: CASE STUDIES ON: Time *I* cost over run. Feasibility report preparation Technology/site selection Types of contmcts (one verses another) Value engineering. In addition to numerical problems on various topics as included above.
2. The performance of the students should be evaluated based on report and presentations.
3. Point nos 1 & 2 above along with an average of a minimum of two tests should account for term work.

TEXT BOOKS:

1. Chaudhary,_PROJECT MANAGEMENT, Tata McGraw Hill
2. Joy, TOTAL PROJECT MANAGBMBNT, MacMillan
3. Jack Meredith & Samuel, PROJECT MANAGEMENT: A Managerial Approach, John Wiley & sons.

REFERENCE BOOKS:

1. Peter S. Timmerhouse._PLANT DESIGN & ECONOMICS FOR CHEMICAL ENGINEER. McGraw Hill
2 Jhamb, INVENTAR Y MANAGEMENT, Everest publishing house
3 J. K.Sharma_OPERATION RESEARCH, MacMillan.

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

8.3 Industrial Safety

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS:

1. **Introduction:** Concepts. Definitions. Types of Accidents. Causes and direct & indirect effects of accidents, Types of damages. Role of safety considerations in chemical plant Design & operations. Protective & safety equipments . Measure of Risk Liabilities of accidents Laws. Rules, Regulations (concerning safety in chemical process plant) for the prevention of accident. Managerial aspects of safety, General Aspects of Post disaster mitigation and management within an organization & in society at large. (4 Hrs.)

2. **Toxicoloqy and Industrial hygiene:** Typical toxins and their biological effects. Outline of their ingestion to and elimination from biological systems. Toxicological Parameters - Their definitions and outline of the measurement rnethods. Evaluation of Exposure to toxicants and its impact. Source Models - Release & flow of toxic gases & liquids, flashing liquids, boiling. liquids, etc. Dispersion Models - factors affecting dispersion and their modelling. Design & Equipment for prevention of toxic release in chemical plants. Management of toxic release scenario. (6 Hrs)

3. **Fires & Explosion:** The fire triangle and factors contributing to fire & explosions. Definition. Relevant material characteristics & properties. Concepts of Ignition, Ignition Energy. Phenomena and Source of Ignition, auto ignition, auto oxidation, adiabatic compression, electrostatic ignition, role of fuel sprays, mists dusts on ignition process. Explosions - various types & conditions for their occurance.
Inerting & Purging of equipment, Ventilation of rooms, Control of static electricity process control systems, Sprinkler systems, Fire fighting systems (8 Hrs.)

4. **Relief and Relief systems:** Definitions. Relief requiring scenarios. Relief types & locations. Relief systems, various options and their sizing and applications for single and multi phase flows. Deflagration venting for dust & vapor explosions. (8 Hrs)

5. **Hazard Identifications:** HAZOP, HAZAN and such methods, safety Review & other methods, examples. Safety Audit. (6 Hrs)

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6. **Risk Assessment:** Review of probability theory in respect of failures, coincidences etc. leading to unsafe situation. Concepts of event trees & fault trees. Analysis of trees for risk assessment, its advantages & disadvantages for simple examples of application of Risk Assessment technique. (6 Hrs)

7. Accident Investigations: Learning from accidents Methods of investigating. and diagnosing. Aids for recommending case studies of well known accidents such as Flixburough. Bhopal etc. (2 Hrs)

TERM WORK:

1.A minimum of 10 assignments involving a report based on literature survey and an oral presentation to the class on one of the assignments during tutorial sessions are envisaged. In addition numerical problems on various topics as included above.

2. The performance of the students should be evaluated based on report and presentations.
3. Point nos 1 & 2 above along with an average of a minimum of two tests should account for term work.

TEXT BOOKS:

1) Crowl, D. Y, Louvar, J.F. "Chemical Process Safety Fundamentals with Applications" Prentice Hall, Englewood, 1990
2) Pandya, C.L., Hazard in Chemical Units" Oxford ISH 1991.
3) Pandya, C.L., Risks in Chemical Units" Oxford IBH 1994.
4) Grimaldi, J. V., Simonds, R.H., "Safety Management . 5/e AITBS, Delhi, 1996

REFERENCE BOOKS

1) Kleitz, T. A., "What went wrong ?"3/ e, Gulf Publishing, 1995.
2) Lees, F. P., "Loss Prevention in Process Industries" Vol. 1~ 2 & 3, Butterworth, 1995
3) Safety Related Acts, Rules & Regulations
4) Gupta R. S. "Hand book of Fire Technology' Orient Longman, 1993.
5) Withers, J., "Major Industrial Hazard - Their Appraisal & Control," Wiley, New Delhi, 1988.
6) CLRI, " Hazard Assessment & Disaster Mitigation in Chemical Process Industries. Oxford IBH, 1994.

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

8.4 Process Simulation and Design

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS:

1. General Concept of Simulation / Design: Introduction to models, Design problem vs Simulation Problem. Approaches to simulation. A brief outline of components of a CAD package in Chemical Engineering: Thermodynamic and physical property package, module library, numerical routines library, costing etc. (3 Hrs.)
2. Mathematical Models, their classification (deterministic vs stochastic, liniear vs non-linear, lumped parameter vs distributed parameter, dynamic vs steady-state with examples) Model Building (writing down equations only) examples (i) homogenous well mixed and plug flow reactor (isothermal and non-isothermal) (ii) heated tank (iii) flash drum (iv) gas-liquid bubble reactor (v) Counter-current multistage liquid liquid extraction
   Parameter Estimation by Least square (linear and quadratic) (7 Hrs)
3. Solution to systems of non-linear algebraic equations (Newtons and Successive substitution) Application in chemical engg., such as equilibrium flash calculations, equations of state, reaction equilibrium etc. (2 Hrs)
4. Solutions of single ODE and systems of ODEs (Implicit Euler & Runge–Kutta IVth Order) Applications to chemical engineering problems such as homogenous well mixed reactor (isothermal and non-isothermal) and heated tank. (3 Hrs)
5. Models of difference equations Applications to chemical engineering - Counter-current multistage liquid liquid extraction. (3 Hrs)
6. Simulation of single units (modules) Degrees of freedom (with and without system constraints). Coupling and Decoupling of equations. Precedence ordering for Design/Simulation (partitioning and tearing). Selection of design variable algorithm and persistant recycles. (7 Hrs)
7. Simulation of complete flowsheet. Degrees of freedom for flow sheet with connecting equations. Approaches to simulation: (I) Sequential modular. Precendence ordering of

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Modules (Partitioning and Tearing of flow sheets) (II)Simultaneous: a. Equation solving b. Simultaneous Modular with linearized modules. (11 Hrs)

8. Batch process simulation Batch distillation Batch reactors (3 Hrs)

TERM WORK:

1. A minimum of four assignments should be given at regular intervals one must include modelling of a process unit not available in text-books.
2. The following parameters should be considered for laboratory performance evaluation. a. Punctuality, b. diligence, c. contents of journal (originality of discussions)
3. Point nos 1 and 2 above along with an average of a minimum of two tests should account for 10 marks (out of 25 marks) for term work.
4. A minimum of ten practicals distributed equitably with respect to the syllabus must be performed using computers and report filed. report should contain a discussion of the methodology, flow sheet and write up working as user guide.

Suggested Practicals

1. Equations of state using Newton's method. 2. Equations of state using successive substitution method. 3. Regression for parameter estimation using a set of data points. 4.Equilibrium flash distillation (multicomponent ideal). 5. Reactions of various orders, in series and parallel. 6. Stage-wise contacting equipment. 7. Solving a simple flowsheet by sequential approach. 8. Solving a simple flowsheet by simultaneous approach. 9. Simulation of batch distillation (binary-ideal). 10. Use Design II / Chemcad / Aspen in simulation or similar software or simulation

TEXT BOOKS:

1. Systematic Methods of Chemical Process Design by Lorenz T. Beigler, E. Ignacio Grossman and Arthur W. Westerberg Prentice Hall International Inc., 1997.
2. Chemical Process Computations by Raghuraman
3. Mathematical Methods in Chemical Engg By Pushpavanam,S. Prentice Hall International Inc.,1998.
4. Applied Mathematics in Chemical Engineering By H. S. Mickley., T. S. Sherwood., and C. S. Reed, Second Edition, Tata McGraw Hill New Delhi 1975
5. Process Dynamics by Wayne Bequette Prentice Hall International Inc.,2000.
6. Mathematical Methods in Chemical Engg By Jenson and Jeffreys Academic Press,1970.

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7. Numerical Methods in Chemical Engg. by S.K Gupta
8. Strategy of Process Engg. By Dale F Rudd, Charles C Watson Willy International,1968.
9. Chemical Process Control By James B. Riggs. Ferret Publishing,1999
10. Modern Control Techniques for the Process Industries By T.H Trai , J.W Loure & C.S Lim Marcel Dekkel Inc
11. Process Modeling & Control in Chemical Engg Kaddour Najim

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

8.5 Elective III: (i) Multiphase Reactor Design

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

SCOPE: The course is inteded to give the students an insight into the analysis of multiphase reactors, the models used, role of residence time distribution and macro mixing, kinetics. In addition, an exposure to issues involved in the design of gas-liquid-solid reactions and reactors, incorporating the heat and mass transfer effects.

DETAILED SYLLABUS:

1. Introduction: Reaction Kinetics for multiphase reactions, brief idea about multiphase reactors and design considerations. Catalyst deactivation and regeneration. (2 Hrs.)
2. Review of reaction kinetics and reactor design (7 Hrs.)
3. Industrial Reactors: Trickle bed, bubble column, segmented bed, agitated slurry, fuidised bed and slurry reactors. Constructional features and operation (batch and continuous) (3 Hrs.)
4. Models for analysis of gas-liquid and gas-liquid-solid reactions. Film and Penetration Theories, Transport resistances and Heat Effects. (4 Hrs.)
5. Residence Time Distributions (RTD) and macro mixing models. Review of methods for obtaining RTD, Problems in Scale-up. (5 Hrs.)
6. Models for Gas-Liquid Solid reactors: Contact Effectiveness, Models for Trickle bed reactors, RTD based models, Models for three phase slurry reactors, Models for packed bubble column, Models for gas liquid reactors (Only model formulations with assumptions and final design equations wherever available. Numerical solutions of model equations is excluded) (8 Hrs.)
7. Brief description of Laboratory reactors and significance of laboratory data for reactor design and scale-up. (3 Hrs.)
8. Intrinsic Kinetics: Catalysis: Langmuir-Hinshelwood models. Catalyst pellets, Effective diffusivity, Tortuosity, effectiveness factors, Falsified kinetics, Mass transfer and reaction

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in packed beds. Determination of limiting steps from reaction data. Introduction to Chemical Vapor Deposition reactors. (8 Hrs.)

TERM WORK:

1.A minimum of 10 assignments involving a report based on literature survey and an oral presentation to the class on one of the assignments during tutorial sessions are envisaged. The assignments may include Flow regime, Pressure drop, radial and axial distribution, axial dispersion, Consideration of Heat and Mass Transfer and control for (a)Trickle Bed Reactor, (b) Co-current Upflow fixed bed, (c) Counter current fixed bed, (d) Gas-Liquid-Suspended solid reactors, etc. Other suggested topics could be study of Zeolites, Chemical Vapor Deposition reactor, etc. In addition numerical problems on various topics as included above.

2. The performance of the students should be evaluated based on reports and presentations.
3. Point nos 1 & 2 above along with an average of a minimum of two tests should account for term work.

TEXT BOOKS:

1.Y. T. Shah, Gas-Liquid-Solid reactor Design, McGraw Hill, 1979
2.Foggler, Elements of Chemical Reaction Engineering, Prentice Hall India.

REFERNCE BOOKS:

1.Westerterp, K. R., Van Swaaij, and Beevackers, Chemical Reactor Design and Operation, John Wiley and Sons 1978
2. Carberry, Verma. Chemical Reactions and Reaction Engineering, Marcell Decker, 1987
3.Gianetta and Silverton, Multiphase Chemical Reactor- Theory, Design Scale-up. Hemisphere Publishing Corporation, 1986
4.Sharma and Doraiswamy, Heterogeneous reactions Vol 1 and 2, John Wiley , 1984

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

8.5 Elective III (ii) Adsorptive Process Design

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS:

1.**Adsorption Processes:** Modern adsorbent such as Activated carbons, molecular sieves of various types, Activated Alumina. Their characteristics and applications. Regeneration & Activation of adsorbents. Thermal & pressure swing processes. Fixed bed, moving bed, simulated moving bed and other processing schemes. Design of adsorption processes for separation & purification. Industrial examples. (16 Hrs.)

2. **Foam Fractionation Processes:** Foam formation, coalescence, collapse & drainage – phenomena and equipment. Adsorption properties of foams. Modes of operation of foam fractionation equipment. Principal of froth flotation, Properties of foam relevant to flotation operation. Design & Development of flotation equipment. Application of froth flotation to mineral processing, protein & enzyme separation, waste water treatment. (10 Hrs)

3.**Liquid Chromatographic Processes:** Basic concept of chromatography, phenomena & their characterization. Various chromatography options. Typical chromatographic separation systems for preparative chromatography. Equipment. Characteristics of solids, their selection for various applications. Column design & Filling. Applications of chromatography in separation of Enzymes & Proteins. Industrial Examples. (14 Hrs)

TERM WORK:

1.A minimum of 10 assignments involving a report based on literature survey and an oral presentation to the class on one of the assignments during tutorial sessions are envisaged. In addition numerical problems on various topics as included above.

2. The performance of the students should be evaluated based on reports and presentations.
3. Point nos 1 & 2 above along with an average of a minimum of two tests should account for term work.

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TEXT BOOKS:

1. Ruthven,D.M., " Principal of Adsorption & Adsorption Processes , Wiley, 1984."
2. Lemlich, R. , ", " Adsorptive Bubble Separation Techniques." Academic Press, 1972.

REFERENCE BOOKS:

1. Coulson, Richardson, " Chemical Engineering Volume – 3, pergamon."
2. Treybal , R.E, " Mess Transfer Operations " McGraw Hill.
3. Ruthven, Faruqh, Knalbal. " Pressure Swing Adsorption." VCH, 1994.
4. Snyder, Kirl and " Introduction to Modern Liquid Chromatography." 2/e, 1979
5. Scott RTW , " Liquid Chromatography – Column Theory ." Wiley, 1992.

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

8.5 Elective III (iii) Membrane Process Design

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS:

1. Introduction Introduction to membrane processes, history, definition of membrane, importance. processes. (3 hr.)
2. Types of membranes, membrane processes and their applications Porous and solid membranes, Osmosis, Micro-filtration, Ultrafiltration, nanofilteration, reverse osmosis, piezodialysis, electrodialysis, dialysis, membranes for gas separation, pervaporation. Applications of these processes. (7 hr.)
3. Liquid membranes Supported & unsupported liquid membranes, applications and mathematical modelling. (3 hr.)
4. Materials and material properties Plolymers and effect of various properties of polymers such as T_g, thermal, chemical and mechanical stability, elastomers and their properties, Inorganic membranes, biological membranes. (4 hr.)
5. Characterization of membranes: Characterization of porous membranes, characterization of ionic membranes, characterization of non-ionic membranes. (2 hr.)
6. Preparation of synthetic membranes Preparation of phase inversion membranes, preparation techniques for immersion precipitation, preparation techniques for composite membranes, Influence of various parameters on membrane morphology, preparation of inorganic membranes. (4 hr.)
7. Transport processes in membranes Driving force, Transport through porous membranes, transport through nonporous membranes, transport in ion-exchange membranes. (3 hr.)
8. Polarization phenomenon and fouling Concentration polarization, characteristic flux behavior in pressure driven membrane operation, various models, temperature polarization, membrane fouling, methods to reduce fouling. (3 hr.)
9. Modules and process design Plate and frame, spiral wound, tubular, capillary, hollow fiber modules and their comparison, system design. (3 hr.)

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10.Membrane reactors Applications of membrane reactors in biotechnology. (2 hr.)
11.Economics and feasibility of membrane technology Comparison of membrane technology with other separation techniques, Scope in the future, current and existing industrial applications. (3 hr.)

TERM WORK:

1.A minimum of 10 assignments involving a report based on literature survey and an oral presentation to the class on one of the assignments during tutorial sessions are envisaged. In addition numerical problems on various topics as included above.
2. The performance of the students should be evaluated based on report and presentations.
3. Point nos 1 & 2 above along with an average of a minimum of two tests should account for term work.

TEXT BOOKS:

1) Basic Principles of membrane technology – Marcel Mulder, Kluwer Academic Publishers (1997)
2) Membrane Separation Technology- E. J. Hoffma, Gulf Prefession Publishing.

REFERENCE BOOK:

1. Membrane Handbook- Editors W. S. Winston Ho, K. K. Sirkar, Van Nostrand Reinhold Publication.

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

8.5 Elective III (iv) Energy Systems Design

LOAD PER WEEK:	LECTURES	: 3 Hrs.
	PRACTICALS	: Nil.
	TUTORIALS	: 2 Hrs.
EVALUATION SYSTEM:	Theory Examination	: 3 Hrs., 100 Marks
	Practical Examination	: --
	Oral Examination	: --
	Term Work	: 25 Marks
	TOTAL	: 125 Marks

DETAILED SYLLABUS:

Scope: The course is devised to enable the student to understand concepts of energy audit and learn techniques of energy integration and cogeneration in the process industries and evaluate alternative sources of energy.

1. Energy audit: Intoduction; methodology and steps taken; Target setting, Reduction in losses, Improvements in the operations, Operating equipment near its best efficiency, more efficient equipment; preventive maintenance for energy efficiency; high frequency Equipments, Energy efficient Process Technologies (6 Hrs.)
2. Energy integration in the process industries:
   a. Design of Heat Exchanger Networks (HENS): Minimizing utilities in heat integration Temperature interval method Using graphical displays Linear Programming method Stream matching at minimum utilities Stream matching at the pinch Concepts of Optimum approach temperature, Superstructures for minimization of annualized cost. (12 Hrs)
   b. Heat integration in Process Units:
      (i) Multiple Effect Evaporators: with and without vapor recompression. (4 Hrs)
      (ii) Distillation Column: Effect of pressure on heat integration, Multiple effect distillation, Heat pumping, vapour recompression and reboiler flashing, Superstructures for minimization of annualized cost. (6 Hrs)
3. Co-generation of Energy: Introduction, advantages of co-generation, Waste heat boilers, Different types of co-generation power plants, Steam turbine systems, Gas turbine systems, Combined gas steam turbine systems, Diesel engine systems. (8 Hrs)

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4. Renewable sources of energy: Solar energy -- Photo-voltaic cells, solar boilers, solar refrigerators, Wind energy; Fuel cells; Biogas, Biodiesel, Biomass gasification etc. (3 Hrs)
5. Introduction to Tidal, Geothermal sources of Energy. Comparison with Nuclear Enrgy. (1 Hrs)

TERM WORK:

1. Term work will consist of at least one assignment from each major topic which would be compilation of report, making a presentation and wherever applicable numerical problems.
2. An average of two tests would also contribute towards the Term Work.

TEXT BOOKS:

1. Seider, W. D., and Seader, J. D. and Lewin D. R., Process Design Principles, John Wiley and Sons. Inc, 1988
2. Douglas J. M. Conceptual Design of Chemical Process, McGraw Hill Book Co, 1988
3. Biegler, L. T., Grossman, E. I. and Westerberg A. W. Syatematic Methods of Chemical Process Design. Prentice Hall Intl Ltd. 1997

REFERENCE BOOKS:

1. Larmine James. Fuel Cells Explained, John Wiley and Sons 2000
2. Kreith, F., Principles of Solar Energy, McGraw Hill Book Co 1978
3. Freris, L. L., Wind Energy Conversion System, Prentice Hall, 1990
4. Turner, (Ed) Energy Management Hand Book, John Wiley and Sons 2000

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Course B.E. (Chemical Engineering)

Year B.E. Semester VII

8.6 Project - B

LOAD PER WEEK:	LECTURES	: Nil.
	PRACTICALS	: Nil.
	TUTORIALS	: 8 Hrs.
EVALUATION SYSTEM:	Theory Examination	: --
	Practical Examination	: --
	Oral Examination	: 50 Marks
	Term Work	: 100 Marks
	TOTAL	: 150 Marks

DETAILED SYLLABUS:

1. The topic and team for the project will be continued from Semester VII. In case of more than one student being in the team, the topic will be subdivided in such a way that each of the student team will have at least one distinct sub task for which that team member will be solely responsible and on the performance of which he will be graded.
2. Each student group will prepare a detailed, typed project report containing a maximum of 100 pages A4 size, inclusive of index, abstract, illustrations, charts, P & ID and other diagrams, flow sheets, photographs, etc. The report will contain a brief summary of the earlier report submitted at the end of semester VII.
3. A. In case of a project involving the design of a process system leading to a product, the report will include :

- Material and energy balances
- Detailed process design and HAZOP of one major equipment per student/ process modules including mechanical design.
- P & ID / Flow Diagram
- Cost and Feasibility Analysis

B. In case of a project involving experimentation, the report will list all the experimental data, analysis of data, conclusions drawn and discussion on how the conclusions are supported by the experimental data and its analysis.

Some discussion on the utility of the work done for design of a full-scale plant / possibilities of scale up should be presented.

C.In case of a project consisting of developing a process system leading to a service, the project report will enunciate the objective, details of specifications /

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recommendations, adequacy of the proposed system, methods to check the adequacy / performance, comparison vis-à-vis existing systems should be discussed.

TERM WORK:

1. The student will make monthly progress reports to the guide, which will be considered for term work grading. An oral presentation to peers and a panel of senior faculty towards the end of the term is a must. The oral presentation shall carry 40% of the marks allocated for term work.
2. The project orals will be as per rules conducted by an internal and an external examiner and would be based on the final project report.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

B. E. (Computer Engineering)

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI

B.E. COMPUTER ENGINEERING
SCHEME OF INSTRUCTIONS AND EVALUATION (R-2001)

B.E. SEMESTER VII

	Subjects	Scheme of Instructions			Scheme of Evaluation					
		Lect/	Pract/	Tuto/	Paper		T/W	Pract/	Oral	Total
		Week	Week	Week	Hours	Marks				
1	Advanced Microprocessors	4	2	-	3	100	25	-	25	150
2	Intelligent Systems	4	2	-	3	100	25	-	25	150
3	Digital Signal Processing	4	2	-	3	100	25	-	25	150
4	Software Engineering	4	2	-	3	100	25	-	25	150
5	Elective-I	4	2	-	3	100	25	-	25	150
6	Project-A	-	-	2	-	-	25	-	25	50
		20	10	2	-	500	150	-	150	800

B.E. SEMESTER VIII

	Subjects	Scheme of Instructions			Scheme of Evaluation					
		Lect/	Pract/	Tuto/	Paper		T/W	Pract	Oral	Total
		Week	Week	Week	Hours	Marks				
1	System Security	4	2	-	3	100	25	-	25	150
2	Distributed Computing	4	2	-	3	100	25	-	25	150
3	Multimedia Systems*	4	2	-	3	100	25	-	25	150
4	Elective-II	4	2	-	3	100	25	-	25	150
5	Project-B	-	-	6	-	-	50	-	50	100
		16	8	6	-	400	150	-	150	700

Elective-I	
1	Image Processing
2	Pattern Recognition*
3	Mobile Computing*
4	Embedded Systems*
5	Computer Simulation and Modeling*
6	Advanced Computer Networks*

Elective-II	
1	Robotics*
2	Computer Vision*
3	Parallel Processing
4	Data Warehousing and Mining*
5	Neural Networks and Fuzzy Systems*
6	Software Testing*

- * Common with IT
- **Common with Electronics, Instrumentation, Electrical, and IT branches of engineering.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: ADVANCED MICROPROCESSORS

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: To study microprocessor basics and the fundamental principles of architecture related to advanced microprocessors.

Pre-requisite: Microprocessors

DETAILED SYLLABUS

1. **Overview of new generation of modern microprocessors.**
2. **Advanced Intel Microprocessors:** Protected Mode operation of x86 Intel Family; Study of Pentium: Super-Scalar architecture & Pipelining, Register Set & special Instructions, Memory Management, Cache Organizations, Bus operation, Branch Prediction Logic.
3. **Study of Pentium Family of Processors:** Pentium I, Pentium II, Pentium III, Pentium IV, Pentium V: Architectural features, Comparative study.
4. **Advanced RISC Microprocessors:** Overview of RISC Development and current systems, Alpha AXP Architecture, Alpha AXP Implementations & Applications.
5. **Study of Sun SPARC Family:** SPARC Architecture, The Super SPARC, SPARC Implementations & Applications.
6. **Standard for Bus Architecture and Ports:** EISA, VESA, PCI, SCSI, PCMCIA Cards & Slots, ATA, ATAPI, LPT, USB, AGP, RAID
7. **System Architectures for Desktop and Server based systems:** Study of memory subsystems and I/O subsystems. Integration issues

BOOKS

Text Books:

1. Daniel Tabak, "*Advanced Microprocessors*", McGraw-Hill.
2. Barry Brey , "*The Intel Microprocessors, Architecture, Programming and Interfacing*"
3. Tom Shanley, "*Pentium Processor System Architecture*", Addison Wesley Press.

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References:

1. Ray and Bhurchandi, "*Advanced Microprocessors and Peripherals*", TMH
2. James Antonakos, "*The Pentium Microprocessor*", Pearson Education.
3. Badri Ram, "*Advanced Microprocessors and Interfacing*", TMH Publication.
4. Intel Manuals.

TERM WORK

1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: INTELLIGENT SYSTEMS

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objectives: To understand and apply principles, methodologies and techniques in design and implementation of intelligent system.

Prerequisite: Data Structures, Programming Languages, and Algorithms

DETAILED SYLLABUS

1. **Artificial Intelligence**: An overview, Intelligent Systems: Evolution of the concept.
2. **Intelligent Agents**: How agent should act, Structure of intelligent agents, Environments
3. **Problem Solving:** Solving problems by searching, Informed search methods, Game playing
4. **Knowledge and Reasoning:** A knowledge based agent, The wumpus world environment, Representation, Reasoning, Logic, Proportional logic, First order logic: Syntax and Semantics, Extensions and Notational variation, Using first order logic
5. **Building a Knowledge Base:** Properties of good and bad knowledge base, Knowledge engineering, General ontology
6. **Interfacing First Order Logic:** Interface rules involving quantifiers, An example proof, Forward and backward chaining, Completeness
7. **Acting Logically:** Planning, Practical planning: Practical planners, Hierarchical decomposition, Conditional planning
8. **Uncertain Knowledge and Reasoning:** Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief networks, Inference in belief networks
9. **Learning:** Learning from observations: General model of learning agents, Inductive learning, learning decision trees, Learning in neural and belief networks: Introduction to neural networks, Perceptrons, Multilayer feed-forward network, Application of ANN, Reinforcement learning: Passive learning in a known environment, Generalization in reinforcement learning, Genetic algorithms
10. **Agents that Communicate:** Communication as action, Types of communicating agents, A formal grammar for a subset of English
11. **Expert system:** Introduction to expert system, Representing and using domain knowledge, Expert system shells, Explanation, Knowledge acquisition
12. **Applications:** Natural language processing, Perception, Robotics

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BOOKS

Text Books:

1. Struart Russell and Peter Norvig, "*Artificial Intelligence: A Modern Approach*"
2. George F.Luger, *"Artificial Intelligence: Structures and Strategies for Complex Problem Solving"*, Pearson Education

References:

1. Nils J. Nillson, *"Artificial Intelligence: A New Synthesis"*, Harcourt Asia
2. Elaine Rich and Kevin Knight, "*Artificial Intelligence*", TMH
3. Patrick Winston, "*Artificial Intelligence*", Pearson Education
4. Ivan Brakto, "*Prolog Programming for Artificial Intelligence*", Pearson Education
5. Efraim Turban Jay E.Aronson, "*Decision Support Systems and Intelligent Systems*"
6. Ed. M. Sasikumar and Others, *"Artificial Intelligence : Theory and Practice"* Proceedings of the International Conference KBCS-2002, Vikas Publishing House

TERM WORK

2. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: DIGITAL SIGNAL PROCESSING

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: Digital Signal Processing continues to play an increasingly important role in the fields that range literally from A (astronomy) to Z (zeugmatography, or magnetic resonance imaging) and encompass applications such as Compact Disc player, Speech Recognition, echo cancellations in communication systems, image Enhancement, geophysical exploration, and noninvasive medical imaging. This course aims to build concepts regarding the fundamental principles and applications of Signals, System Transforms and Filters.

Pre-requisites: Nil

DETAILED SYLLABUS

1. **Discrete Time Signals & System:** Discrete–time signals, Discrete–time systems, Analysis of discrete-time LTI systems, Discrete-time systems described by differential equations, Implementation of discrete-time systems, Correlation of discrete-time systems
2. **Z-Transform:** Definition and Properties of Z-transform, Rational Z-transforms, Inverse Z-transform, one-sided Z-transform, Analysis of LTI systems in Z-domain
3. **Frequency Analysis of Signals and Systems:** Frequency analysis: Continuous time signals and Discrete-time signals, Properties of the Fourier transform for discrete-time signals, Frequency domain characteristics of LTI systems, LTI system as a frequency selective filter, Inverse systems and deconvolution
4. **Discrete Fourier Transform:** Frequency domain sampling, Properties of DFT, Linear filtering method based on DFT, Frequency analysis of signals using DFT, FFT algorithm, Applications of FFT, Goertzel algorithm, Quantisation effects in the computation of DFT
5. **Implementation of Discrete Time Systems:** Structure of FIR systems, Structure of IIR systems, quantization of filter coefficients, round-off effects in digital filters
6. **Design of Digital Filters:** Design of FIR filters, Design of IIR filters from analog filters, frequency transformations, Design of digital filters based on least-squares method digital filters from analogue filters, Properties of FIR digital filters, Design of FIR filters using windows, Comparison of IIR and FIR filters, and Linear phase filters.
7. **Introduction to DSP co-**processors: TMS 320C40/50, Analog Devices.
8. **Applications :** Image processing, Control, Speech, Audio, Telecommunication

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BOOKS
Text Books:
1. J.G. Proakis, "*Introduction to Digital Signal Processing*", PHI 2. Oppenhiem and Schaffer, "*Discrete Time Signal Processing*"
References:
1. S.K. Mitra, "*Digital Signal Processing*", TMH. 2. T.J. Cavicchi, "*Digital Signal Processing*", John Wiley. 3. L.C. Ludeman," *Fundamentals Of Digital Signal Processing*", John Wiley. 4. E.C. Ifeachor, B.W. Jervis, "*Digital Signal Processing*", Pearson Education. 5. S Sallivahanan, *"Digital Signal Processing*", TMH. 6. Ashok Ambardar, "*Analog and Digital Signal Processing*", Thompson Learning.
TERM WORK
3. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: SOFTWARE ENGINEERING

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Objectives: Apply various software Engineering principles and methodologies while dealing with the various phases of software development.

Pre-requisite: Programming concepts.

DETAILED SYLLABUS

1. **Product:** Evolving role of software, Software Characteristics, Software Applications, Software myths.
2. **Process:** Software Process, Process Models, Linear sequential model, Prototyping model, RAD model, Evolutionary software models, Component-based development, Formal methods model, Fourth generation techniques, Process technology, Product and process.
3. **Project Management:** Management spectrum, People, Product, Process, Project, W^5HH principle.
4. **Software Process and Project Metrics:** Measures-Metrics-Indicators, Metrics in the process and project domains, Software measurement, Metrics for software quality, Integrating metrics within the software engineering process, Statistical quality control, Metrics for small organizations, Establishing a software metrics program.
5. **Software Project Planning:** Objectives, Software scope, Resources, Software project estimation, Decomposition techniques, Empirical estimation models, Make/Buy decision, Automated estimation tools.
6. **Risk Analysis and Management:** Reactive versus proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Risk mitigation-monitoring-management, Safety risks and hazards, RMMM plan.
7. **Project Scheduling and Tracking:** Basic concepts, Relationship between people and effort, Defining a task set for the software project, Selecting software Engineering tasks, Refinement of major tasks, Defining a task network, Scheduling, Earned value network, Error tracking, Project plan.
8. **Software Quality Assurance:** Quality concepts, Quality Movement, Software quality assurance, Software reviews, Formal technical reviews, Formal approaches to SQA, Statistical software quality assurance, Software reliability, Mistake-proofing for software, ISO 9000 quality standards, SQA plan.
9. **Software Configuration Management:** Introduction, SCM process, Identification of objects in the software configuration, Version control, Change control, Configuration audit, Status reporting, SCM standards.
10. **System Engineering:** Computer-based systems, System engineering hierarchy, Business process engineering, product engineering, Requirements

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engineering, System modeling.

11. **Analysis Concepts and Principles:** Requirement Analysis, Requirement elicitation for software, Analysis principles, Software prototyping, Specification.
12. **Analysis Modeling:** Introduction, Elements of analysis model, Data modeling, Functional modeling and information flow, Behavioral modeling, Mechanics of structured analysis, Data dictionary, Other classical analysis methods.
13. **Design Concepts and Principles:** Software design and software engineering, Design process, Design principles, Design concepts, Effective modular design, Design heuristics for effective modularity, Design model, Design documentation.
14. **Architectural Design:** Software architecture, Data design, Architectural styles, Analyzing alternative architectural designs, Mapping requirements into a software architecture, Transform mapping, Transaction mapping, Refining architectural design.
15. **User Interface Design:** The golden rules, User interface design, Task analysis and modeling, Interface design activities, Implementation tools, Design evaluation.
16. **Component-Level Design:** Structured programming, Comparison of design notation.
17. **Software Testing Techniques:** Software testing fundamentals, Test case design, White-box testing, Basis path testing, Control structure testing, Black-box testing, Testing for specialized environments, architectures and applications.
18. **Software Testing Strategies:** Strategic approach to software testing, Strategic issues, Unit testing, Integration testing, Validation testing, System testing, Art of debugging.
19. **Technical Metrics for Software:** Software quality, framework for technical software metrics, Metrics for the analysis model, Metrics for the design model, Metrics for source code, Metrics for testing, Metrics for maintenance.

BOOKS

Text Books:

1. Roger Pressman, "*Software Engineering*", McGraw Hill, Fifth Edition.
2. James Peter, "*Software Engineering An Engineering Approach*", John Wiley
3. Ian Sommerville, "*Software Engineering*", Pearson Education.

References:

1. W.S. Jawadekar, "Software *Engineering*", TMH.
2. Pankaj Jalote, "*An Integrated Approach To Software Engineering* ", Narosa.
3. R. Mall, "*Fundamentals of Software Engineering*", Prentice Hall of India
4. A. Behferooz & F. J. Hudson, "*Software Engineering Fundamentals*", Oxford University Press
5. S. L. Pfleeger, "*Software Engineering Theory and Practice*", Pearson Education

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TERM WORK
4. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: IMAGE PROCESSING
(ELECTIVE-I)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: Digital Image Processing is a rapidly evolving field with growing applications in science and engineering. Image processing holds the possibility of developing the ultimate machine that could perform the visual functions of all living beings. There is an abundance of image processing applications that can serve mankind with the available and anticipated technology in the near future.

Pre-requisites: Digital Signal Processing, & Computer Graphics

DETAILED SYLLABUS

1. **Digital Image Processing Systems:** Introduction, Structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, Storage, Processing, Communication, Display. Image sampling and quantization, Basic relationships between pixels
2. **Image Transforms (Implementation):** Introduction to Fourier transform, DFT and 2-D DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform, Hadamard transform, Discrete cosine transform, Slant transform, Optimum transform: Karhunen - Loeve (Hotelling) transform.
3. **Image Enhancement in the Spatial Domain:** Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters
4. **Image Enhancement in the Frequency Domain:** Frequency domain filters: Smoothing and Sharpening filters, Homomorphic filtering
5. **Wavelets and Multiresolution Processing:** Image pyramids, Subband coding, Haar transform, Series expansion, Scaling functions, Wavelet functions, Discrete wavelet transforms in one dimensions, Fast wavelet transform, Wavelet transforms in two dimensions
6. **Image Data Compression:** Fundamentals, Redundancies: Coding, Interpixel, Psycho-visual, Fidelity criteria, Image compression models, Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone still image compression standards, Video compression standards.
7. **Morphological Image Processing:** Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Morphological algorithm operations on binary images, Morphological algorithm operations on gray-scale images

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8. **Image Segmentation:** Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Region based segmentation
9. **Image Representation and Description:** Representation schemes, Boundary descriptors, Regional descriptors

BOOKS

Text Books:

1. R.C.Gonsales R.E.Woods, "*Digital Image Processing*", Second Edition, Pearson Education
2. Anil K.Jain, "*Fundamentals of Image Processing*", PHI

References:

1. William Pratt, "*Digital Image Processing*", John Wiley
3. Milan Sonka,Vaclav Hlavac, Roger Boyle, "*Image Processing, Analysis, and Machine Vision*" Thomson Learning
2. N Ahmed & K.R. Rao, "*Orthogonal Transforms for Digital Signal Processing*" Springer
3. B. Chanda, D. Dutta Majumder, "*Digital Image Processing and Analysis*", PHI.

TERM WORK

5. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: PATTERN RECOGNITION
(ELECTIVE-I)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: This course teaches the fundamentals of techniques for classifying multi-dimensional data, to be utilized for problem-solving in a wide variety of applications, such as engineering system design, manufacturing, technical and medical diagnostics, image processing, economics, psychology.

Pre-requisite: Linear Algebra, Probability and Statistics

DETAILED SYLLABUS

1. **Introduction:** Machine perception, Pattern recognition systems, Design cycle, Learning and Adaptation
2. **Bayesian Decision Theory:** Bayesian decision theory: Continuous features, Minimum-error rate classification, classification, Classifiers, Discriminant functions and Decision surfaces, Normal density, Discriminant functions for normal density, Bayes Decision theory: discrete features
3. **Maximum-Likelihood and Bayesian Parameter Estimation:** Maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation: Gaussian caseand General theory, Prolems of dimentionality, Hidden Markov Model
4. **Nonparametric Techniques:** Density estimation, Parzen windows, k_n-Nearest-Neighbor estimation, Nearest-Neighbor rule, Matrics and Nearest-Neighbor classification
5. **Linear Discriminants Functions:** Linear discriminant functions and decision surfaces, Generalised linear discriminant functions, 2-Category linearly separable case, Minimising the Perceptron criterion function, Relaxation procedure, Non-separable behavior, Minimum squared error procedure, Ho-Kashyap procedures, Multicategory generalizations
6. **Nonmetric Methods:** Decision tree, CART, ID3, C4.5, Gramatical methods, Gramatical interfaces
7. **Algorithm Independent Machine Learning:** Lack of inherent superiority of any classifier, Bias and Variance, Resampling for estimating statistic, Resampling for classifier design, Estimating and comparing classifiers, Combining classifiers
8. **Unsupervised Learning and Clustering:** Mixture densities and Identifiability, Maximum-Likelihood estimations, Application to normal mixtures, Unsupervised Bayesian learning, Data description and clustering criterion function for clustering, Hierarchical clustering
9. **Applications of Pattern Recognition**

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BOOKS
Text Books:
1. Duda, Hart, and Stock, "*Pattern Classification*", John Wiley and Sons. 2. Gose, Johnsonbaugh and Jost, "*Pattern Recognition and Image analysis*", PHI
TERM WORK
6. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING FOURTH YEAR SEMISTER VII	
SUBJECT: MOBILE COMPUTING (ELECTIVE-I)	
Lectures: 4 Hrs per week Practical: 2 Hrs per week	**Theory: 100 Marks Term work: 25 Marks Oral: 25 Marks**
Objective: Recent developments in portable devices and high-bandwidth, ubiquitous wireless networks has made mobile computing a reality. Indeed, it is widely predicted that within the next few years' access to Internet services will be primarily from wireless devices, with desktop browsing the exception. Such predictions are based on the huge growth in the wireless phone market and the success of wireless data services.This course will help in understanding fundamental concepts, current developments in mobile communication systems and wireless computer networks.	
Pre-requisites: Computer Networks.	
DETAILED SYLLABUS	
1. **Introduction:** Applications, A short history of wireless communication 2. **Wireless Transmission:** Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems. 3. **Medium Access Control:** Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access. 4. **Telecommunication Systems:** GSM: Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, Security, New data services; DECT: System architecture, Protocol architecture; TETRA, UMTS and IMT-2000: UMTS Basic architecture, UTRA FDD mode, UTRA TDD mode 5. **Satellite Systems:** History, Applications, Basics: GEO, LEO, MEO; Routing, Localization, Handover, Examples 6. **Broadcast Systems:** Overview, Cyclic repetition of data, Digital audio broadcasting: Multimedia object transfer protocol; Digital video broadcasting 7. **Wireless LAN:** Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control. Sublayer, Medium access control Sublayer, Information bases And Networking; Bluetooth: User scenarios, Physical layer, MAC layer, Networking. Security, Link	

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management.

8. **Wireless ATM**: Motivation for WATM, Wireless ATM working group, WATM services, Reference model: Example configurations, Generic reference model; Functions: Wireless mobile terminal side, Mobility supporting network side; Radio access layer: Requirements, BRAN; Handover: Handover reference model, Handover requirements, Types of handover, Handover scenarios, Backward handover, Forward handover; Location management: Requirements for location management, Procedures and Entities; Addressing, Mobile quality of service, Access point control protocol
9. **Mobile Network Layer**: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation , Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol, Ad hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Hierarchical algorithms, Alternative metrics
10. **Mobile Transport Layer**: Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP
11. **Support for Mobility**: File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Hypertext markup language, Some approaches that might help wireless access, System architectures; Wireless application protocol: Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WML script, Wireless telephony application, Examples Stacks with Wap, Mobile databases, Mobile agents

BOOKS

Text Books:

1. Jochen Schiller, "*Mobile communications*", Addison wisely , Pearson Education
2. Wiiliam Stallings, "*Wireless Communications and Networks*"

References :

1. Rappaort, "*Wireless Communications Principals and Practices*"
2. YI Bing Lin , "*Wireless and Mobile Network Architectures*", John Wiley
3. P. Nicopolitidis , "*Wireless Networks*", John Wiley
4. K Pahlavan, P. Krishnamurthy , "*Principles of Wireless Networks*"
5. M. Richharia , "*Mobile Satellite Communication: Principles and Trends*", Pearson Education

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TERM WORK
7. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: EMBEDDED SYSTEMS
(ELECTIVE-I)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: Embedded system tools and products are evolving rapidly. This course deals with various approaches to building embedded systems. It introduces unified view of hardware and software. The aim of this course is to make the students aware of the various applications of embedded systems.

Pre-requisites: Microprocessors and C Programming

DETAILED SYLLABUS

1. **An overview of embedded systems:** Introduction to embedded systems, Categories and requirements of embedded systems, Challenges and issues related to embedded software development, Hardware/Software co-design, Introduction to IC technology, Introduction to design technology
2. **Embedded Software development:** Concepts of concurrency, processes, threads, mutual exclusion and inter-process communication, Models and languages for embedded software, Synchronous approach to embedded system design, Scheduling paradigms, Scheduling algorithms, Introduction to RTOS, Basic design using RTOS
3. **Embedded C Language:** Real time methods, Mixing C and Assembly, Standard I/O functions, Preprocessor directives, Study of C compilers and IDE, Programming the target device
4. **Hardware for embedded systems:** Various interface standards, Various methods of interfacing, Parallel I/O interface, Blind counting synchronization and Gadfly Busy waiting, Parallel port interfacing with switches, keypads and display units, Memory and high speed interfacing, Interfacing of data acquisition systems, Interfacing of controllers, Serial communication interface, Implementation of above concepts using C language
5. **Study of ATMEL RISC Processor:** Architecture, Memory, Reset and interrupt , functions, Parallel I/O ports, Timers/Counters, Serial communication, Analog interfaces, Implementation of above concepts using C language, Implementation of above concepts using C language
6. **Case studies and Applications of embedded systems:** Applications to: Communication, Networking, Database, Process Control, Case Studies of: Digital Camera, Network Router, RTLinux

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BOOKS

Text Books:

1. Raj Kamal, "*Embedded Systems*", TMH
2. David E. Simon, "*An Embedded Software Primer* ", Pearson Education
3. Muhammad Ali Mazidi and Janice Gillispie Mazidi, "*The 8051Microcontroller and Embedded Systems*", Pearson Education

References:

1. Frank Vahid, Tony Givargis, "*Embedded System Design: A Unified Hardware/Software Introduction*", John Wiley
2. Craig Hollabaugh, "*Embedded Linux*", Pearson Education
3. Daniel Lewis, "*Fundamentals of Embedded Software*", Pearson Education.
4. Barnett, Cox, O'Cull, "*Embedded C Programming and the Atmel AVR* ", Thomson Learning
5. Myke Predko, "*Programming and Customizing the 8051 Microcontroller*", TMH

TERM WORK

8. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
   - Four experiments on micro controller based systems.
   - Four experiments using cross C compiler and Linux.
   - Two experiments using developments tools like logic analyzer, emulator and simulator.
   - Two experiments on case study of advanced embedded systems

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: COMPUTER SIMULATION AND MODELING
(ELECTIVE-I)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral Exam: 25 Marks**

Objective: In the last five decades digital computer simulation has developed from infancy to a full-fledged discipline. The field of modeling and simulation is as diverse as of man. The application of simulation continues to expand, both in terms of extent to which simulation is used and the range of applications. This course gives a comprehensive and state of art treatment of all the important aspects of a simulation study, including modeling, simulation software, model verification and validation, input modeling.

Pre-Requisite: Probability and Statistics

DETAILED SYLLABUS

1. **Introduction to Simulation:** System and System environment, Components of system, Type of systems, Type of models, Steps in simulation study, Advantages and Disadvantages of simulation.
2. **Simulation Examples:** Simulation of Queueing systems, Other examples of simulation.
3. **General Principles:** Concepts of discrete event simulation, List processing,
4. **Simulation Software:** History of simulation software, Desirable software features, General-purpose simulation packages, Object oriented simulation, Trends in simulation software.
5. **Statistical Models in Simulation:** Useful statistical model, Discrete distribution, Continuous distribution, Poisson process, Empirical distribution.
6. **Queueing Models:** Characteristics of Queueing systems, Queueing notations, Long run measures of performance of Queueing systems, Steady state behavior of infinite population Markovian models, Steady state behavior finite population model, Network of Queues.
7. **Random Number Generation:** Properties of random numbers, Generation of pseudo random numbers, Techniques for generating random numbers, Tests for random numbers.
8. **Random Variate Generation:** Inverse transform technique, Convolution method, Acceptance rejection techniques
9. **Input Modeling:** Data Collection, Identifying the Distribution of data, Parameter estimation, Goodness of fit tests, Selection input model without data, Multivariate and Time series input models.
10. **Verification and Validation of Simulation Model:** Model building, Verification, and Validation, Verification of simulation models, Calibration and Validation of models.

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11. **Output Analysis for a Single Model:** Types of simulations with respect to output analysis, Stochastic nature of output data, Measure of performance and their estimation, Output analysis of terminating simulators, Output analysis for steady state simulation
12. **Comparison and Evaluation of Alternative System Design:** Comparison of two system design, Comparison of several system design, Meta modeling, Optimization via simulation.
13. **Case Studies:** Simulation of manufacturing systems, Simulation of computer systems, Simulation of super market, Simulation of pert network

BOOKS

Text Books:

1. Jerry Banks, John Carson, Barry Nelson, David Nicol, "*Discrete Event System Simulation*"
2. Averill Law, W. David Kelton, "*Simulation Modeling and Analysis*", McGRAW-HILL

References:

1. Geffery Gordon, "*System Simulation*", PHI
2. Bernard Zeigler, Herbert Praehofer, Tag Gon Kim, "*Theory of Modeling and Simulation*", Academic Press
3. Narsing Deo, "*System Simulation with Digital Computer*", PHI
4. Donald W. Body, "*System Analysis and Modeling*", Academic Press Harcourt India
5. W David Kelton, Randall Sadowski, Deborah Sadowski, "*Simulation with Arena*", McGRAW-HILL.

TERM WORK

9. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: ADVANCED COMPUTER NETWORKS
(ELECTIVE-I)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral Examination: 25 Marks**

Objectives: In first part, Advanced technologies like High speed Devices etc. are to be considered. Second part Network programming is to be studied. Not just SOCKETS but also protocols, Drivers, Simulation Programming. In third part we should study Network Design, Protocols designs and analysis considering deterministic and non-deterministic approach. We expect natural thinking from student. For example he should able to consider different constraints and assume suitable data and solve the problems.

Pre-requisites: Computer networks

DETAILED SYLLABUS

1. **Data Communications:** Business Drivers and Networking Directions : Data communication Past and future.
2. **Understanding the standards and their maker:** Creating standards: players and Process, Current forums, Standard protocols, Layered reference models: The OSIRM, Standard computer architectures.
3. **Introduction to Transmission Technologies:** Hardware selection in the design process.
4. **Optical Networking:** SONET/SDH standards, Dense wavelength division multiplexing (DWDM), Performance and Design considerations.
5. **Physical Layer Protocols and Access Technologies:** Physical Layer Protocols and Interfaces, Accessing the Network, Copper access technologies, Cable Access Technologies, Fiber Access Technologies, Air Access Technologies.
6. **Common Protocols and Interfaces in the LAN environment:** Data link layers protocols, LLC and MAC sub layer protocol, Ethernet, Token Ring, Token Bus and FDDI, Bridge protocols, Switching in the LAN environment.
7. **Frame Relay:** FR specification and design, VoFR: Performance and Design considerations, Advantages and disadvantages of FR.
8. **Common WAN Protocol:** ATM: Many faces of ATM, ATM protocol operation (ATM cell and Transmission), ATM networking basics, Theory of operations, B-ISDN protocol reference model, PHY layer, ATM layer (Protocol model), ATM layer and cell (Definition), Traffic descriptors and parameters, Traffic and Congestion control defined, AAL Protocol model, Traffic contract and QoS, User plane overview, Control plane AAL, Management plane, Sub-DS3 ATM, ATM public services.

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9. **Common Protocols and Interfaces in the Upper Layers(TCP/IP):** Background (Routing protocols), TCP/IP suite, Network layer (Internetwork layer), Transport layer, Application layer, Addressing and routing design.
10. **Mature Packet Switched Protocol:** ITU Recommendation X.25, User connectivity, Theory of Operation, Network layer functions, X.75 Internetworking protocol, switched multimegabit data service (SMDS), SMDS and IEEE 802.6, Subscriber Interface and Access protocol, Addressing and Traffic control.
11. **Requirements Definition:** User requirements, Traffic sizing, Traffic characteristics, Protocols, Time and Delay considerations, Connectivity, Availability, Reliability and Maintainability, Service aspects, Budget constraints,.
12. **Traffic Engineering and Capacity planning:** Background (Throughput calculations) , Traffic engineering basics (Traffic characteristics), Traditional Traffic engineering, Queued data and packet switched traffic modeling, Designing for peaks, Delay or Latency, Availability and reliability, Network performance modeling, Creating the traffic matrix, Capacity planning and Network vision, Design tool, Categories of tools, Classes of design tool, Components of design projects, Types of design projects.
13. **Technology Comparisons:** Circuits-message-packet and cell switching methods, Packet switching service aspects, Generic packet switching network characteristics, Private verses public networking, Public network service selection, Business aspects of Packet-Frame and cell switching services, High speed LAN protocols comparisons, Application performance needs.
14. **Access Network Design:** Network design layers, Access layer design, Access network capacity, network topology and hardware, completing the access network design.
15. **Backbone Network Design:** Backbone requirements, Network capacities, Topologies, Topologies strategies, Tuning the network.

BOOKS

Text Books:

1. Darren L Spohn, "Data Network Design", TMH
2. D. Bertsekas, R. Gallager, "*Data Networks*", PHI

References:

1. W.R. Stevens, "*Unix Network Programming*", Vol.1, Pearson Education
2. J.Walrand, P. Varaiya, "High Performance Communication Networks", Morgan Kaufmann
3. Y. Zheng, S. Akhtar, "Networks for Computer Scientists and Engineers", Oxford
4. A.S. Tanenbaum, "Computer Networks"
5. Peterson & Davie, "Computer Networks", Harcourt Asia.
6. James D. McCabe , "Practical Computer Analysis and Design", Harcourt Asia.

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TERM WORK
10. Term work should consist of at least 10 practical experiments and two assignments covering all the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: PROJECT-A

Tutorial: 2 Hrs per week	Term Work: 25 Marks Oral: 25 Marks

GUIDELINES

1. Project-A exam be conducted by two examiners appointed by university. Students have to give seminar on the project-A for the term work marks. All the students of the class must attend all the seminars. Seminars should be conducted continuously for couple of days.
2. Project-A should preferably contain abstract, existing system, problem definition, scope, proposed system, its design, introduction to programming tools, hardware and software platforms requirements etc.
3. Out of the total projects 35 percent may be allowed as to be industry projects. 65 percent projects must be in-house. Head of dept and senior staff in the department will take decision regarding projects.
4. Every student must prepare hand written synopsis in the normal journal format.
5. Internal guide has to interact at least once in fortnight and maintain the progress and attendance report during both the terms.
6. Two research projects may be allowed only for outstanding students with research aptitude.
7. In case of industry projects, visit by internal guide will be preferred. Industry project will attract demos either at site or in college.
8. Make sure that external project guides are BE graduates.
9. Number of students for a project should be preferably 2 to 4. Only one student should be avoided and up to 6 may be allowed only for exceptional and complex projects.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VIII

SUBJECT: SYSTEM SECURITY

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral: 25 Marks**

Objectives of the course: Learn about the threats in computer security. Understand what puts you at a risk and how to control it. Controlling a risk is not eliminating the risk but to bring it to a tolerable level.

Pre-requisites: Computer Networks, Operating system.

DETAILED SYLLABUS

1. **Introduction:** Security, Attacks, Computer criminals, Method of defense
2. **Cryptography:** Basic Cryptography: Classical Cryptosystems, Public key Cryptography, Cryptographic checksum, Key Management: Key exchange, Key generation, Cryptographic key infrastructure, Storing and revoking keys, Hash algorithm, Digital signature, Cipher Techniques: Problems, Stream and block ciphers: AES, DES, RC4.
3. **Program Security:** Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats
4. **Operating System Security:** Protected objects and methods of protection, Memory address protection, Control of access to general objects, File protection mechanism, Authentication: Authentication basics, Password, Challenge-response, Biometrics.
5. **Database Security:** Security requirements, Reliability and integrity, Sensitive data, Interface, Multilevel database, Proposals for multilevel security
6. **Security in Networks:** Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure e-mail, Networks and cryptography, Example protocols: PEM, SSL, IPsec
7. **Administrating Security:** Security planning, Risk analysis, Organizational security policies, Physical security.
8. **Legal, Privacy, and Ethical Issues in Computer Security:** Protecting programs and data, Information and law, Rights of employees and employers, Software failures, Computer crime, Privacy, Ethical issues in computer society, Case studies of ethics

Books

Text Books:

1. Stallings, "*Cryptography And Network Security: Principles and practice*"
2. C. P. Pfleeger, and S. L. Pfleeger, "*Security in Computing*", Pearson Education.

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3. Matt Bishop, "*Computer Security: Art and Science*", Pearson Education.

References :

1. Kaufman, Perlman, Speciner, "*Network Security*"
2. Eric Maiwald, "*Network Security : A Beginner's Guide*", TMH
3. Bruce Schneier, "*Applied Cryptography*", John Wiley.
4. Macro Pistoia, "*Java network security* ", Pearson Education
5. Whitman, Mattord, "*Principles of information security*", Thomson

TERM WORK

11. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VIII

SUBJECT: DISTRIBUTED COMPUTING

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral: 25 marks**

Objective: This course aims to build concepts regarding the fundamental principles of distributed systems. The design issues and distributed operating system concepts are covered.

Pre-requisites: Operating Systems and Computer Networks

DETAILED SYLLABUS

1. **Introduction to Distributed System:** Goals, Hardware concepts, Software concepts, and Client-Server model. Examples of distributed systems.
2. **Communication:** Layered protocols, Remote procedures call, Remote object invocation, Message-oriented communication, Stream-oriented communication.
3. **Processes:** Threads, Clients, Servers, Code Migration, Software agent.
4. **Naming:** Naming entities, Locating mobile entities, Removing un-referenced entities.
5. **Synchronization:** Clock synchronization, Logical clocks, Global state, Election algorithms, Mutual exclusion, Distributed transactions.
6. **Consistency and Replication:** Introduction, Data centric consistency models, Client centric consistency models, Distribution protocols, Consistency protocols.
7. **Fault Tolerance:** Introduction, Process resilience, Reliable client server communication, Reliable group communication. Distributed commit, Recovery.
8. **Security:** Introduction, Secure channels, Access control, Security management.
9. **Distributed File System:** Sun network file system, CODA files system.
10. **Case Study:** CORBA, Distributed COM, Globe, Comparison of CORBA, DCOM, and Globe.

BOOKS

Text Books:

1. A. Taunenbaum, "*Distributed Systems: Principles and Paradigms*"
2. G. Coulouris, J. Dollimore, and T. Kindberg, "*Distributed Systems: Concepts and Design*", Pearson Education

References:

1. M. Singhal, N. Shivaratri, "*Advanced Concepts in Operating Systems*", TMH

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TERM WORK
12. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VIII

SUBJECT: MULTIMEDIA SYSTEMS

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral: 25 marks**

Objectives of the course: This course teaches students to collect, and intelligently integrate multiple media on computers. Students learn the issues involved in capturing, compressing, processing, manipulating, searching, indexing, storing, and retrieving various kinds of continuous media in the text section.

Pre-requisites: Operating Systems, Computer Networks

DETAILED SYLLABUS

1. Multimedia Systems Introduction: Multimedia application, Multimedia system architecture, Evolving technologies for multimedia systems, defining objects for multimedia systems, Multimedia data interface standards
2. Compression and Decompression: Types of compression, Binary image compression schemes, Color, Gray scale, Still video image compression, Video image compression, Audio compression, Fractal compression, Data and File Format Standards: Rich text format, TIFF, RIFF, MIDI, JPEG, AVI, MPEG
3. Multimedia Input/Output Technologies: Key technologies issues, Pen input, Video and Image display system, Printout technology, Image scanners, Digital Voice and Audio, Full motion video
4. Storage and Retrieval Technologies: Magnetic media technology, Optical media, Hierarchical storage management, Cache management for storage system, Image and video databases: Indexing and Retrieval
5. Architectural and Telecommunications Considerations: Specialized computational processors, Memory systems, Multimedia board solutions, LAN/WAN connectivity, Multimedia transport across ATM networks, Multimedia across wireless, Distributed object models
6. Multimedia Networking: Multimedia networking applications, Streaming stored audio and video, RTP, Scheduling and policing mechanisms, Integrated services, RSVP
7. Multimedia Application Design: Multimedia application classes, Types of multimedia systems, Virtual reality design, Components of multimedia systems, Organizing multimedia databases, application workflow design issues, Distributed application design issues, Applications like Interactive, Television, Video Conferencing, Video-on-demand, Educational applications and authoring, Industrial applications, Multimedia archives and digital libraries
8. Multimedia Authoring and User Interface: Multimedia authoring systems, Hyper media application design considerations, User interface design, information access, Object display/playback issues

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9. Hyper Media Messaging: Mobile messaging, Hyper media message components, Hypermedia linking and embedding, Creating hypermedia messages, integrated multimedia message standards, Integrated document management, The world-wide web, Open hypermedia systems, Content based navigation.
10. Distributed Multimedia Systems: Components of distributed multimedia systems, Distributed client server operations, Multimedia object servers, Multi-server network topologies, Distributed multimedia database, Managing distributed objects
11. Multimedia System Design: Methodology and considerations, Multimedia systems design examples.

Books

Text Books:

1. Prabhat K. Andheigh, Kiran Thakrar, "*Multimedia Systems Design*", PHI John F,
2. Koegel Buford, "*Multimedia Systems*", Pearson Education.

References :

1. Free Halshall, "*Multimedia Communications*", Pearson Education.
2. R. Steimnetz, K. Nahrstedt, "*Multimedia Computing, Communications and Applications*", Pearson Education
3. K.R. Rao, D. Milovanovic, "*Multimedia Communication Systems: Techniques, Standards, and Networks*"
4. Subrahmanian, "*Multimedia Database Systems*", M. Kaufman
5. J. D. Gibson, "*Multimedia Communications: Directions and Innovations*", Academic Press, Hardcourt India
6. J.F. Kurose, K.W. Ross, "*Computer Networking*", Pearson Education

TERM WORK

13. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VIII

SUBJECT: Elective – II, Robotics

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Rationale: This course familiarizes students with the concepts and techniques in robot manipulator control, enough to evaluate, choose, and incorporate robots in engineering systems.

DETAILED SYLLABUS

Robotic Manipulation
Automation and Robots, Classification, Application, Specification, Notations.

Direct Kinematics
Dot and cross products, Co-ordinate frames, Rotations, Homogeneous, Co-ordinates, Link co-ordination arm equation, (Five-axis robot, Four axis robot, Six axis robot).

Inverse Kinematics
General properties of solutions tool configuration Five axis robots, Three-Four axis, Six axis robot (Inverse kinematics).
Workspace analysis and trajectory planning work envelop and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

Robot Vision
Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation (Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured Illumination, Camera calibration).

Task Planning
Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp planning, Fine-motion Planning, Simulation of Planer motion, Source and goal scenes, Task planner simulation.

Moments of Inertia.

Principles of NC and CNC Machines.

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BOOKS

Text Books:

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India
2. Fu, Gonzales and Lee, Robotics, McGraw Hill
3. J.J, Craig, Introduction to Robotics, Pearson Education

Additional Reading:

1. Staughard, Robotics and AI, Prentice Hall of India
2. Grover, Wiess, Nagel, Oderey, "Industrial Robotics", McGraw Hill
3. Walfram Stdder, Robotics and Mechatronics,
4. Niku, Introduction to Robotics, Pearson Education
5. Klafter, Chmielewski, Negin, Robot Engineering, Prentice Hall of India
6. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications

TERM WORK

1. Term work should consist of at least 10 practicals and assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VIII

SUBJECT: COMPUTER VISION
(ELECTIVE-II)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: To introduce the student to computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving

Pre-requisite: Introduction to Image Processing.

DETAILED SYLLABUS

1. **Recognition Methodology:** Conditioning, Labeling, Grouping, Extracting, Matching. Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection. Thinning, Region growing, region shrinking, Labeling of connected components.
2. **Binary Machine Vision:** Thresholding, Segmentation, Connected component labeling, Hierarchal segmentation, Spatial clustering, Split & merge, Rule-based Segmentation, Motion-based segmentation.
3. **Area Extraction:** Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting).
4. **Region Analysis:** Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.
5. **Facet Model Recognition:** Labeling lines, Understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, Consisting labeling problem, Back-tracking, Perspective Projective geometry, Inverse perspective Projection, Photogrammetry – from 2D to 3D, Image matching : Intensity matching of ID signals, Matching of 2D image, Hierarchical image matching.
6. **Object Models And Matching:** 2D representation, Global vs. Local features.
7. **General Frame Works For Matching:** Distance relational approach, Ordered-structural matching, View class matching, Models database organization.
8. **General Frame Works:** Distance –relational approach, Ordered –Structural matching, View class matching, Models database organization.
9. **Knowledge Based Vision:** Knowledge representation, Control-strategies, Information integration.

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BOOKS
Text Books:
1. David A. Forsyth, Jean Ponce, *"Computer Vision: A Modern Approach"* 2. R. Jain, R. Kasturi, and B. G. Schunk, *"Machine Vision"*, McGraw-Hill.
References:
1. Milan Sonka,Vaclav Hlavac, Roger Boyle, "*Image Processing, Analysis, and Machine Vision*" Thomson Learning 2. Robert Haralick and Linda Shapiro, *"Computer and Robot Vision"*, Vol I, II, Addison-Wesley, 1993.
TERM WORK
14. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VIII

SUBJECT: PARALLEL PROCESSING
(ELECTIVE-II)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: Upon completion of this course students will be able to understand and employ the fundamental concepts and mechanisms which form the basis of the design of parallel computation models and algorithms, recognize problems and limitations to parallel systems, as well as possible solutions

Pre-requisite: Computer architecture, Data structures

DETAILED SYLLABUS

1. **Introduction:** Parallel Processing Architectures: Parallelism in sequential machines, Abstract model of parallel computer, Multiprocessor architecture, Pipelining, Array processors.
2. **Programmability Issues:** An overview, Operating system support, Types of operating systems, Parallel programming models, Software tools
3. **Data Dependency Analysis:** Types of dependencies loop and array dependences, Loop dependence analysis, Solving diophantine equations, Program transformations
4. **Shared Memory Programming:** General model of shared memory programming, Process model under UNIX
5. **Algorithms for Parallel Machines:** Speedup, Complexity and cost, Histogram computation, Parallel reduction, Quadrature problem, Matrix multiplication, Parallel sorting algorithms, Solving linear systems, Probabilistic algorithms
6. **Message Passing Programming:** Introduction, Model, Interface, Circuit satisfiability, Introducing collective, Benchmarking parallel performance
7. **Parallel Programming languages:** Fortran90, nCUBE C, Occam, C-Linda
8. **Debugging Parallel Programs:** Debugging techniques, Debugging message passing parallel programs, Debugging shared memory parallel programs
9. **Memory and I/O Subsystems:** Hierarchical memory structure, Virtual memory system, Memory allocation and management, Cache allocation and management, Cache memories and management, Input output subsystems
10. **Other Parallelism Paradigms:** Data flow computing, Systolic architectures, Functional and logic paradigms, Distributed shared memory
11. **Performance of Parallel Processors:** Speedup and efficiency, Amdahl's law, Gustafson-Barsis's law, Karf-Flatt metric, Isoefficiency metric

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BOOKS

Text Books:

1. Hawang Kai and Briggs F. A., "*Computer Architecture and Parallel Processing*", McGraw Hill
2. Jorden H. F. and Alaghaband G., "*Fundamentals of Parallel Processing*"
3. M.J. Quinn, "*Parallel Programming*", TMH

References:

1. Shasikumar M., "*Introduction to Parallel Processing*", PHI
2. Wilson G.V., "*Practical Parallel Programming*", PHI
3. D. E. Culler, J.P. Singh, A. Gupta, *"Parallel Computer Architecture*", Morgan Kaufman

TERM WORK

15. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VIII

SUBJECT: DATA WAREHOUSING AND MINING
(ELECTIVE-II)

Lectures: 4 Hrs per week Practical: 2 Hrs per week	**Theory: 100 Marks** **Term work: 25 Marks** **Oral Exam: 25 Marks**

Objectives of the course: The data warehousing part of module aims to give students a good overview of the ideas and techniques which are behind recent development in the data warehousing and online analytical processing (OLAP) fields, in terms of data models, query language, conceptual design methodologies, and storage techniques. Data mining part of the model aims to motivate, define and characterize data mining as process; to motivate, define and characterize data mining applications.

Pre-requisites: DBMS

DETAILED SYLLABUS

Data Warehousing:

1. **Overview And Concepts:** Need for data warehousing, Basic elements of data warehousing, Trends in data warehousing.
2. **Planning And Requirements:** Project planning and management, Collecting the requirements.
3. **Architecture And Infrastructure:** Architectural components, Infrastructure and metadata.
4. **Data Design And Data Representation:** Principles of dimensional modeling, Dimensional modeling advanced topics, data extraction, transformation and loading, data quality.
5. **Information Access And Delivery:** Matching information to classes of users, OLAP in data warehouse, Data warehousing and the web.
6. **Implementation And Maintenance:** Physical design process, data warehouse deployment, growth and maintenance.

Data Mining:

1. **Introduction:** Basics of data mining, related concepts, Data mining techniques.
2. **Data Mining Algorithms:** Classification, Clustering, Association rules.
3. **Knowledge Discovery :** KDD Process
4. **Web Mining:** Web Content Mining, Web Structure Mining, Web Usage mining.
5. **Advanced Topics:** Spatial mining, Temporal mining.
6. **Visualisation :** Data generalization and summarization-based characterization, Analytical characterization: analysis of attribute relevance, Mining class comparisons: Discriminating between different classes, Mining descriptive statistical measures in large databases

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7. **Data Mining Primitives, Languages, and System Architectures:** Data mining primitives, Query language, Designing GUI based on a data mining query language, Architectures of data mining systems
8. **Application and Trends in Data Mining:** Applications, Systems products and research prototypes, Additional themes in data mining, Trends in data mining

BOOKS

Text Books:

1. Paulraj Ponnian, "*Data Warehousing Fundamentals*", John Wiley.
2. M.H. Dunham, "*Data Mining Introductory and Advanced Topics*", Pearson Education.
3. Han, Kamber, "*Data Mining Concepts and Techniques*", Morgan Kaufmann

References:

1. Ralph Kimball, "*The Data Warehouse Lifecycle toolkit*", John Wiley.
2. M Berry and G. Linoff, "*Mastering Data Mining*", John Wiley.
3. W.H. Inmon, "*Building the Data Warehouses*", Wiley Dreamtech.
4. R. Kimpall, "*The Data Warehouse Toolkit*", John Wiley.
5. E.G. Mallach, "*Decision Support and Data Warehouse systems*", TMH.

TERM WORK

16. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VIII

SUBJECT: NEURAL NETWORKS & FUZZY SYSTEMS (ELECTIVE-II)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: This course covers basic concepts of artificial neural networks, fuzzy logic systems and their applications. Its focus will be on the introduction of basic theory, algorithm formulation and ways to apply these techniques to solve real world problems.

Pre-requisite: Knowledge of calculus, and basic probability and statistics are required. Background in the following subjects desirable: numerical analysis (including optimization). Programming skills in one of the following would be desirable: Matlab, MathCad, C, Java, C++

DETAILED SYLLABUS

1. **Introduction:** Biological neurons, McCulloch and Pitts models of neuron, Types of activation function, Network architectures, Knowledge representation. Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules.
2. **Single Layer Perceptron:** Perceptron convergence theorem, Method of steepest descent - least mean square algorithms.
3. **Multilayer Perceptron:** Derivation of the back-propagation algorithm, Learning Factors.
4. **Radial Basis and Recurrent Neural Networks:** RBF network structure, theorem and the reparability of patterns, RBF learning strategies, K-means and LMS algorithms, comparison of RBF and MLP networks, Hopfield networks: energy function, spurious states, error performance .
5. **Simulated Annealing:** The Boltzmann machine, Boltzmann learning rule, Bidirectional Associative Memory.
6. **Fuzzy logic:** Fuzzy sets, Properties, Operations on fuzzy sets, Fuzzy relations, Operations on fuzzy relations, The extension principle, Fuzzy measures, Membership functions, Fuzzification and defuzzification methods, Fuzzy controllers.

BOOKS

Text Books:

1. Simon Haykin, "*Neural Network a - Comprehensive Foundation*", Pearson Education
2. Zurada J.M., "*Introduction to Artificial Neural Systems*, Jaico publishers
3. Thimothy J. Ross, "*Fuzzy Logic with Engineering Applications*", McGraw Hill

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4. Ahmad Ibrahim, "*Introduction to Applied Fuzzy Electronics*", PHI

References:

1. Yegnanarayana B., "*Artificial Neural Networks*", PHI
2. Driankov D., Hellendoorn H. & Reinfrank M., "*An Introduction to Fuzzy Control*", Norosa Publishing House
3. Berkan R.C., and Trubatch S.L., "*Fuzzy Systems Design Principles*", IEEE Press

TERM WORK

17. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VII

SUBJECT: SOFTWARE ENGINEERING

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objectives: Apply various software Engineering principles and methodologies while dealing with the various phases of software development.

Pre-requisite: Programming concepts.

DETAILED SYLLABUS

20. **Product:** Evolving role of software, Software Characteristics, Software Applications, Software myths.
21. **Process:** Software Process, Process Models, Linear sequential model, Prototyping model, RAD model, Evolutionary software models, Component-based development, Formal methods model, Fourth generation techniques, Process technology, Product and process.
22. **Project Management:** Management spectrum, People, Product, Process, Project, W^5HH principle.
23. **Software Process and Project Metrics:** Measures-Metrics-Indicators, Metrics in the process and project domains, Software measurement, Metrics for software quality, Integrating metrics within the software engineering process, Statistical quality control, Metrics for small organizations, Establishing a software metrics program.
24. **Software Project Planning:** Objectives, Software scope, Resources, Software project estimation, Decomposition techniques, Empirical estimation models, Make/Buy decision, Automated estimation tools.
25. **Risk Analysis and Management:** Reactive versus proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, Risk mitigation-monitoring-management, Safety risks and hazards, RMMM plan.
26. **Project Scheduling and Tracking:** Basic concepts, Relationship between people and effort, Defining a task set for the software project, Selecting software Engineering tasks, Refinement of major tasks, Defining a task network, Scheduling, Earned value network, Error tracking, Project plan.
27. **Software Quality Assurance:** Quality concepts, Quality Movement, Software quality assurance, Software reviews, Formal technical reviews, Formal approaches to SQA, Statistical software quality assurance, Software reliability, Mistake-proofing for software, ISO 9000 quality standards, SQA plan.
28. **Software Configuration Management:** Introduction, SCM process, Identification of objects in the software configuration, Version control, Change control, Configuration audit, Status reporting, SCM standards.

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29. **System Engineering:** Computer-based systems, System engineering hierarchy, Business process engineering, product engineering, Requirements engineering, System modeling.
30. **Analysis Concepts and Principles:** Requirement Analysis, Requirement elicitation for software, Analysis principles, Software prototyping, Specification.
31. **Analysis Modeling:** Introduction, Elements of analysis model, Data modeling, Functional modeling and information flow, Behavioral modeling, Mechanics of structured analysis, Data dictionary, Other classical analysis methods.
32. **Design Concepts and Principles:** Software design and software engineering, Design process, Design principles, Design concepts, Effective modular design, Design heuristics for effective modularity, Design model, Design documentation.
33. **Architectural Design:** Software architecture, Data design, Architectural styles, Analyzing alternative architectural designs, Mapping requirements into a software architecture, Transform mapping, Transaction mapping, Refining architectural design.
34. **User Interface Design:** The golden rules, User interface design, Task analysis and modeling, Interface design activities, Implementation tools, Design evaluation.
35. **Component-Level Design:** Structured programming, Comparison of design notation.
36. **Software Testing Techniques:** Software testing fundamentals, Test case design, White-box testing, Basis path testing, Control structure testing, Black-box testing, Testing for specialized environments, architectures and applications.
37. **Software Testing Strategies:** Strategic approach to software testing, Strategic issues, Unit testing, Integration testing, Validation testing, System testing, Art of debugging.
38. **Technical Metrics for Software:** Software quality, framework for technical software metrics, Metrics for the analysis model, Metrics for the design model, Metrics for source code, Metrics for testing, Metrics for maintenance.

BOOKS

Text Books:

4. Roger Pressman, "*Software Engineering*", McGraw Hill, Fifth Edition.
5. James Peter, "*Software Engineering An Engineering Approach*", John Wiley
6. Ian Sommerville, "*Software Engineering*", Pearson Education.

References:

6. W.S. Jawadekar, "Software *Engineering*", TMH.
7. Pankaj Jalote, "*An Integrated Approach To Software Engineering* ", Narosa.
8. R. Mall, "*Fundamentals of Software Engineering*", Prentice Hall of India
9. A. Behferooz & F. J. Hudson, "*Software Engineering Fundamentals*", Oxford University Press
10. S. L. Pfleeger, "*Software Engineering Theory and Practice*", Pearson Education

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TERM WORK
18. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. COMPUTER ENGINEERING
FOURTH YEAR SEMISTER VIII

SUBJECT: PROJECT-B

Tutorial: 6 Hrs per week	Term Work: 50 Marks Oral: 50 Marks

GUIDELINES

1. Project-B exam be conducted by two examiners appointed by university. Students have to give demonstration and seminar on the project-B for the term work marks. All the students of the class must attend all the seminars. Seminars should be conducted continuously for couple of days.
2. Project –B should contain:
   - Introduction and motivation, Problem statement, Requirement analysis, Project design, Implementation details, Technologies used, Test cases, Project time line, Task distribution, References, and Appendix consisting of users manual, technical reference manual.
   - CD containing: Project documentation, Implementation code, Required utilities, Software's and Manuals.
   - Every student must prepare well formatted, printed and hard bound report.
3. Internal guide has to interact at least once in fortnight and maintain the progress and attendance report during the term.
4. Make sure that external project guides are BE graduates.
5. Convener should make sure that external examiners are appointed from the list as per appropriate technical area.

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Enclosure to Item No._____

UNIVERSITY OF MUMBAI

Revised Scheme & Syllabus

for

INFORMATION TECHNOLOGY

Semester VII and VIII

(with effect from the academic year 2004-2005)

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UNIVERSITY OF MUMBAI
B.E, INFORMATION TECHNOLOGY
SCHEME OF INSTRUCTIONS AND EVALUATION (R-2001)

B.E. SEMESTER VII

	Subjects	Scheme of Instructions			Scheme of Evaluation					
		Lect/	Pract /	Tuto/	Paper		T/W	Pract	Oral	Total
		Week	Week	Week	Hours	Marks				
1	Computer Simulation and Modeling*	4	2	-	3	100	25	-	25	150
2	Mobile Computing*	4	2	-	3	100	25	-	25	150
3	Image Processing	4	2	-	3	100	25	-	25	150
4	Management Information Systems	4	2	-	3	100	25	-	25	150
5	Elective-I	4	2	-	3	100	25	-	25	150
6	Project-A	-	-	2	-	-	25	-	25	50
		20	10	2	-	500	150	-	150	800

B.E. SEMESTER VIII

	Subjects	Scheme of Instructions			Scheme of Evaluation					
		Lect/	Pract /	Tuto/	Paper		T/W	Pract	Oral	Total
		Week	Week	Week	Hours	Marks				
1	Data Warehousing and Mining*	4	2	-	3	100	25	-	25	150
2	Multimedia Systems*	4	2	-	3	100	25	-	25	150
3	Project Management	4	2	-	3	100	25	-	25	150
4	Elective-II	4	2	-	3	100	25	-	25	150
5	Project-B	-	-	6	-	-	50	-	50	100
		16	8	6	-	400	150	-	150	700

Elective-I	
1	Programming With Components
2	Pattern Recognition*
3	Speech Recognition
4	Embedded Systems*
5	Advanced Database Systems
6	Advanced Computer Networks*

Elective-II	
1	Robotics**
2	Computer Vision*
3	Geographical Information System
4	Neural Networks and Fuzzy Systems*
5	Software Testing*
6	Information Security

* Common with CE
**Common with Electronics, Instrumentation, Electrical, Computer Engineering branches

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: COMPUTER SIMULATION AND MODELING

Lectures: 4 Hrs per week **Practical:** 2 Hrs per week	**Theory:** 100 Marks **Term Work:** 25 Marks **Oral Exam:** 25 Marks

Objective: In the last five decades digital computer simulation has developed from infancy to a full-fledged discipline. The field of modeling and simulation is as diverse as of man. The application of simulation continues to expand, both in terms of extent to which simulation is used and the range of applications. This course gives a comprehensive and state of art treatment of all the important aspects of a simulation study, including modeling, simulation software, model verification and validation, input modeling.

Pre-Requisite: Probability and Statistics

DETAILED SYLLABUS

1. **Introduction to Simulation:** System and System environment, Components of system, Type of systems, Type of models, Steps in simulation study, Advantages and Disadvantages of simulation.
2. **Simulation Examples:** Simulation of Queueing systems, Other examples of simulation.
3. **General Principles:** Concepts of discrete event simulation, List processing,
4. **Simulation Software:** History of simulation software, Desirable software features, General-purpose simulation packages, Object oriented simulation, Trends in simulation software.
5. **Statistical Models in Simulation:** Useful statistical model, Discrete distribution, Continuous distribution, Poisson process, Empirical distribution.
6. **Queueing Models:** Characteristics of Queueing systems, Queueing notations, Long run measures of performance of Queueing systems, Steady state behavior of infinite population Markovian models, Steady state behavior finite population model, Network of Queues.
7. **Random Number Generation:** Properties of random numbers, Generation of pseudo random numbers, Techniques for generating random numbers, Tests for random numbers.
8. **Random Variate Generation:** Inverse transform technique, Convolution method, Acceptance rejection techniques
9. **Input Modeling:** Data Collectien, Identifying the Distribution of data, Parameter estimation, Goodness of fit tests, Selection input model without data, Multivariate and Time series input models.
10. **Verification and Validation of Simulation Model:** Model building, Verification, and Validation, Verification of simulation models, Calibration and Validation of models.
11. **Output Analysis for a Single Model:** Types of simulations with respect to output analysis, Stochastic nature of output data, Measure of performance and

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their estimation, Output analysis of terminating simulators, Output analysis for steady state simulation

12. **Comparison and Evaluation of Alternative System Design:** Comparison of two system design, Comparison of several system design, Meta modeling, Optimization via simulation.
13. **Case Studies:** Simulation of manufacturing systems, Simulation of computer systems, Simulation of super market, Simulation of pert network

BOOKS

Text Books:

1. Jerry Banks, John Carson, Barry Nelson, David Nicol, "*Discrete Event System Simulation*"
2. Averill Law, W. David Kelton, "*Simulation Modeling and Analysis*", McGRAW-HILL

References:

1. Geffery Gordon, "*System Simulation*", PHI
2. Bernard Zeigler, Herbert Praehofer, Tag Gon Kim, "*Theory of Modeling and Simulation*", Academic Press
3. Narsing Deo, "*System Simulation with Digital Computer*", PHI
4. Donald W. Body, "*System Analysis and Modeling*", Academic Press Harcourt India
5. W David Kelton, Randall Sadowski, Deborah Sadowski, "*Simulation with Arena*", McGRAW-HILL.

TERM WORK

1. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: MOBILE COMPUTING

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral: 25 Marks**

Objective: Recent developments in portable devices and high-bandwidth, ubiquitous wireless networks has made mobile computing a reality. Indeed, it is widely predicted that within the next few years' access to Internet services will be primarily from wireless devices, with desktop browsing the exception. Such predictions are based on the huge growth in the wireless phone market and the success of wireless data services. This course will help in understanding fundamental concepts, current developments in mobile communication systems and wireless computer networks.

Pre-requisites: Computer Networks.

DETAILED SYLLABUS

1. **Introduction:** Applications, A short history of wireless communication
2. **Wireless Transmission:** Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems.
3. **Medium Access Control:** Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SDMA, FDMA, TDMA: Fixed TDM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, Reservation TDMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access.
4. **Telecommunication Systems:** GSM: Mobile services, System architecture, Radio interface, Protocols, Localization And Calling, Handover, Security, New data services; DECT: System architecture, Protocol architecture; TETRA, UMTS and IMT-2000: UMTS Basic architecture, UTRA FDD mode, UTRA TDD mode
5. **Satellite Systems:** History, Applications, Basics: GEO, LEO, MEO; Routing, Localization, Handover, Examples
6. **Broadcast Systems:** Overview, Cyclic repetition of data, Digital audio broadcasting: Multimedia object transfer protocol; Digital video broadcasting
7. **Wireless LAN:** Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical layer, Channel access control. Sublayer, Medium access control Sublayer, Information bases And Networking; Bluetooth: User scenarios, Physical layer, MAC layer, Networking. Security, Link management.
8. **Wireless ATM:** Motivation for WATM, Wireless ATM working group, WATM

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services, Reference model: Example configurations, Generic reference model; Functions: Wireless mobile terminal side, Mobility supporting network side; Radio access layer: Requirements, BRAN; Handover: Handover reference model, Handover requirements, Types of handover, Handover scenarios, Backward handover, Forward handover; Location management: Requirements for location management, Procedures and Entities; Addressing, Mobile quality of service, Access point control protocol

9. **Mobile Network Layer:** Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation , Optimizations, Reverse tunneling, Ipv6; Dynamic host configuration protocol, Ad hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Hierarchical algorithms, Alternative metrics
10. **Mobile Transport Layer:** Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP
11. **Support for Mobility:** File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Hypertext markup language, Some approaches that might help wireless access, System architectures; Wireless application protocol: Architecture, Wireless datagram protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language, WML script, Wireless telephony application, Examples Stacks with Wap, Mobile databases, Mobile agents

BOOKS

Text Books:

1. Jochen Schiller, "*Mobile communications*", Addison wisely , Pearson Education
2. Wiiliam Stallings, "*Wireless Communications and Networks*"

References :

1. Rappaort, "*Wireless Communications Principals and Practices*"
2. YI Bing Lin , "*Wireless and Mobile Network Architectures*", John Wiley
3. P. Nicopolitidis , "*Wireless Networks*", John Wiley
4. K Pahlavan, P. Krishnamurthy , "*Principles of Wireless Networks*"
5. M. Richharia , "*Mobile Satellite Communication: Principles and Trends*", Pearson Education

TERM WORK

2. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIN TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: IMAGE PROCESSING

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: Digital Image Processing is a rapidly evolving field with growing applications in science and engineering. Image processing holds the possibility of developing the ultimate machine that could perform the visual functions of all living beings. There is an abundance of image processing applications that can serve mankind with the available and anticipated technology in the near future.

Pre-requisites: Digital Signal Processing

DETAILED SYLLABUS

1. **Introduction to Computer Graphics:** Geometry and line generation, Graphics primitives, Transformations
2. **Digital Image Processing Systems:** Introduction, Structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, Storage, Processing, Communication, Display. Image sampling and quantization, Basic relationships between pixels
3. **Image Transforms (Implementation):** Introduction to Fourier transform, DFT and 2-D DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform, Hadamard transform, Discrete cosine transform, Slant transform, Optimum transform: Karhunen - Loeve (Hotelling) transform.
4. **Image Enhancement in the Spatial Domain:** Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters
5. **Image Enhancement in the Frequency Domain:** Frequency domain filters: Smoothing and Sharpening filters, Homomorphic filtering
6. **Wavelets and Multiresolution Processing:** Image pyramids, Subband coding, Haar transform, Series expansion, Scaling functions, Wavelet functions, Discrete wavelet transforms in one dimensions, Fast wavelet transform, Wavelet transforms in two dimensions
7. **Image Data Compression:** Fundamentals, Redundancies: Coding, Interpixel, Psycho-visual, Fidelity criteria, Image compression models, Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone still image compression standards, Video compression standards.
8. **Morphological Image Processing:** Introduction, Dilation, Erosion, Opening, Closing, Hit-or-Miss transformation, Morphological algorithm operations on binary images, Morphological algorithm operations on gray-scale images
9. **Image Segmentation:** Detection of discontinuities, Edge linking and Boundary detection, Thresholding, Region based segmentation
10. **Image Representation and Description:** Representation schemes,

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Boundary descriptors, Regional descriptors

BOOKS

Text Books:

1. R.C.Gonsales R.E.Woods, "*Digital Image Processing*", Second Edition, Pearson Education
2. Anil K. Jain, "*Fundamentals of Image Processing*", PHI

References:

1. William Pratt, "*Digital Image Processing*", John Wiley
2. S. Harrrington, "Computer Graphics", McGraw Hill
3. Milan Sonka,Vaclav Hlavac, Roger Boyle, "*Image Processing, Analysis, and Machine Vision*" Thomson Learning.
3. N Ahmed & K.R. Rao, "*Orthogonal Transforms for Digital Signal Processing*" Springer
4. B. Chanda, D. Dutta Majumder, "*Digital Image Processing and Analysis*", PHI

TERM WORK

3. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATION TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: MANAGEMENT INFORMATION SYSTEM

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral Exam: 25 Marks**

Objectives: To enable students to understand the role and importance of information system

Pre-requisites: Computer fundamentals, DBMS

DETAILED SYLLABUS

1. **Foundation of Information System:** Introduction to Information System and MIS, Decision support and decision making systems, systems approach, the systems view of business, MIS organization within company, Management information and the systems approach.
2. **Information Technology:** A manager's overview, managerial overviews, computer hardware & software, , DBMS, RDBMS and Telecommunication.
3. **Conceptual System Design:** Define the problems, set systems objective, establish system constraints, determine information needs determine information sources, develop alternative conceptual design and select one document the system concept, prepare the conceptual design report.
4. **Detailed System Design:** Inform and involve the organization, aim of detailed design, project management of MIS detailed design , identify dominant and trade of criteria, define the sub systems, sketch the detailed operating sub systems and information flow, determine the degree of automation of each operation, inform and involve the organization again, inputs outputs and processing, early system testing, software, hardware and tools propose and organization to operate the system, document the detailed design revisit the manager user.
5. **Implementation Evaluation and Maintenance of the MIS:** Plan the implementation, acquire floor space and plan space layouts, organize for implementation, develop procedures for implementation, train the operating personnel, computer related acquisitions, develop forms for data collection and information dissemination, develop the files test the system, cut-over, document the system, evaluate the MIS control and maintain the system. Pitfalls in MIS development .
6. **Advanced Concepts in Information Systems:** Enterprise Resources Management(ERP), Supply Chain Management, C R M , Procurement Management System.
7. **Applications:** Applications of MIS in Manufacturing sector, Service sector

BOOKS

Text Books:

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1. W.S. Jawadekar, "*Management Information System*", TMH.
2. Gordon B. Davis and M.H. Olson, "*Management Information System*", McGraw Hill.

References:

1. J.A. O'Brien, "*Management Information System*", TMH.
2. K.C. Laudon, J.P. Laudon, "*Management Information System*"
3. Turban, Rainer, Potter, "*Introduction to Information Technology*", John Wiley
4. D.P. Goyal, "*Management Information System*", Macmillan
5. G.V. Post, D.L. Anderson, "*Management Information System*", TMH.
6. Steven Alter, "*Information Systems*", Pearson Education.

TERM WORK

4. Term work should consist of case studies/prcticals and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: PROGRAMMING WITH COMPONENTS
(ELECTIVE-I)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral Exam: 25 Marks**

Objectives of the course: COM addresses software design in a very pragmatic way. Instead of providing a solution based on almost religious academic dogma of object oriented programming, COM's design takes into account both human nature and capitalism. COM is mostly widely used object model for developing distributed and concurrent systems. Aim of this subject to study and learn COM and use COM to deploy such systems successfully.

Pre-requisites: C++, Java Programming, OOAD

DETAILED SYLLABUS

1. **Introduction to object oriented systems:** Preview of Object-orientation, Concept of distributed object systems, Reasons to distribute for centralized objects. Mapping objects to locations. Object oriented system architecture, client-server system architecture, multi tier system architectures. Design of object oriented system architecture and component technology compound document.
2. **Introduction to distributed objects:** Computing standards, OMG, Overview of CORBA, Overview of COM/DCOM and of an open doc, Overview of Object Web, Overview of java, Enterprise java beans.
3. **Component Object Model (COM) introduction:** Com as better C++ software distribution, Dynamic linking, Separating interface and COM implementation, Run time polymorphism, Introduction to DCOM.
4. **Interface in COM-DCOM:** Introduction to interfaces, Interface definition language (IDL), Interface and IDL, Using COM interface pointers, Optimizing query interface, Code sharing and reuse.
5. **Classes and Objects in COM-DCOM:** Introduction, Classes and servers, Optimizations, Classes and IDL, Class emulation, Query interface types and properties, Object services and dynamic composition.
6. **Apartments:** Cross-apartments access, lifecycle management.
7. **CORBA:** Introduction and concepts, distributed objects in CORBA, CORBA components, architectural features, method invocations static and dynamic: IDL (Interface Definition Language) models and interfaces. Structure of CORBA IDL, CORBA's self-describing data; CORBA interface repository.
8. **CORBA Services:** Services for object naming, Object lifecycle, Event, Transaction service features, concurrency control services, persistent object service and CORBA security service.
9. **Enterprise Java Beans**
10. **JAVA Interface:** JNI interface with C++, VC++.

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11. **Object Web:** web technologies interfacing with distributed objects over client server and distribute architecture.
BOOKS
Text Books:
1. Booch, Jacobson, Rambug, "*Essential COM*", Pearson Education 2. Don Box, "*Essential COM*", Pearson Education. 3. Jason Pritchard, "*COM and CORBA side by side*", Pearson Education.
References:
1. Tom Valesky, "*Enterprise Java Beans*", Pearson Education
TERM WORK
1. Term work should consist of at least 10 practical experiments covering the topics of the syllabus using COM/ EJB Technologies
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: PATTERN RECOGNITION
(ELECTIVE-I)

Lectures: 4 Hrs per week **Practical:** 2 Hrs per week	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: This course teaches the fundamentals of techniques for classifying multi-dimensional data, to be utilized for problem-solving in a wide variety of applications, such as engineering system design, manufacturing, technical and medical diagnostics, image processing, economics, psychology.

Pre-requisite: Linear Algebra, Probability and Statistics

DETAILED SYLLABUS

1. **Introduction:** Machine perception, Pattern recognition systems, Design cycle, Learning and Adaptation
2. **Bayesian Decision Theory:** Bayesian decision theory: Continuous features, Minimum-error rate classification, classification, Classifiers, Discriminant functions and Decision surfaces, Normal density, Discriminant functions for normal density, Bayes Decision theory: discrete features
3. **Maximum-Likelihood and Bayesian Parameter Estimation:** Maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation: Gaussian caseand General theory, Prolems of dimentionality, Hidden Markov Model
4. **Nonparametric Techniques:** Density estimation, Parzen windows, k_n-Nearest-Neighbor estimation, Nearest-Neighbor rule, Matrics and Nearest-Neighbor classification
5. **Linear Discriminants Functions:** Linear discriminant functions and decision surfaces, Generalised linear discriminant functions, 2-Category linearly separable case, Minimising the Perceptron criterion function, Relaxation procedure, Non-separable behavior, Minimum squared error procedure, Ho-Kashyap procedures, Multicategory generalizations
6. **Nonmetric Methods:** Decision tree, CART, ID3, C4.5, Gramatical methods, Gramatical interfaces
7. **Algorithm Independent Machine Learning:** Lack of inherent superiority of any classifier, Bias and Variance, Resampling for estimating statistic, Resampling for classifier design, Estimating and comparing classifiers, Combining classifiers
8. **Unsupervised Learning and Clustering:** Mixture densities and Identifiability, Maximum-Likelihood estimations, Application to normal mixtures, Unsupervised Bayesian learning, Data description and clustering criterion function for clustering, Hierarchical clustering
9. **Applications of Pattern Recognition**

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BOOKS

Text Books:

1. Duda, Hart, and Stock, "*Pattern Classification*", John Wiley and Sons.
2. Gose, Johnsonbaugh and Jost, "*Pattern Recognition and Image analysis*", PHI

TERM WORK

5. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATION TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: SPEECH RECOGNITION
(ELECTIVE-I)

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term work: 25 Marks Oral Exam: 25 Marks

Objectives: Develop an understanding of the relationship of vocal tract shapes and physical acoustics to the acoustic speech signal. Use a spectrum analyzer to relate the acoustic speech signal to acoustical processes. Design and implement digital filters to synthesize speech and code speech at a low bit rate. Implement speech analysis and speech synthesis modules using object-oriented software programs, using techniques such as class derivation, the use of software objects as components in a larger software system.

Pre-requisites: Digital Signal Processing

DETAILED SYLLABUS

1. **Fundamentals Of Speech Recognition:** Introduction, The paradigm for speech Recognition, out line, Brief history of speech recognition research.
2. **The Speech Signal:** Production, reception, and Acoustic-phonetic characterization: The speech production system, Representing speech in time and frequency domains, Speech Sounds and features, Approaches to automatic speech recognition by machine.
3. **Signal Processing And Analysis Methods For Speech Recognition:** The bank-of-filters front-end processor. Linear predictive model for speech recognition, Vector quantization, Auditory based Spectral analysis model.
4. **Pattern Comparison Techniques:** Speech detection, Distortion Measures-Mathematical Considerations, Distortion Measures-Perceptual Considerations, Spectral-Distortion Measures, Incorporation of spectral dynamic features into distortion measures, Time Alignment and Normalization.
5. **Speech Recognition System Design And Implementation Issues:** Application of source coding techniques to recognition, Template training methods, Performance analysis and recognition enhancements, Template adoption to new talkers, Discriminative methods in speech recognition, Speech recognition in adverse environment.
6. **Theory And Implementation Of Hidden Markov Models:** Discrete time Markov processes, Extensions to hidden Markov Models, The three basic problems for HMMs, Types of HMMs, Implementation issues for HMMs, HMM system for isolated word recognition
7. **Speech Recognition Based On Connected Words Models:** General notations for the connected Word-Recognition problem, The two level dynamic programming algorithm, The level building algorithm, The one pass algorithm, Multiple candidate strings, Grammar networks for connected digit recognition, Segmental K-Means training procedure, Connected digit recognition

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implementation.

8. **Large Vocabulary Continuous Speech Recognition.**
9. **Task Oriented Applications Of Automatic Speech Recognition**

BOOKS

Text Books:

1. L. Rabiner and B. Juang, "*Fundamentals of Speech Recognition*", Pearson Education.
2. L R Rabiner and RW Schafer, "*Digital Processing of Speech Signals*", Pearson Education.

References:

1. B. Gold and N. Morgan, "*Speech and Audio Signal Processing*", John Wiley.
2. D. Jurafsky and J.H. Martin, "*Speech and Language Processing*", Pearson Education.

TERM WORK

6. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: EMBEDDED SYSTEMS
(ELECTIVE-I)

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Objective: Embedded system tools and products are evolving rapidly. This course deals with various approaches to building embedded systems. It introduces unified view of hardware and software. The aim of this course is to make the students aware of the various applications of embedded systems.

Pre-requisites: Microprocessors and C Programming

DETAILED SYLLABUS

1. **An overview of embedded systems:** Introduction to embedded systems, Categories and requirements of embedded systems, Challenges and issues related to embedded software development, Hardware/Software co-design, Introduction to IC technology, Introduction to design technology
2. **Embedded Software development:** Concepts of concurrency, processes, threads, mutual exclusion and inter-process communication, Models and languages for embedded software, Synchronous approach to embedded system design, Scheduling paradigms, Scheduling algorithms, Introduction to RTOS, Basic design using RTOS
3. **Embedded C Language:** Real time methods, Mixing C and Assembly, Standard I/O functions, Preprocessor directives, Study of C compilers and IDE, Programming the target device
4. **Hardware for embedded systems:** Various interface standards, Various methods of interfacing, Parallel I/O interface, Blind counting synchronization and Gadfly Busy waiting, Parallel port interfacing with switches, keypads and display units, Memory and high speed interfacing, Interfacing of data acquisition systems, Interfacing of controllers, Serial communication interface, Implementation of above concepts using C language
5. **Study of ATMEL RISC Processor:** Architecture, Memory, Reset and interrupt , functions, Parallel I/O ports, Timers/Counters, Serial communication, Analog interfaces, Implementation of above concepts using C language, Implementation of above concepts using C language
6. **Case studies and Applications of embedded systems:** Applications to: Communication, Networking, Database, Process Control, Case Studies of: Digital Camera, Network Router, RTLinux

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BOOKS

Text Books:

1. Raj Kamal, "*Embedded Systems*", TMH
2. David E. Simon, "*An Embedded Software Primer*", Pearson Education
3. Muhammad Ali Mazidi and Janice Gillispie Mazidi, "*The 8051Microcontroller and Embedded Systems*", Pearson Education

References:

1. Frank Vahid, Tony Givargis, "*Embedded System Design: A Unified Hardware/Software Introduction*", John Wiley
2. Craig Hollabaugh, "*Embedded Linux*", Pearson Education
3. Daniel Lewis, "*Fundamentals of Embedded Software*", Pearson Education.
4. Barnett, Cox, O'Cull, "*Embedded C Programming and the Atmel AVR*", Thomson Learning
5. Myke Predko, "*Programming and Customizing the 8051 Microcontroller*", TMH

TERM WORK

7. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
   - Four experiments on micro controller based systems.
   - Four experiments using cross C compiler and Linux.
   - Two experiments using developments tools like logic analyzer, emulator and simulator.
   - Two experiments on case study of advanced embedded systems

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: ADVANCED DATABASE SYSTEMS
(ELECTIVE-I)

Lectures: 4 Hrs per week **Practical:** 2 Hrs per week	**Theory:** 100 Marks **Term work:** 25 Marks **Oral Exam.:** 25 Marks

Objectives: To study the further database techniques beyond which covered in the second year, and thus to acquaint the students with some relatively advanced issues. At the end of the course students should be able to: gain an awareness of the basic issues in objected oriented data models, learn about the Web-DBMS integration technology and XML for Internet database applications, familiarize with the data-warehousing and data-mining techniques and other advanced topics, apply the knowledge acquired to solve simple problems

Pre-requisites: Database Systems, OOAD.

DETAILED SYLLABUS

1. **The Extended Entity Relationship Model and Object Model:** The ER model revisited, Motivation for complex data types, User defined abstract data types and structured types, Subclasses, Super classes, Inheritance, Specialization and Generalization, Constraints and characteristics of specialization and Generalization, Relationship types of degree higher than two.
2. **Object-Oriented Databases:** Overview of Object-Oriented concepts, Object identity, Object structure, and type constructors, Encapsulation of operations, Methods, and Persistence, Type hierarchies and Inheritance, Type extents and queries, Complex objects; Database schema design for OODBMS; OQL, Persistent programming languages; OODBMS architecture and storage issues; Transactions and Concurrency control, Example of ODBMS
3. **Object Relational and Extended Relational Databases:** Database design for an ORDBMS - Nested relations and collections; Storage and access methods, Query processing and Optimization; An overview of SQL3, Implementation issues for extended type; Systems comparison of RDBMS, OODBMS, ORDBMS
4. **Parallel and Distributed Databases and Client-Server Architecture:** Architectures for parallel databases, Parallel query evaluation; Parallelizing individual operations, Sorting, Joins; Distributed database concepts, Data fragmentation, Replication, and allocation techniques for distributed database design; Query processing in distributed databases; Concurrency control and Recovery in distributed databases. An overview of Client-Server architecture
5. **Databases on the Web and Semi Structured Data:** Web interfaces to the Web, Overview of XML; Structure of XML data, Document schema, Querying XML data; Storage of XML data, XML applications; The semi structured data model, Implementation issues, Indexes for text data
6. **Enhanced Data Models for Advanced Applications:** Active database concepts. Temporal database concepts.; Spatial databases, Concepts and

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architecture; Deductive databases and Query processing; Mobile databases, Geographic information systems.
BOOKS
Text Books:
1. Elmasri and Navathe, "*Fundamentals of Database Systems*", Pearson Education 2. Raghu Ramakrishnan, Johannes Gehrke, "*Database Management Systems*", McGraw-Hill
References:
1. Korth, Silberchatz, Sudarshan , "*Database System Concepts*", McGraw-Hill. 2. Peter Rob and Coronel, "*Database Systems, Design, Implementation and Management*", Thomson Learning. 3. C.J.Date, Longman, "*Introduction To Database Systems*", Pearson Education
TERM WORK
8. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: ADVANCED COMPUTER NETWORKS
(ELECTIVE-I)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral Examination: 25 Marks**

Objectives: In first part, Advanced technologies like High speed Devices etc. are to be considered. Second part Network programming is to be studied. Not just SOCKETS but also protocols, Drivers, Simulation Programming. In third part we should study Network Design, Protocols designs and analysis considering deterministic and non-deterministic approach. We expect natural thinking from student. For example he should able to consider different constraints and assume suitable data and solve the problems.

Pre-requisites: Computer networks

DETAILED SYLLABUS

1. **Data Communications:** Business Drivers and Networking Directions : Data communication Past and future.
2. **Understanding the standards and their maker:** Creating standards: players and Process, Current forums, Standard protocols, Layered reference models: The OSIRM, Standard computer architectures.
3. **Introduction to Transmission Technologies:** Hardware selection in the design process.
4. **Optical Networking:** SONET/SDH standards, Dense wavelength division multiplexing (DWDM), Performance and Design considerations.
5. **Physical Layer Protocols and Access Technologies:** Physical Layer Protocols and Interfaces, Accessing the Network, Copper access technologies, Cable Access Technologies, Fiber Access Technologies, Air Access Technologies.
6. **Common Protocols and Interfaces in the LAN environment:** Data link layers protocols, LLC and MAC sub layer protocol, Ethernet, Token Ring, Token Bus and FDDI, Bridge protocols, Switching in the LAN environment.
7. **Frame Relay:** FR specification and design, VoFR: Performance and Design considerations, Advantages and disadvantages of FR.
8. **Common WAN Protocol:** ATM: Many faces of ATM, ATM protocol operation (ATM cell and Transmission), ATM networking basics, Theory of operations, B-ISDN protocol reference model, PHY layer, ATM layer (Protocol model), ATM layer and cell (Definition), Traffic descriptors and parameters, Traffic and Congestion control defined, AAL Protocol model, Traffic contract and QoS, User plane overview, Control plane AAL, Management plane, Sub-DS3 ATM, ATM public services.
9. **Common Protocols and Interfaces in the Upper Layers(TCP/IP):** Background (Routing protocols), TCP/IP suite, Network layer (Internetwork

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layer), Transport layer, Application layer, Addressing and routing design.

10. **Mature Packet Switched Protocol:** ITU Recommendation X.25, User connectivity, Theory of Operation, Network layer functions, X.75 Internetworking protocol, switched multimegabit data service (SMDS), SMDS and IEEE 802.6, Subscriber Interface and Access protocol, Addressing and Traffic control.
11. **Requirements Definition:** User requirements, Traffic sizing, Traffic characteristics, Protocols, Time and Delay considerations, Connectivity, Availability, Reliability and Maintainability, Service aspects, Budget constraints,.
12. **Traffic Engineering and Capacity planning:** Background (Throughput calculations) , Traffic engineering basics (Traffic characteristics), Traditional Traffic engineering, Queued data and packet switched traffic modeling, Designing for peaks, Delay or Latency, Availability and reliability, Network performance modeling, Creating the traffic matrix, Capacity planning and Network vision, Design tool, Categories of tools, Classes of design tool, Components of design projects, Types of design projects.
13. **Technology Comparisons:** Circuits-message-packet and cell switching methods, Packet switching service aspects, Generic packet switching network characteristics, Private verses public networking, Public network service selection, Business aspects of Packet-Frame and cell switching services, High speed LAN protocols comparisons, Application performance needs.
14. **Access Network Design:** Network design layers, Access layer design, Access network capacity, network topology and hardware, completing the access network design.
15. **Backbone Network Design:** Backbone requirements, Network capacities, Topologies, Topologies strategies, Tuning the network.

BOOKS

Text Books:

1. Darren L Spohn, "Data Network Design", TMH
2. D. Bertsekas, R. Gallager, "*Data Networks*", PHI

References:

1. W.R. Stevens, "*Unix Network Programming*", Vol.1, Pearson Education
2. J.Walrand, P. Varaiya, "High Performance Communication Networks", Morgan Kaufmann
3. Y. Zheng, S. Akhtar, "Networks for Computer Scientists and Engineers", Oxford
4. A.S. Tanenbaum, "Computer Networks"
5. Peterson & Davie, "Computer Networks", Harcourt Asia.
6. James D. McCabe , "Practical Computer Analysis and Design", Harcourt Asia.

TERM WORK

9. Term work should consist of at least 10 practical experiments and two assignments covering all the topics of the syllabus.

ORAL EXAMINATION

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An oral examination is to be conducted based on the above syllabus.

B.E. INFORMATION TECHNOLOGY
FOURTH YEAR SEMISTER VII

SUBJECT: PROJECT-A

Tutorial: 2 Hrs per week	Term Work: 25 Marks Oral: 25 Marks

GUIDELINES

1. Project-A exam be conducted by two examiners appointed by university. Students have to give seminar on the project-A for the term work marks. All the students of the class must attend all the seminars. Seminars should be conducted continuously for couple of days.
2. Project-A should preferably contain abstract, existing system, problem definition, scope, proposed system, its design, introduction to programming tools, hardware and software platforms requirements etc.
3. Out of the total projects 35 percent may be allowed as to be industry projects. 65 percent projects must be in-house. Head of dept and senior staff in the department will take decision regarding projects.
4. Every student must prepare hand written synopsis in the normal journal format.
5. Internal guide has to interact at least once in fortnight and maintain the progress and attendance report during both the terms.
6. Two research projects may be allowed only for outstanding students with research aptitude.
7. In case of industry projects, visit by internal guide will be preferred. Industry project will attract demos either at site or in college.
8. Make sure that external project guides are BE graduates.
9. Number of students for a project should be preferably 2 to 4. Only one student should be avoided and up to 6 may be allowed only for exceptional and complex projects.

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B.E. INFORMATION TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: DATA WAREHOUSING AND MINING

Lectures: 4 Hrs per week **Practical:** 2 Hrs per week	**Theory:** 100 Marks **Term work:** 25 Marks **Oral Exam:** 25 Marks

Objectives of the course: The data warehousing part of module aims to give students a good overview of the ideas and techniques which are behind recent development in the data warehousing and online analytical processing (OLAP) fields, in terms of data models, query language, conceptual design methodologies, and storage techniques. Data mining part of the model aims to motivate, define and characterize data mining as process; to motivate, define and characterize data mining applications.

Pre-requisites: DBMS

DETAILED SYLLABUS

Data Warehousing:

1. **Overview And Concepts:** Need for data warehousing, Basic elements of data warehousing, Trends in data warehousing.
2. **Planning And Requirements:** Project planning and management, Collecting the requirements.
3. **Architecture And Infrastructure:** Architectural components, Infrastructure and metadata.
4. **Data Design And Data Representation:** Principles of dimensional modeling, Dimensional modeling advanced topics, data extraction, transformation and loading, data quality.
5. **Information Access And Delivery:** Matching information to classes of users, OLAP in data warehouse, Data warehousing and the web.
6. **Implementation And Maintenance:** Physical design process, data warehouse deployment, growth and maintenance.

Data Mining:

1. **Introduction:** Basics of data mining, related concepts, Data mining techniques.
2. **Data Mining Algorithms:** Classification, Clustering, Association rules.
3. **Knowledge Discovery :** KDD Process
4. **Web Mining:** Web Content Mining, Web Structure Mining, Web Usage mining.
5. **Advanced Topics:** Spatial mining, Temporal mining.
6. **Visualisation :** Data generalization and summarization-based characterization, Analytical characterization: analysis of attribute relevance, Mining class comparisons: Discriminating between different classes, Mining descriptive statistical measures in large databases
7. **Data Mining Primitives, Languages, and System Architectures:** Data mining primitives, Query language, Designing GUI based on a data mining

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query language, Architectures of data mining systems

8. **Application and Trends in Data Mining:** Applications, Systems products and research prototypes, Additional themes in data mining, Trends in data mining

BOOKS

Text Books:

1. Paulraj Ponnian, "*Data Warehousing Fundamentals*", John Wiley.
2. M.H. Dunham, "*Data Mining Introductory and Advanced Topics*", Pearson Education.
3. Han, Kamber, "*Data Mining Concepts and Techniques*", Morgan Kaufmann

References:

1. Ralph Kimball, "*The Data Warehouse Lifecycle toolkit*", John Wiley.
2. M Berry and G. Linoff, "*Mastering Data Mining*", John Wiley.
3. W.H. Inmon, "*Building the Data Warehouses*", Wiley Dreamtech.
4. R. Kimpall, "*The Data Warehouse Toolkit*", John Wiley.
5. E.G. Mallach, "*Decision Support and Data Warehouse systems*", TMH.

TERM WORK

10. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: MULTIMEDIA SYSTEMS

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral: 25 marks**

Objectives of the course: This course teaches students to collect, and intelligently integrate multiple media on computers. Students learn the issues involved in capturing, compressing, processing, manipulating, searching, indexing, storing, and retrieving various kinds of continuous media in the text section.

Pre-requisites: Operating Systems, Computer Networks

DETAILED SYLLABUS

1. Multimedia Systems Introduction: Multimedia application, Multimedia system architecture, Evolving technologies for multimedia systems, defining objects for multimedia systems, Multimedia data interface standards
2. Compression and Decompression: Types of compression, Binary image compression schemes, Color, Gray scale, Still video image compression, Video image compression, Audio compression, Fractal compression, Data and File Format Standards: Rich text format, TIFF, RIFF, MIDI, JPEG, AVI, MPEG
3. Multimedia Input/Output Technologies: Key technologies issues, Pen input, Video and Image display system, Printout technology, Image scanners, Digital Voice and Audio, Full motion video
4. Storage and Retrieval Technologies: Magnetic media technology, Optical media, Hierarchical storage management, Cache management for storage system, Image and video databases: Indexing and Retrieval
5. Architectural and Telecommunications Considerations: Specialized computational processors, Memory systems, Multimedia board solutions, LAN/WAN connectivity, Multimedia transport across ATM networks, Multimedia across wireless, Distributed object models
6. Multimedia Networking: Multimedia networking applications, Streaming stored audio and video, RTP, Scheduling and policing mechanisms, Integrated services, RSVP
7. Multimedia Application Design: Multimedia application classes, Types of multimedia systems, Virtual reality design, Components of multimedia systems, Organizing multimedia databases, application workflow design issues, Distributed application design issues, Applications like Interactive, Television, Video Conferencing, Video-on-demand, Educational applications and authoring, Industrial applications, Multimedia archives and digital libraries
8. Multimedia Authoring and User Interface: Multimedia authoring systems, Hyper media application design considerations, User interface design, information access, Object display/playback issues
9. Hyper Media Messaging: Mobile messaging, Hyper media message components, Hypermedia linking and embedding, Creating hypermedia

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messages, integrated multimedia message standards, Integrated document management, The world-wide web, Open hypermedia systems, Content based navigation.

10. Distributed Multimedia Systems: Components of distributed multimedia systems, Distributed client server operations, Multimedia object servers, Multi-server network topologies, Distributed multimedia database, Managing distributed objects
11. Multimedia System Design: Methodology and considerations, Multimedia systems design examples.

Books

Text Books:

1. Prabhat K. Andheigh, Kiran Thakrar, "*Multimedia Systems Design*", PHI John F,
2. Koegel Buford, "*Multimedia Systems*", Pearson Education.

References :

1. Free Halshall, "*Multimedia Communications*", Pearson Education.
2. R. Steimnetz, K. Nahrstedt, "*Multimedia Computing, Communications and Applications*", Pearson Education
3. K.R. Rao, D. Milovanovic, "*Multimedia Communication Systems: Techniques, Standards, and Networks*"
4. Subrahmanian, "*Multimedia Database Systems*", M. Kaufman
5. J. D. Gibson, "*Multimedia Communications: Directions and Innovations*", Academic Press, Hardcourt India
6. J.F. Kurose, K.W. Ross, "*Computer Networking*", Pearson Education

TERM WORK

11. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATION TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: PROJECT MANAGEMENT

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Objectives: This course will help to identify key areas of concern and uses of measurement for project management, define indicators based upon what a project manager would want to know, use measurement to support decision making, understand where measurement is used from the perspective of a generic management process

Pre-requisite: Software Engineering

DETAILED SYLLABUS

1. **Project Management:** Introduction, Need, Goals, Evolution, Project environments, Systems, Organizations, and System methodologies.
2. **Systems Development Cycle:** Early stages: Life cycle, Development cycle, Constraints in systems development, Phase A: Conception, Project proposals, Project contracting; Middle and Later stages: Phase B: definition, Phase c: Execution, Implementation stage, Phase D: Operation, System development in Industrial and service Organization, System development in large Government programs.
3. **Systems and Procedures:** Planning fundamentals: Planning steps, Project master plan, Scope and work definition, Project organization structure and responsibilities, Project management system, Scheduling, Planning and scheduling charts;
4. **Network scheduling and PDM:** Logic diagram and network, Critical path, Scheduling and time based networks, Management schedule reserve, PDM networks, PERT, CPM, Resource allocation, GERT;
5. **Cost estimating and budgeting:** Cost estimating, Cost escalation, Cost estimating and system development cycle, Cost estimating process, Elements of budgets and estimates, Project cost accounting and MIS, Budgeting using cost accounts, Cost schedules and forecasts;
6. **Risk Management:** Basic concepts, Identification, Assessment, Response planning, management;
7. **Project Control:** Control process, Control emphasis, Information monitoring, Internal and external project control, Traditional cost control, Cost accounting systems for project control, Performance analysis, Performance index monitoring, Variance limits, Controlling changes, Contract administration, Control problems;
8. **Project Management Information System:** Functions of PMIS, Computer based tools, Computer –based PMIS, Representative Computer –based PMIS, Web based Project management, Applying computer based PMS, Project evaluation, Project reporting, Project

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9. **Software Quality:** Introduction, Importance, ISO 9126, Software quality measures, External standards, Techniques to enhance software quality
10. **Termination:** Terminating the project, termination responsibilities, Closing and contracts, Project extension.
11. **Organization Behavior:** Project Organization structure and integration: Organization structure, Formal organization structure, Organization design by differentiation and integration, Requirements of project organizations, Integration of subunits in projects, liaison roles, Task forces, and Teams, Project expeditors and co-coordinators, Matrix organization, Informal organization, Concurrent engineering, Quality function deployment; Project roles, Responsibility and Authority, Managing participation, Team work and conflict.

BOOKS

Text Books:

1. J. M. Nicholas, *"Project Management for Business and Technology"*, PHI
2. B. Hughes, M. Cotterell, *"Software Project Management"*, TMH

References:

1. R. K. Wysocki, R.Beck Jr., D.B. Crane, "*Effective Project Management*", John Wiley
2. J. Phillips, "*IT Project Management*", TMH
3. P. Jalote, "*Software Project Management in Practice*", Pearson Education

TERM WORK

12. Term work should consist of at least 10 practical experiments and two assignments covering all the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: Elective – II, Robotics

Lectures: 4 Hrs per week Practical: 2 Hrs per week	Theory: 100 Marks Term Work: 25 Marks Oral: 25 Marks

Rationale: This course familiarizes students with the concepts and techniques in robot manipulator control, enough to evaluate, choose, and incorporate robots in engineering systems.

DETAILED SYLLABUS

Robotic Manipulation
Automation and Robots, Classification, Application, Specification, Notations.

Direct Kinematics
Dot and cross products, Co-ordinate frames, Rotations, Homogeneous, Co-ordinates, Link co-ordination arm equation, (Five-axis robot, Four axis robot, Six axis robot).

Inverse Kinematics
General properties of solutions tool configuration Five axis robots, Three-Four axis, Six axis robot (Inverse kinematics).
Workspace analysis and trajectory planning work envelop and examples, workspace fixtures, Pick and place operations, Continuous path motion, Interpolated motion, Straight-line motion.

Robot Vision
Image representation, Template matching, Polyhedral objects, Shane analysis, Segmentation (Thresholding, region labeling, Shrink operators, Swell operators, Euler numbers, Perspective transformation, Structured Illumination, Camera calibration).

Task Planning
Task level programming, Uncertainty, Configuration, Space, Gross motion, Planning, Grasp planning, Fine-motion Planning, Simulation of Planer motion, Source and goal scenes, Task planner simulation.

Moments of Inertia.

Principles of NC and CNC Machines.

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BOOKS

Text Books:

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India
2. Fu, Gonzales and Lee, Robotics, McGraw Hill
3. J.J, Craig, Introduction to Robotics, Pearson Education

Additional Reading:

1. Staughard, Robotics and AI, Prentice Hall of India
2. Grover, Wiess, Nagel, Oderey, "Industrial Robotics", McGraw Hill
3. Walfram Stdder, Robotics and Mechatronics,
4. Niku, Introduction to Robotics, Pearson Education
5. Klafter, Chmielewski, Negin, Robot Engineering, Prentice Hall of India
6. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications

TERM WORK

1. Term work should consist of at least 10 practicals and assignments covering the topics of the syllabus.
2. A term work test shall be conducted with a weightage of 10 marks.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: COMPUTER VISION
(ELECTIVE-II)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: To introduce the student to computer vision algorithms, methods and concepts which will enable the student to implement computer vision systems with emphasis on applications and problem solving

Pre-requisite: Introduction to Image Processing.

DETAILED SYLLABUS

1. **Recognition Methodology:** Conditioning, Labeling, Grouping, Extracting, Matching. Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection. Thinning, Region growing, region shrinking, Labeling of connected components.
2. **Binary Machine Vision:** Thresholding, Segmentation, Connected component labeling, Hierarchal segmentation, Spatial clustering, Split & merge, Rule-based Segmentation, Motion-based segmentation.
3. **Area Extraction:** Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting).
4. **Region Analysis:** Region properties, External points, Spatial moments, Mixed spatial gray-level moments, Boundary analysis: Signature properties, Shape numbers.
5. **Facet Model Recognition:** Labeling lines, Understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, Consisting labeling problem, Back-tracking, Perspective Projective geometry, Inverse perspective Projection, Photogrammetry – from 2D to 3D, Image matching : Intensity matching of ID signals, Matching of 2D image, Hierarchical image matching.
6. **Object Models And Matching:** 2D representation, Global vs. Local features.
7. **General Frame Works For Matching:** Distance relational approach, Ordered-structural matching, View class matching, Models database organization.
8. **General Frame Works:** Distance –relational approach, Ordered –Structural matching, View class matching, Models database organization.
9. **Knowledge Based Vision:** Knowledge representation, Control-strategies, Information integration.

BOOKS

Text Books:

1. David A. Forsyth, Jean Ponce, *"Computer Vision: A Modern Approach"*
2. R. Jain, R. Kasturi, and B. G. Schunk, *"Machine Vision"*, McGraw-Hill.

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References:

1. Milan Sonka,Vaclav Hlavac, Roger Boyle, "*Image Processing, Analysis, and Machine Vision*" Thomson Learning
2. Robert Haralick and Linda Shapiro, *"Computer and Robot Vision"*, Vol I, II, Addison-Wesley, 1993.

TERM WORK

13. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATION TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: GEOGRAPHICAL INFORMATION SYSTEM (ELECTIVE-II)

Lectures: 4 Hrs per week **Practical:** 2 Hrs per week	**Theory:** 100 Marks **Term work:** 25 Marks **Oral Exam:** 25 Marks

Objectives: This course is designed to provide an introduction to and an understanding of the basic concepts, procedures and applications of the exciting and rapidly expanding field of Geographical Information Systems.

Pre-requisites: Image processing, Computer programming concepts

DETAILED SYLLABUS

1. **Introduction To GIS:** Introduction, Definition of GIS, Evolution of GIS, Component of GIS.
2. **Maps And GIS:** Map scale, Classes of map, Mapping process, Coordinate systems, Map projection, Spatial framework for mapping locations, Topographic mapping, Attribute data for Thematic mapping
3. **Digital Representation Of Geographic Data:** Technical issues to digital representation of data, Database and Database management System, Raster geographic data representation, Vector geographic data representation, Object oriented geographic data representation, Relationship between Data representation and Data analysis.
4. **Data Quality And Standards:** Concepts and definition of data quality, Component of geographic data, Data quality assessment, Spatial data error management, Geographic data standards, Geographic data standards and GIS development.
5. **GIS Data Processing, Analysis And Visualization:** Raster based GIS data processing, Vector based GIS data processing, Human computer interaction and GIS, Visualization of geographic information, Principles of Cartographic design in GIS, Generation of information product.
6. **Data Modeling:** Digital Terrain Modeling, Approaches to digital terrain data modeling, Acquisition of digital terrain data, Data processing, Analysis and visualization, Spatial modeling, Descriptive statics, Spatial autocorrelation, Quadrat counts and Nearest- Neighbor analysis, Trend surface analysis, Gravity models.
7. **GIS Project Design And Management:** Software engineering as applied to GIS, GIS project planning, System analysis and study of user requirement, Geographic database design methodology, GIS application software design methodology, System implementation, System maintenance and support.
8. **GIS Issues And Future Of GIS:** Issues of implementing GIS, Trend of GIS development, GIS applications and GIS users.

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BOOKS
Text Books:
1. C.P. Lo, Albert K.W. Yeung, "*Concepts and Techniques of Geographic Information Systems*", PHI 2. Kang-Tsung Chang, "*Introduction to Geographic Information Systems*", TMH
References:
1. Ian Heywood, Sarah Cornelius, Steve Carver, "*An Introduction to Geographical Information System*", Person Education 2. Peter A Burrough, R. A. McDonnell, "*Principles of Geographical Information System*", Oxford Press
TERM WORK
14. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: NEURAL NETWORKS & FUZZY SYSTEMS (ELECTIVE-II)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term Work: 25 Marks** **Oral: 25 Marks**

Objective: This course covers basic concepts of artificial neural networks, fuzzy logic systems and their applications. Its focus will be on the introduction of basic theory, algorithm formulation and ways to apply these techniques to solve real world problems.

Pre-requisite: Knowledge of calculus, and basic probability and statistics are required. Background in the following subjects desirable: numerical analysis (including optimization). Programming skills in one of the following would be desirable: Matlab, MathCad, C, Java, C++

DETAILED SYLLABUS

1. **Introduction:** Biological neurons, McCulloch and Pitts models of neuron, Types of activation function, Network architectures, Knowledge representation. Learning process: Error-correction learning, Supervised learning, Unsupervised learning, Learning Rules.
2. **Single Layer Perceptron:** Perceptron convergence theorem, Method of steepest descent - least mean square algorithms.
3. **Multilayer Perceptron**: Derivation of the back-propagation algorithm, Learning Factors.
4. **Radial Basis and Recurrent Neural Networks:** RBF network structure, theorem and the reparability of patterns, RBF learning strategies, K-means and LMS algorithms, comparison of RBF and MLP networks, Hopfield networks: energy function, spurious states, error performance .
5. **Simulated Annealing**: The Boltzmann machine, Boltzmann learning rule, Bidirectional Associative Memory.
6. **Fuzzy logic:** Fuzzy sets, Properties, Operations on fuzzy sets, Fuzzy relations, Operations on fuzzy relations, The extension principle, Fuzzy measures, Membership functions, Fuzzification and defuzzification methods, Fuzzy controllers.

BOOKS

Text Books:

1. Simon Haykin, "*Neural Network a - Comprehensive Foundation*", Pearson Education
2. Zurada J.M., "*Introduction to Artificial Neural Systems*, Jaico publishers
3. Thimothy J. Ross, *"Fuzzy Logic with Engineering Applications"*, McGraw Hill
4. Ahmad Ibrahim, "*Introduction to Applied Fuzzy Electronics*", PHI

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References:

1. Yegnanarayana B., "*Artificial Neural Networks*", PHI
2. Driankov D., Hellendoorn H. & Reinfrank M., "*An Introduction to Fuzzy Control*", Norosa Publishing House
3. Berkan R.C., and Trubatch S.L., "*Fuzzy Systems Design Principles*", IEEE Press

TERM WORK

15. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATIOM TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: SOFTWARE TESTING
(ELECTIVE-II)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral: 25 marks**

Objectives To improve your understanding of software testing - its purpose and nature - and raise your awareness of issues and constraints around testing. To provide a professional qualification widely recognized by employers, customers and peers. To learn standard terminology. Discover good sources of information. To provide a complete picture of the test activities and processes from requirements review to system implementation.

Pre-requisites: Software Engineering, OOAD

DETAILED SYLLABUS

1. **Introduction:** Defect, Defect Vs failures, Process problems and defect rates, The business perspective for testing
2. **Building a Software Testing Strategy:** Computer system strategic risk, Economics of testing, Common computer problems, Economics of SDLC testing, Testing- an organizational issue, Establishing a testing policy, Structured approach to testing, Test strategy, Testing methodology
3. **Establishing a Software Testing Methodology:** Introduction, Verification and validation, Functional and structural testing, Workbench concept, Considerations in developing testing methodologies
4. **Determining Software Testing Techniques:** Testing techniques/tool selection process, Selecting techniques/tools, Structural system testing techniques, Functional system testing techniques, Unit testing techniques, Functional testing and analysis
5. **Selecting and Installing Software Testing Tools:** Testing tools-Hammers of testing, Selecting and using the test tools, Appointing managers for testing tools
6. **Software Testing Process:** Cost of computer testing, Life cycle testing concept, Verification and validation in the software development process, Software testing process, Workbench skills
7. **Software Testing Process:** Access Project Management Development Estimate and Status, Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report Test Result, Testing Software Installation, Test Software Change, Evaluate Test Effectiveness
8. **Testing Specialized Systems and Applications:** Client/Server systems, RAD, System documentation, Web based systems, Off-the-self software, Multi platform environment, Security, Data Warehouse
9. **Building Test Document:** Uses, Types, Responsibility, Storage, Test plan

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documentation, Test analysis report documentation

Books

Text Books:

3. W.E. Perry, "*Effective Methods for Software Testing*", John Wiley.
4. Kaner C., Nguyen H., Falk J., "*Testing Computer Software*", John Wiley.

References :

1. Boris Beizer, "*Software Testing Techniques*", Dreamtech
2. Louise Tamres, "*Introducing Software Testing*", Pearson Education.

TERM WORK

16. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.

ORAL EXAMINATION

An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATION TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: INFORMATION SECURITY
(ELECTIVE-II)

Lectures: 4 Hrs per week **Practical: 2 Hrs per week**	**Theory: 100 Marks** **Term work: 25 Marks** **Oral: 25 Marks**

Objectives of the course: Learn about the threats in computer security. Understand what puts you at a risk and how to control it. Controlling a risk is not eliminating the risk but to bring it to a tolerable level.

Pre-requisites: Computer Networks, Operating system.

DETAILED SYLLABUS

1. **Introduction:** Security, Attacks, Computer criminals, Method of defense
2. **Program Security:** Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats
3. **Operating System Security:** Protected objects and methods of protection, Memory address protection, Control of access to general objects, File protection mechanism, Authentication: Authentication basics, Password, Challenge-response, Biometrics.
4. **Database Security:** Security requirements, Reliability and integrity, Sensitive data, Interface, Multilevel database, Proposals for multilevel security
5. **Security in Networks:** Threats in networks, Network security control, Firewalls, Intrusion detection systems, Secure e-mail, Networks and cryptography, Example protocols: PEM, SSL, IPsec
6. **Administrating Security:** Security planning, Risk analysis, Organizational security policies, Physical security.
7. **Legal, Privacy, and Ethical Issues in Computer Security:** Protecting programs and data, Information and law, Rights of employees and employers, Software failures, Computer crime, Privacy, Ethical issues in computer society, Case studies of ethics

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Books
Text Books: 1. C. P. Pfleeger, and S. L. Pfleeger, "*Security in Computing*", Pearson Education. 2. Matt Bishop, "*Computer Security: Art and Science*", Pearson Education.
References :
1. Stallings, "*Cryptography And Network Security: Principles and practice*" 2. Kaufman, Perlman, Speciner, "*Network Security*" 3. Eric Maiwald, "*Network Security : A Beginner's Guide*", TMH 4. Macro Pistoia, "*Java Network Security*", Pearson Education 5. Whitman, Mattord, "*Principles of information security*", Thomson
TERM WORK
17. Term work should consist of at least 10 practical experiments and two assignments covering the topics of the syllabus.
ORAL EXAMINATION
An oral examination is to be conducted based on the above syllabus.

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B.E. INFORMATION TECHNOLOGY
FOURTH YEAR SEMISTER VIII

SUBJECT: PROJECT-B

Tutorial: 6 Hrs per week	Term Work: 50 Marks Oral: 50 Marks

GUIDELINES

1. Project-B exam be conducted by two examiners appointed by university. Students have to give demonstration and seminar on the project-B for the term work marks. All the students of the class must attend all the seminars. Seminars should be conducted continuously for couple of days.
2. Project –B should contain:
   - Introduction and motivation, Problem statement, Requirement analysis, Project design, Implementation details, Technologies used, Test cases, Project time line, Task distribution, References, and Appendix consisting of users manual, technical reference manual.
   - CD containing: Project documentation, Implementation code, Required utilities, Software's and Manuals.
   - Every student must prepare well formatted, printed and hard bound report.
3. Internal guide has to interact at least once in fortnight and maintain the progress and attendance report during the term.
4. Make sure that external project guides are BE graduates.
5. Convener should make sure that external examiners are appointed from the list as per appropriate technical area.

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