

**AFFILIATED INSTITUTIONS**  
**ANNA UNIVERSITY CHENNAI : : CHENNAI 600 025**  
**REGULATIONS - 2008**  
**VI TO VIII SEMESTERS AND ELECTIVES**  
**B.E. CIVIL ENGINEERING**

**SEMESTER VI**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
MG2351	<a href="#">Principles of Management</a>	3	0	0	3
CE2351	<a href="#">Structural Analysis – II</a>	3	1	0	4
CE2352	<a href="#">Design of Steel Structures</a>	3	1	0	4
CE2353	<a href="#">Construction Planning &amp; Scheduling</a>	3	0	0	3
CE2354	<a href="#">Environmental Engineering II</a>	3	0	0	3
E1***	Elective – I	3	0	0	3
<b>PRACTICAL</b>					
CE2355	<a href="#">Environmental and Irrigation Engineering Drawing</a>	0	0	4	2
CE2356	<a href="#">Environmental Engineering Laboratory</a>	0	0	3	2
CE2357	<a href="#">Survey Camp</a>	-	-	-	3
<b>TOTAL</b>		<b>18</b>	<b>2</b>	<b>7</b>	<b>27</b>

**SEMESTER VII**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
CE2401	<a href="#">Design of RC and Brick Masonry Structures</a>	3	1	0	4
CE2402	<a href="#">Estimation and Quantity Surveying</a>	3	0	0	3
CE2403	<a href="#">Basics of Dynamics and Aseismic Design</a>	3	0	0	3
CE2404	<a href="#">Prestressed Concrete Structures</a>	3	0	0	3
E2***	Elective – II	3	0	0	3
E3***	Elective – III	3	0	0	3
<b>PRACTICAL</b>					
CE2405	<a href="#">Computer Aided Design and Drafting Laboratory</a>	0	0	4	2
CE2406	<a href="#">Design Project</a>	0	0	4	2
<b>TOTAL</b>		<b>18</b>	<b>1</b>	<b>8</b>	<b>23</b>

**SEMESTER VIII**

Code No.	Course Title	L	T	P	C
<b>THEORY</b>					
CE2451	<a href="#">Engineering Economics and Cost Analysis</a>	3	0	0	3
E4***	Elective – IV	3	0	0	3
E5***	Elective – V	3	0	0	3
<b>PRACTICAL</b>					
CE2453	<a href="#">Project Work</a>	0	0	12	6
<b>TOTAL</b>		<b>9</b>	<b>0</b>	<b>15</b>	<b>15</b>

## LIST OF ELECTIVES

### SEMESTER VI

Code No.	Course Title	L	T	P	C
CE2021	<a href="#">Hydrology</a>	3	0	0	3
CE2022	<a href="#">Cartography</a>	3	0	0	3
CE2023	<a href="#">Electronic Surveying</a>	3	0	0	3
CE2024	<a href="#">Remote Sensing Techniques and GIS</a>	3	0	0	3
CE2025	<a href="#">Architecture</a>	3	0	0	3
GE2021	<a href="#">Professional Ethics in Engineering</a>	3	0	0	3
GE2022	<a href="#">Total Quality Management</a>	3	0	0	3
GE2023	<a href="#">Fundamentals of Nanoscience</a>	3	0	0	3
GE2071	<a href="#">Intellectual Property Rights (IPR)</a>	3	0	0	3
GE2072	<a href="#">Indian Constitution and Society</a>	3	0	0	3

### SEMESTER VII

Code No.	Course Title	L	T	P	C
CE2026	<a href="#">Traffic Engineering Management</a>	3	0	0	3
CE2027	<a href="#">Housing Planning &amp; Management</a>	3	0	0	3
CE2028	<a href="#">Ground Water Engineering</a>	3	0	0	3
CE2029	<a href="#">Management of Irrigation Systems</a>	3	0	0	3
CE2030	<a href="#">Coastal Zone Management</a>	3	0	0	3
CE2031	<a href="#">Water Resources Engineering</a>	3	0	0	3
CE2032	<a href="#">Pavement Engineering</a>	3	0	0	3
CE2033	<a href="#">Ground Improvement Techniques</a>	3	0	0	3
CE2034	<a href="#">Introduction to Soil Dynamics and Machine Foundations</a>	3	0	0	3
CE2035	<a href="#">Rock Engineering</a>	3	0	0	3
CE2036	<a href="#">Environmental Impact Assessment of Civil Engineering Projects</a>	3	0	0	3
CE2037	<a href="#">Industrial Waste Management</a>	3	0	0	3
CE2038	<a href="#">Air Pollution Management</a>	3	0	0	3
CE2039	<a href="#">Municipal Solid Waste and Management</a>	3	0	0	3
CE2040	<a href="#">Ecological Engineering</a>	3	0	0	3
GE2073	<a href="#">Contract Laws and Regulations</a>	3	0	0	3

### SEMESTER VIII

Code No.	Course Title	L	T	P	C
CE2041	<a href="#">Bridge Structures</a>	3	0	0	3
CE2042	<a href="#">Storage Structures</a>	3	0	0	3
CE2043	<a href="#">Design of Plate and Shell Structures</a>	3	0	0	3
CE2044	<a href="#">Tall Buildings</a>	3	0	0	3
CE2045	<a href="#">Prefabricated structures</a>	3	0	0	3
CE2046	<a href="#">Wind Engineering</a>	3	0	0	3
CE2047	<a href="#">Computer Aided Design of Structures</a>	3	0	0	3
CE2048	<a href="#">Industrial Structures</a>	3	0	0	3
CE2049	<a href="#">Smart Structures and smart Materials</a>	3	0	0	3
CE2050	<a href="#">Finite Element Techniques</a>	3	0	0	3
CE2071	<a href="#">Repair and Rehabilitation of Structures</a>	3	0	0	3

**UNIT I OVERVIEW OF MANAGEMENT 9**

Definition - Management - Role of managers - Evolution of Management thought - Organization and the environmental factors – Trends and Challenges of Management in Global Scenario.

**UNIT II PLANNING 9**

Nature and purpose of planning - Planning process - Types of plans – Objectives - Managing by objective (MBO) Strategies - Types of strategies - Policies - Decision Making - Types of decision - Decision Making Process - Rational Decision Making Process - Decision Making under different conditions.

**UNIT III ORGANIZING 9**

Nature and purpose of organizing - Organization structure - Formal and informal groups / organization - Line and Staff authority - Departmentation - Span of control - Centralization and Decentralization - Delegation of authority - Staffing - Selection and Recruitment - Orientation - Career Development - Career stages – Training - Performance Appraisal.

**UNIT IV DIRECTING 9**

Creativity and Innovation - Motivation and Satisfaction - Motivation Theories - Leadership Styles - Leadership theories - Communication - Barriers to effective communication - Organization Culture - Elements and types of culture - Managing cultural diversity.

**UNIT V CONTROLLING 9**

Process of controlling - Types of control - Budgetary and non-budgetary control techniques - Managing Productivity - Cost Control - Purchase Control - Maintenance Control - Quality Control - Planning operations.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Stephen P. Robbins and Mary Coulter, 'Management', Prentice Hall of India, 8th edition.
2. Charles W L Hill, Steven L McShane, 'Principles of Management', Mcgraw Hill Education, Special Indian Edition, 2007.

**REFERENCES**

1. Hellriegel, Slocum & Jackson, ' Management - A Competency Based Approach', Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and Mark V Cannice, 'Management - A global& Entrepreneurial Perspective', Tata Mcgraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, 'Essentials of Management', Thomson Southwestern, 7th edition, 2007.

**OBJECTIVE**

- This course is in continuation of Structural Analysis – Classical Methods. Here in advanced method of analysis like Matrix method and Plastic Analysis are covered. Advanced topics such as FE method and Space Structures are covered.

**UNIT I FLEXIBILITY METHOD 12**

Equilibrium and compatibility – Determinate vs Indeterminate structures – Indeterminacy - Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

**UNIT II STIFFNESS MATRIX METHOD 12**

Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations – Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames( with redundancy vertical to two)

**UNIT III FINITE ELEMENT METHOD 12**

Introduction – Discretisation of a structure – Displacement functions – Truss element – Beam element – Plane stress and plane strain - Triangular elements

**UNIT IV PLASTIC ANALYSIS OF STRUCTURES 12**

Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems

**UNIT V SPACE AND CABLE STRUCTURES 12**

Analysis of Space trusses using method of tension coefficients – Beams curved in plan Suspension cables – suspension bridges with two and three hinged stiffening girders

**L : 45 , T : 15 TOTAL: 60 PERIODS**

**TEXT BOOKS**

- 1 Vaidyanathan, R. and Perumal, P., “Comprehensive structural Analysis – Vol. I & II”, Laxmi Publications, New Delhi, 2003
- 2 L.S. Negi & R.S. Jangid, “Structural Analysis”, Tata McGraw-Hill Publications, New Delhi, 2003.
- 3 BhaviKatti, S.S, “Structural Analysis – Vol. 1 Vol. 2”, Vikas Publishing House Pvt. Ltd., New Delhi, 2008

**REFERENCES**

1. Ghali,A, Nebille,A.M. and Brown,T.G. “Structural Analysis” A unified classical and Matrix approach” –5<sup>th</sup> edition. Spon Press, London and New York, 2003.
2. Coates R.C, Coutie M.G. and Kong F.K., “Structural Analysis”, ELBS and Nelson, 1990
3. Structural Analysis – A Matrix Approach – G.S. Pandit & S.P. Gupta, Tata McGraw Hill 2004.
4. Matrix Analysis of Framed Structures – Jr. William Weaver & James M. Gere, CBS Publishers and Distributors, Delhi.

**OBJECTIVE**

- This course covers the design of structural steel members subjected to compressive, tensile and bending loads, as per current codal provisions (IS 800 - 2007) including connections. Design of structural systems such as roof trusses, gantry girders are included.

**UNIT I INTRODUCTION****12**

Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures – Metal joining methods using rivets, welding, bolting – Design of bolted, riveted and welded joints – Eccentric connections - Efficiency of joints – High Tension bolts

**UNIT II TENSION MEMBERS****8**

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag

**UNIT III COMPRESSION MEMBERS****16**

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of lacing and battening type columns – Design of column bases – Gusseted base

**UNIT IV BEAMS****12**

Design of laterally supported and unsupported beams – Built up beams – Beams subjected to biaxial bending – Design of plate girders riveted and welded – Intermediate and bearing stiffeners – Web splices – Design of beam columns

**UNIT V ROOF TRUSSES AND INDUSTRIAL STRUCTURES****12**

Roof trusses – Roof and side coverings – Design loads, design of purlin and elements of truss; end bearing – Design of gantry girder

**TUTORIAL: 15 TOTAL: 60 PERIODS****TEXT BOOKS**

1. Dayaratnam, P., "Design of Steel Structures", Second edition, S. Chand & Company, 2003.
2. Ramachandra, S. and Virendra Gehlot, "Design of Steel Structures – Vol. I & II", Standard Publication, New Delhi, 2007

**REFERENCES**

1. "Teaching Resources for Structural Steel Design – Vol. I & II", INSDAG, Kolkatta.
2. Gaylord, E.H., Gaylord, N.C., and Stallmeyer, J.E., "Design of Steel Structures", 3<sup>rd</sup> edition, McGraw-Hill Publications, 1992
3. Negi L.S.. Design of Steel Structures, Tata McGraw Hill Publishing Pvt Ltd, New Delhi, 2007.
4. IS 800-2007 Indian Standard - General Construction in Steel – code of practice (3<sup>rd</sup> Revision).

**OBJECTIVE**

- At the end of this course the student is expected to have learnt how to plan construction projects, schedule the activities using network diagrams, determine the cost of the project, control the cost of the project by creating cash flows and budgeting and how to use the project information as an information and decision making tool.

**UNIT I CONSTRUCTION PLANNING 6**

Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks- Definition- Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

**UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 12**

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling-Activity float and schedules-Presenting project schedules-Critical path scheduling for Activity-on-node and with leads, Lags and Windows-Calculations for scheduling with leads, lags and windows-Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Crashing and time/cost trade offs -Improving the Scheduling process – Introduction to application software.

**UNIT III COST CONTROL MONITORING AND ACCOUNTING 11**

The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.

**UNIT IV QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 8**

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods -Statistical Quality control with Sampling by Attributes-Statistical Quality control by Sampling and Variables-Safety.

**UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION 8**

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Chitkara, K.K. "Construction Project Management Planning", Scheduling and Control, Tata McGraw-Hill Publishing Co., New Delhi, 1998.
2. Srinath,L.S., "PERT and CPM Priniples and Applications ", Affiliated East West Press, 2001

**REFERENCES**

1. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners", Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Moder.J., C.Phillips and Davis, "Project Management with CPM", PERT and Precedence Diagramming, Van Nostrand Reinhold Co., Third Edition, 1983.
3. Willis., E.M., "Scheduling Construction projects", John Wiley and Sons 1986.
4. Halpin,D.W., "Financial and cost concepts for construction Management", John Wiley and Sons, New York, 1985.

**OBJECTIVE**

- To educate the students on the principles and design of Sewage Collection, Conveyance, treatment and disposal.

**UNIT I PLANNING FOR SEWERAGE SYSTEMS 9**

Sources of wastewater generation – Effects – Estimation of sanitary sewage flow – Estimation of storm runoff – Factors affecting Characteristics and composition of sewage and their significance – Effluent standards – Legislation requirements.

**UNIT II SEWER DESIGN 9**

Sewerage – Hydraulics of flow in sewers – Objectives – Design period - Design of sanitary and storm sewers – Small bore systems - Computer applications – Laying, joining & testing of sewers – appurtenances – Pumps – selection of pumps and pipe Drainage -. Plumbing System for Buildings – One pipe and two pipe system.

**UNIT III PRIMARY TREATMENT OF SEWAGE 9**

Objective – Unit Operation and Processes – Selection of treatment processes – Onsite sanitation - Septic tank, Grey water harvesting – Primary treatment – Principles, functions design and drawing of screen, grit chambers and primary sedimentation tanks – Operation and Maintenance aspects.

**UNIT IV SECONDARY TREATMENT OF SEWAGE 9**

Objective – Selection of Treatment Methods – Principles, Functions, Design and Drawing of Units - Activated Sludge Process and Trickling filter, other treatment methods – Oxidation ditches, UASB – Waste Stabilization Ponds – Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment – Construction and Operation & Maintenance of Sewage Treatment Plants.

**UNIT V DISPOSAL OF SEWAGE AND SLUDGE 9**

Standards for Disposal - Methods – dilution – Self purification of surface water bodies – Oxygen sag curve – Land disposal – Sewage farming – Deep well injection – Soil dispersion system - Sludge characterization – Thickening – Sludge digestion – Biogas recovery – Sludge Conditioning and Dewatering – disposal – Advances in Sludge Treatment and disposal.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Garg, S.K., Environmental Engineering Vol. II, Khanna Publishers, New Delhi, 2003.
2. Punmia, B.C., Jain, A.K., and Jain.A., Environmental Engineering, Vol.II, Lakshmi Publications, Newsletter, 2005.

**REFERENCES**

1. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1997.
2. Wastewater Engineering – Treatment and Reuse, Tata Mc.Graw-Hill Company, New Delhi, 2003.

**UNIT I WATER SUPPLY AND TREATMENT 15**  
Design & Drawing of flash mixer, flocculator, clarifier – Rapid sand filter – Service reservoirs – Pumping station – House service connection for water supply and drainage.

**UNIT II SEWAGE TREATMENT & DISPOSAL 15**  
Design and Drawing of screen chamber - Grit channel - Primary clarifier - Activated sludge process – Aeration tank – Secondary clarifiers – Sludge digester – Sludge drying beds – Waste stabilisation ponds - Septic tanks and disposal arrangements – Manholes.

**UNIT III IMPOUNDING STRUCTURES 10**  
Gravity dam, Tank Surplus Weir, Tank Sluice with tower road – Drawing showing plan, elevation, half section including foundation details.

**UNIT IV CANAL TRANSMISSION STRUCTURES 10**  
Aqueducts – Syphon Aqueducts – Super passage – Canal siphon – Canal Drops- Drawing showing plan, elevation and foundation details.

**UNIT V CANAL REGULATION STRUCTURES 10**  
Canal head works- Canal Regulator – Canal escape- Proportional Distributors – Drawing showing detailed plan, elevation and foundation.

**TOTAL: 60 PERIODS**

**TEXT BOOKS**

1. Modi, P.N., “Environmental Engineering I & II”, Standard Book House, Delhi – 6
2. Sathyanarayana Murthy “Irrigation Design and Drawing” Published by Mrs L.Banumathi, Tuni east Godavari District. A.P. 1998.
3. Sharma R.K. Irrigation Engineering and Hydraulic Structures Oxford and IBH Publishing co., New Delhi 2002.

**REFERENCES**

1. Peary, H.S., ROWE, D.R., Tchobanoglous, G., “Environmental Engineering”, McGraw-Hill Book Co., New Delhi, 1995.
2. Metcalf & Eddy, “Wastewater Engineering (Treatment and Reuse)”, 4<sup>th</sup> edition, Tata McGraw-Hill, New Delhi, 2003.
3. Garg S.K., “Irrigation Environmental Engineering and design Structures”, Khanna Publishers, New Delhi, 17<sup>th</sup> Reprint, 2003.
4. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999
5. Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 1993.



**OBJECTIVE**

- This subject includes the list of experiments to be conducted for characterisation of water and municipal sewage. At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

**LIST OF EXPERIMENTS**

1. Sampling and preservation methods and significance of characterisation of water and wastewater.
2. Determination of
  - i) P<sup>H</sup> and turbidity
  - ii) Hardness
3. Determination of iron & fluoride
4. Determination of residual chlorine
5. Determination of Chlorides
6. Determination of Ammonia Nitrogen
7. Determination of Sulphate
8. Determination of Optimum Coagulant Dosage
9. Determination of available Chlorine in Bleaching powder
10. Determination of dissolved oxygen
11. Determination of suspended, volatile and fixed solids
12. B.O.D. test
13. C.O.D. test
14. Introduction to Bacteriological Analysis (Demonstration only)

**TOTAL: 45 PERIODS****REFERENCES**

1. Standard methods for the examination of water and wastewater, APHA, 20<sup>th</sup> Edition, Washington, 1998
2. Garg, S.K., "Environmental Engineering Vol. I & II", Khanna Publishers, New Delhi
3. Modi, P.N., "Environmental Engineering Vol. I & II", Standard Book House, Delhi-6

**LIST OF EQUIPMENT****(For a batch of 30 students)**

1.	P <sup>H</sup> meter	-	1 no.
2.	Turbidity meter	-	1 no.
3.	Conductivity meter	-	1 No.
4.	Refrigerator	-	1 No.
5.	BOD incubator	-	1 No.
6.	Muffle furnace	-	1 No.
7.	Hot air oven	-	1 No.
8.	Magnetic stirrer with hot plates	-	5 Nos.
9.	Desicator	-	1 No.
10.	Jar test apparatus	-	1 No.
11.	Water bath	-	1 No.
12.	Furniture	-	1 lot
13.	Glass waves / Crucibles	-	1 lot

14.	Chemicals	-	1 lot
15.	COD apparatus	-	1 No.
16.	Kjeldane apparatus	-	1 No.
17.	Heating mantles	-	5 Nos.
18.	Calorimeter	-	1 No.
19.	Chlorine comparator	-	1 No.
20.	Furniture : Work table	-	10 Nos.
21.	Beaker	-	30 Nos.
22.	Standard flask	-	30 Nos.
23.	Burette with stand	-	15 Nos.
24.	Pipette	-	15 Nos.
25.	Crucible	-	15 Nos.
26.	Filtration assembly	-	1 No.
27.	Chemicals	-	Lot

**CE 2357**

**SURVEY CAMP**

**L T P C  
0 0 0 3**

Ten days survey camp using Theodolite, cross staff, levelling staff, tapes, plane table and total station. The camp must involve work on a large area of not less than 400 hectares. At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

- (i) Triangulation
- (ii) Trilateration
- (iii) Sun / Star observation to determine azimuth
- (iv) Use of GTS to determine latitude and longitude

### **EVALUATION PROCEDURE**

1. Internal Marks : 20 marks  
(decided by the staff in-charge appointed by the Institution)
2. Evaluation of Survey Camp Report : 30 marks  
(Evaluated by the external examiner appointed the University)
3. Viva voce examination : 50 marks  
(evaluated by the internal examiner appointed by the HOD with the approval of HOI and external examiner appointed by the University – with equal Weightage)

**TOTAL: 100 MARKS**

**CE 2401 DESIGN OF REINFORCED CONCRETE & BRICK MASONRY STRUCTURES****L T P C****3 1 0 4****OBJECTIVE**

- This course covers the design of Reinforced Concrete Structures such as Retaining Wall, Water Tanks, Staircases, Flat slabs and Principles of design pertaining to Box culverts, Mat foundation and Bridges. At the end of the course student has a comprehensive design knowledge related to structures, systems that are likely to be encountered in professional practice.

**UNIT I RETAINING WALLS 12**

Design of cantilever and counter fort retaining walls

**UNIT II WATER TANKS 12**

Underground rectangular tanks – Domes – Overhead circular and rectangular tanks – Design of staging and foundations

**UNIT III SELECTED TOPICS 12**

Design of staircases (ordinary and doglegged) – Design of flat slabs – Design of Reinforced concrete walls – Principles of design of mat foundation, box culvert and road bridges

**UNIT IV YIELD LINE THEORY 12**

Application of virtual work method to square, rectangular, circular and triangular slabs

**UNIT V BRICK MASONRY 12**

Introduction, Classification of walls, Lateral supports and stability, effective height of wall and columns, effective length of walls, design loads, load dispersion, permissible stresses, design of axially and eccentrically loaded brick walls

**L : 45 , T : 15 TOTAL: 60 PERIODS****TEXT BOOKS**

1. Krishna Raju, N., "Design of RC Structures", CBS Publishers and Distributors, Delhi, 2006
2. Dayaratnam, P., "Brick and Reinforced Brick Structures", Oxford & IBH Publishing House, 1997
3. Varghese, P.C., "Limit State Design of Reinforced Concrete Structures "Prentice hall of India Pvt Ltd New Delhi, 2007.

**REFERENCES**

1. Mallick, D.K. and Gupta A.P., "Reinforced Concrete", Oxford and IBH Publishing Company
2. Syal, I.C. and Goel, A.K., "Reinforced Concrete Structures", A.H. Wheelers & Co. Pvt. Ltd., 1994
3. Ram Chandra.N. and Virendra Gehlot, "Limit State Design", Standard Book House.2004.

**OBJECTIVE**

- This subject covers the various aspects of estimating of quantities of items of works involved in buildings, water supply and sanitary works, road works and irrigation works. This also covers the rate analysis, valuation of properties and preparation of reports for estimation of various items. At the end of this course the student shall be able to estimate the material quantities, prepare a bill of quantities, make specifications and prepare tender documents. Student should also be able to prepare value estimates.

**UNIT I ESTIMATE OF BUILDINGS 11**

Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for panelled and glazed doors, windows, ventilators, handrails etc.

**UNIT II ESTIMATE OF OTHER STRUCTURES 10**

Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line – sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimate of retaining walls – culverts – estimating of irrigation works – aqueduct, siphon, fall.

**UNIT III SPECIFICATION AND TENDERS 8**

Data – Schedule of rates – Analysis of rates – Specifications – sources – Detailed and general specifications – Tenders – Contracts – Types of contracts – Arbitration and legal requirements.

**UNIT IV VALUATION 8**

Necessity – Basics of value engineering – Capitalised value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease

**UNIT V REPORT PREPARATION 8**

Principles for report preparation – report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations – Tube wells – Open wells.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Dutta, B.N., “Estimating and Costing in Civil Engineering”, UBS Publishers & Distributors Pvt. Ltd., 2003
2. Kohli, D.D and Kohli, R.C., “A Text Book of Estimating and Costing (Civil)”, S.Chand & Company Ltd., 2004

**REFERENCE**

1. PWD Data Book.

**OBJECTIVE**

- The main objective of this course is to introduce to the student the phenomena of earthquakes, the process, measurements and the factors that affect the design of structures in seismic areas. This objective is achieved through imparting rudiments of theory of vibrations necessary to understand and analyse the dynamic forces caused by earthquakes and structures. Further, the student is also taught the codal provisions as well as the aseismic design methodology.

**UNIT I THEORY OF VIBRATIONS 9**

Concept of inertia and damping – Types of Damping – Difference between static forces and dynamic excitation – Degrees of freedom – SDOF idealisation – Equations of motion of SDOF system for mass as well as base excitation – Free vibration of SDOF system – Response to harmonic excitation – Impulse and response to unit impulse – Duhamel integral

**UNIT II MULTIPLE DEGREE OF FREEDOM SYSTEM 9**

Two degree of freedom system – Normal modes of vibration – Natural frequencies - Mode shapes - Introduction to MDOF systems – Decoupling of equations of motion – Concept of mode superposition (No derivations).

**UNIT III ELEMENTS OF SEISMOLOGY 9**

Causes of Earthquake – Geological faults – Tectonic plate theory – Elastic rebound – Epicentre – Hypocentre – Primary, shear and Raleigh waves – Seismogram – Magnitude and intensity of earthquakes – Magnitude and Intensity scales – Spectral Acceleration - Information on some disastrous earthquakes

**UNIT IV RESPONSE OF STRUCTURES TO EARTHQUAKE 9**

Response and design spectra – Design earthquake – concept of peak acceleration – Site specific response spectrum – Effect of soil properties and damping – Liquefaction of soils – Importance of ductility – Methods of introducing ductility into RC structures.

**UNIT V DESIGN METHODOLOGY 9**

IS 1893, IS 13920 and IS 4326 – Codal provisions – Design as per the codes – Base isolation techniques – Vibration control measures – Important points in mitigating effects of earthquake on structures.

**TOTAL: 45 PERIODS****TEXT BOOK**

- Chopra, A.K., “Dynamics of Structures – Theory and Applications to Earthquake Engineering”, Second Edition, Pearson Education, 2003.

**REFERENCES**

- Biggs, J.M., “Introduction to Structural Dynamics”, McGraw–Hill Book Co., N.Y., 1964
- Dowrick, D.J., “Earthquake Resistant Design”, John Wiley & Sons, London, 1977
- Paz, M., “Structural Dynamics – Theory & Computation”, CSB Publishers & Distributors, Shahdara, Delhi, 1985
- NPEEE Publications.

**OBJECTIVE**

- At the end of this course the student shall have a knowledge of methods of prestressing, advantages of prestressing concrete, the losses involved and the design methods for prestressed concrete elements under codal provisions.

**UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 9**

Basic concepts – Advantages – Materials required – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of loading on the tensile stresses in tendons – Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections - Losses of prestress – Estimation of crack width

**UNIT II DESIGN CONCEPTS 9**

Flexural strength – Simplified procedures as per codes – strain compatibility method – Basic concepts in selection of cross section for bending – stress distribution in end block, Design of anchorage zone reinforcement – Limit state design criteria – Partial prestressing – Applications.

**UNIT III CIRCULAR PRESTRESSING 9**

Design of prestressed concrete tanks – Pipes

**UNIT IV COMPOSITE CONSTRUCTION 9**

Analysis for stresses – Estimate for deflections – Flexural and shear strength of composite members

**UNIT V PRE-STRESSED CONCRETE BRIDGES 9**

General aspects – pretensioned prestressed bridge decks – Post tensioned prestressed bridge decks – Principles of design only.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, New Delhi 1998
2. Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co. Pvt. Ltd. 1997.
3. Rajagopalan, N, "Prestressed Concrete", Alpha Science, 2002

**REFERENCES**

1. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi, 1990
2. Lin T.Y. Design of prestressed concrete structures, Asia Publishing House, Bombay 1995.
3. David A.Sheppard, William R. and Philips, Plant Cast precast and prestressed concrete – A design guide, McGraw Hill, New Delhi 1992.

**OBJECTIVES**

- At the end of the course the student acquires hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice.
1. Design and drawing of RCC cantilever and counterfort type retaining walls with reinforcement details
  2. Design of solid slab and RCC Tee beam bridges for IRC loading and reinforcement details
  3. Design and drafting of Intz type water tank, Detailing of circular and rectangular water tanks
  4. Design of plate girder bridge – Twin Girder deck type railway bridge – Truss Girder bridges – Detailed Drawings including connections

**TOTAL: 60 PERIODS****TEXT BOOKS**

1. Krishna Raju, "Structural Design & Drawing (Concrete & Steel)", CBS Publishers 2004.
2. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Design of steel structures", Lakshmi publications Pvt. Ltd 2003.

**REFERENCES**

1. Krishnamurthy, D., "Structural Design & Drawing – Vol. II", CBS Publishers & Distributors, Delhi 1992.
2. Krishnamurthy, D., "Structural Design & Drawing – Vol. III Steel Structures", CBS Publishers & Distributors, New Delhi 1992.

**EXAMINATION DURATION      4 HOURS****LIST OF EQUIPMENTS**

- |                                 |   |         |
|---------------------------------|---|---------|
| 1. Models of Structures         | - | 1 each. |
| 2. Computers Pentium IV         | - | 30 Nos. |
| 3. Analysis and Design Software | - | 1 No.   |
| - Minimum 5 user License        | - |         |
| 4. Auto CAD Software            | - | 1 No.   |
| - Multi user License            | - |         |

**OBJECTIVE**

- The objective of this course is to impart and improve the design capability of the student. This course conceives purely a design problem in any one of the disciplines of Civil Engineering; e.g., Design of an RC structure, Design of a waste water treatment plant, Design of a foundation system, Design of traffic intersection etc. The design problem can be allotted to either an individual student or a group of students comprising of not more than four. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.

**TOTAL: 60 PERIODS**

## EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks : 20 marks  
(Decided by conducting 3 reviews by the guide appointed by the Institution)
2. Evaluation of Project Report : 30 marks  
(Evaluated by the external examiner appointed the University).  
Every student belonging to the same group gets the same mark
3. Viva voce examination : 50 marks  
(Evaluated by the internal examiner appointed by the HOD with the approval of HOI, external examiner appointed by the University and Guide of the course – with equal Weightage)

**TOTAL: 100 MARKS**

**CE 2451**

**ENGINEERING ECONOMICS AND COST ANALYSIS**

**L T P C  
3 0 0 3**

### OBJECTIVE

- The main objective of this course is to make the Civil Engineering student know about the basic law of economics, how to organise a business, the financial aspects related to business, different methods of appraisal of projects and pricing techniques. At the end of this course the student shall have the knowledge of how to start a construction business, how to get finances, how to account, how to price and bid and how to assess the health of a project.

### UNIT I BASIC ECONOMICS

**7**

Definition of economics - nature and scope of economic science - nature and scope of managerial economics - basic terms and concepts - goods - utility - value - wealth - factors of production - land - its peculiarities - labour - economies of large and small scale - consumption - wants - its characteristics and classification - law of diminishing marginal utility - relation between economic decision and technical decision.

### UNIT II DEMAND AND SCHEDULE

**8**

Demand - demand schedule - demand curve - law of demand - elasticity of demand - types of elasticity - factors determining elasticity - measurement - its significance - supply - supply schedule - supply curve - law of supply - elasticity of supply - time element in the determination of value - market price and normal price - perfect competition - monopoly - monopolistic competition.

### UNIT III ORGANISATION

**8**

Forms of business - proprietorship - partnership - joint stock company - cooperative organisation - state enterprise - mixed economy - money and banking - banking - kinds - commercial banks - central banking functions - control of credit - monetary policy - credit instrument.

### UNIT IV FINANCING

**9**

Types of financing - Short term borrowing - Long term borrowing - Internal generation of funds - External commercial borrowings - Assistance from government budgeting support and international finance corporations - analysis of financial statement – Balance Sheet - Profit and Loss account - Funds flow statement.



**UNIT V COST AND BREAK EVEN ANALYSES****13**

Types of costing – traditional costing approach - activity base costing - Fixed Cost – variable cost – marginal cost – cost output relationship in the short run and in long run – pricing practice – full cost pricing – marginal cost pricing – going rate pricing – bid pricing – pricing for a rate of return – appraising project profitability – internal rate of return – pay back period – net present value – cost benefit analysis – feasibility reports – appraisal process – technical feasibility- economic feasibility – financial feasibility. Break even analysis - basic assumptions – break even chart – managerial uses of break even analysis.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Dewett K.K. & Varma J.D., Elementary Economic Theory, S Chand & Co., 2006
2. Sharma JC “Construction Management and Accounts” Satya Prakashan, New Delhi.

**REFERENCES**

1. Barthwal R.R., Industrial Economics - An Introductory Text Book, New Age
2. Jhingan M.L., Micro Economic Theory, Konark
3. Samuelson P.A., Economics - An Introductory Analysis, McGraw-Hill
4. Adhikary M., Managerial Economics
5. Khan MY and Jain PK “Financial Management” McGraw-Hill Publishing Co., Ltd
6. Varshney RL and Maheshwary KL “ Managerial Economics” S Chand and Co

**CE 2453****PROJECT WORK****L T P C  
0 0 12 6****OBJECTIVE**

The objective of the project work is to enable the students to work in convenient groups of not more than four members in a group on a project involving theoretical and experimental studies related to Civil Engineering. Every Project Work shall have a Guide who is a member of the faculty of Civil Engineering of the college where the student is registered. The hours allotted for this course shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis or field work and also to present in periodical seminars the progress made in the project.

Each student shall finally produce a comprehensive report covering background information, literature Survey, problem statement, Project work details and conclusions.

This experience of project work shall help the student in expanding his / her knowledge base and also provide opportunity to utilise the creative ability and inference capability.

**TOTAL: 180 PERIODS****EVALUATION PROCEDURE**

The method of evaluation will be as follows:

1. Internal Marks : 20 marks  
(decided by conducting 3 reviews by the guide appointed by the Institution)
2. Evaluation of Project Report : 30 marks  
(Evaluated by the external examiner appointed the University).  
Every student belonging to the same group gets the same mark

3. Viva voce examination : 50 marks  
(evaluated by the internal examiner appointed by the HOD with the approval of HOI, external examiner appointed by the University and Guide of the course – with equal Weightage)

**TOTAL: 100 MARKS**

**CE 2021 HYDROLOGY L T P C  
3 0 0 3**

**OBJECTIVE**

- At the end of the semester, the student shall be having a good understanding of all the components of the hydrological cycle. The mechanics of rainfall, its spatial and temporal measurement and their applications will be understood. Simple statistical analysis and application of probability distribution of rainfall and run off shall also be understood. Student will also learn simple methods of flood routing and ground water hydrology.

**UNIT I PRECIPITATION 9**

Hydrologic cycle – Types of precipitation – Forms of precipitation – Measurement of Rainfall – Spatial measurement methods – Temporal measurement methods – Frequency analysis of point rainfall – Intensity, duration, frequency relationship – Probable maximum precipitation.

**UNIT II ABSTRACTION FROM PRECIPITATION 9**

Losses from precipitation – Evaporation process – Reservoir evaporation – Infiltration process – Infiltration capacity – Measurement of infiltration – Infiltration indices – Effective rainfall.

**UNIT III HYDROGRAPHS 9**

Factors affecting Hydrograph – Baseflow separation – Unit hydrograph – Derivation of unit hydrograph – S curve hydrograph – Unit hydrograph of different deviations - Synthetic Unit Hydrograph

**UNIT IV FLOODS AND FLOOD ROUTING 9**

Flood frequency studies – Recurrence interval – Gumbel’s method – Flood routing – Reservoir flood routing – Muskingum’s Channel Routing – Flood control

**UNIT V GROUND WATER HYDROLOGY 9**

Types of aquifers – Darcy’s law – Dupuit’s assumptions – Confined Aquifer – Unconfined Aquifer – Recuperation test – Transmissibility – Specific capacity – Pumping test – Steady flow analysis only.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

- Subramanya, K., “Engineering Hydrology”, Tata McGraw-Hill Publishing Co., Ltd., 2000
- Raghunath, H.M., “Hydrology”, Wiley Eastern Ltd., 2000

**REFERENCES**

- Chow, V.T. and Maidment, “Hydrology for Engineers”, McGraw-Hill Inc., Ltd., 2000
- Singh, V.P., “Hydrology”, McGraw-Hill Inc., Ltd., 2000.

**OBJECTIVE**

- At the end of the course the student will possess knowledge about Cartographic Concepts.

**UNIT I INTRODUCTION 9**

Cartography today - Nature of Cartography - History of Cartography - Graticules - Cartometry.

**UNIT II EARTH 9**

Earth-Map Relations - Basic Geodesy - Map Projections, Scale, Reference and Coordinate system - Transformation - Basic Transformation - Affin Transformation.

**UNIT III SOURCES OF DATA 9**

Sources of data - Ground Survey and Positioning - Remote Sensing data collection - Census and sampling - data - Models for digital cartographic information, Map digitizing.

**UNIT IV PERCEPTION AND DESIGN 9**

Cartographic design - Color theory and models - Color and pattern creation and specification - Color and pattern - Typography and lettering the map - Map compilation.

**UNIT V CARTOGRAPHY ABSTRACTION 9**

Selection and Generalisation Principles - Symbolisation - Topographic and thematic maps - Map production and Reproduction - Map series.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. R.W. ANSON and F.J. ORMELING, Basic Cartography for students and Technicians. Vol. I, II and III, Elsevier Applied Science Publishers 2<sup>nd</sup> Edition, 1994.
2. ARTHUR, H. ROBINSON Et al Elements of Cartography, Sixth Edition, John Wiley and Sons, 1995.
3. John Campbell, Introductory Cartography Second Edition, 1994. Wm.C. Brown Publishers.
4. M.J.Kraak and F.J. Ormeling, Cartography: Visualisation and spatial data. Prentice Hall – 1996.

**OBJECTIVE**

- At the end of the course the student will possess knowledge about Electronic surveying

**UNIT I FUNDAMENTALS 7**

Methods of measuring distance, historical development, basic principles of EDM, classifications, applications and comparison with conventional surveying.

**UNIT II BASIC ELECTRONICS 8**

Fundamentals of electronics, resonant circuits, semiconductors, Lasers, Cathode ray tube, photo multiplier tube, transducers, oscillators, frequency mixing, modulation and demodulation, Kerrcell modulator, measurement of phase difference, reflectors and power sources.

**UNIT III PROPAGATION OF ELECTROMAGNETIC WAVES 11**

Definition, classification, applications, propagation properties, wave propagation at lower and higher frequencies. Refractive index, factors affecting, computation of group refractive index for light and near infrared waves at standard conditions and ambient conditions, reference refractive index, first velocity correction, computation of refractive index for microwaves, measurement of atmospheric parameters, mean refractive index, real time application of first velocity correction, second velocity correction and total atmospheric correction.

**UNIT IV ELECTROMAGNETIC DISTANCE MEASURING SYSTEM 11**

Electro-optical system, measuring principle, working principle, sources of error, infrared EDM instruments, Laser EDM instruments and total station. Microwave system, measuring principle, working principle, sources of error, microwave EDM instruments, comparison with Electro-optical system, care and maintenance of EDM instruments, Modern Positioning Systems. EDM traversing, trilateration and base line measurement using EDM.

**UNIT V FIELD STUDIES 8**

Study of different EDM instruments and Total Station. EDM traversing, trilateration and base line measurement using EDM.

**TOTAL: 45 PERIODS**

**REFERENCES**

1. Burnside, C.D. Electromagnetic distance measurement Crosby Lock wood staples, U.K. 1971.
2. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 1990.
3. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1983.
4. Soastamoinen, J.J. Surveyor's guide to electro-magnetic Distance Measurement, Adam Hilger Ltd., 1967.

**CE2024 REMOTE SENSING TECHNIQUES AND GIS L T P C  
3 0 0 3**

**OBJECTIVE**

- To introduce the students to the basic concepts and principles of various components of remote sensing.
- To provide an exposure to GIS and its practical applications in civil engineering.

**UNIT I EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL 9**

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.

**UNIT II PLATFORMS AND SENSORS 9**

Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Payload description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR and microwave sensors.

**UNIT III IMAGE INTERPRETATION AND ANALYSIS 9**

Types of Data Products – types of image interpretation – basic elements of image interpretation - visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image classification – Supervised and unsupervised.

**UNIT IV GEOGRAPHIC INFORMATION SYSTEM 9**

Introduction – Maps – Definitions – Map projections – types of map projections – map analysis – GIS definition – basic components of GIS – standard GIS softwares – Data type – Spatial and non-spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

**UNIT V DATA ENTRY, STORAGE AND ANALYSIS 9**

Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data analysis – Modeling in GIS Highway alignment studies – Land Information System.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Lillesand, T.M., Kiefer, R.W. and J.W.Chipman. (2004). Remote Sensing and Image Interpretation. V Edn. John Willey and Sons (Asia) Pvt. Ltd., New Delhi. Pp:763.
2. Anji Reddy, M. (2001). Textbook of Remote Sensing and Geographical Information System. Second edn. BS Publications, Hyderabad.

**REFERENCES**

1. Lo. C.P.and A.K.W.Yeung (2002). Concepts and Techniques of Geographic Information Systems. Prentice-Hall of India Pvt. Ltd., New Delhi. Pp:492.
2. Peter A.Burrough, Rachael A.McDonnell (2000). Principles of GIS. Oxford University Press.
3. Ian Heywood (2000). An Introduction to GIS. Pearson Education Asia.

**CE 2025**

**ARCHITECTURE**

**L T P C  
3 0 0 3**

**OBJECTIVE**

- To provide the basic knowledge on the principles of design of buildings relating to the environment and climate.

**UNIT I ARCHITECTURAL DESIGN 8**

Architectural Design – an analysis – integration of function and aesthetics – Introduction to basic elements and principles of design.

**UNIT II SITE PLANNING 9**

Surveys – Site analysis – Development Control – Layout regulations- Layout design concepts.

**UNIT III BUILDING TYPES 12**

Residential, institutional, commercial and Industrial – Application of anthropometry and space standards-Inter relationships of functions – Safety standards – Building rules and regulations – Integration of building services – Interior design

**UNIT IV CLIMATE AND ENVIRONMENTAL RESPONSIVE DESIGN 8**

Man and environment interaction- Factors that determine climate – Characteristics of climate types – Design for various climate types – Passive and active energy controls – Green building concept

**UNIT V TOWN PLANNING 8**

Planning – Definition, concepts and processes- Urban planning standards and zoning regulations- Urban renewal – Conservation – Principles of Landscape design

**TOTAL: 45 PERIODS**

## REFERENCES

1. Francis D.K. Ching, "Architecture: Form, Space and Order", VNR, N.Y., 1999.
2. Givoni B., "Man Climate and Architecture", Applied Science, Barking ESSEX, 1982
3. Edward D.Mills, "Planning and Architects Handbook", Butterworth London, 1995.
4. Gallian B.Arthur and Simon Eisner, "The Urban Pattern – City Planning and Design", Affiliated Press Pvt. Ltd., New Delhi, 1995.
5. Margaret Robert, "An Introduction to Town Planning Techniques", Hutchinsolondon , 1990.

**GE 2021**

**PROFESSIONAL ETHICS IN ENGINEERING**

**L T P C  
3 0 0 3**

### **UNIT I ENGINEERING ETHICS 9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

### **UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9**

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

### **UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal

### **UNIT IV RESPONSIBILITIES AND RIGHTS 9**

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) - Discrimination

### **UNIT V GLOBAL ISSUES 9**

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct

**TOTAL: 45 PERIODS**

### **TEXT BOOKS**

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 2005.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.

### **REFERENCES**

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics – An Indian Perspective", Biztantra, New Delhi, 2004.
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

**UNIT I INTRODUCTION 9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

**UNIT II TQM PRINCIPLES 9**

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

**UNIT III TQM TOOLS & TECHNIQUES I 9**

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

**UNIT IV TQM TOOLS & TECHNIQUES II 9**

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

**UNIT V QUALITY SYSTEMS 9**

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

**TOTAL: 45 PERIODS****TEXT BOOK**

1. Dale H. Besterfield, et al., "Total Quality Management", Pearson Education Asia, 3<sup>rd</sup> Edition, Indian Reprint (2006).

**REFERENCES**

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6<sup>th</sup> Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3<sup>rd</sup> Edition, 2003.
3. Suganthi, L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

**UNIT I INTRODUCTION 9**

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

**UNIT II PREPARATION METHODS 10**

Bottom-up Synthesis-Top-down Approach: Precipitation, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

**UNIT III PATTERNING AND LITHOGRAPHY FOR NANOSCALE DEVICES 7**

Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

**UNIT IV PREPARATION ENVIRONMENTS 9**

Clean rooms: specifications and design, air and water purity, requirements for particular processes, Vibration free environments: Services and facilities required. Working practices, sample cleaning, Chemical purification, chemical and biological contamination, Safety issues, flammable and toxic hazards, biohazards.

**UNIT V CHARECTERISATION TECHNIQUES 10**

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. A.S. Edelstein and R.C. Cammeearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale charecterisation of surfaces & Interfaces", 2<sup>nd</sup> edition, Weinheim Cambridge, Wiley-VCH, 2000

**REFERENCES**

1. G Timp (Editor), "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor), "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

**GE2071 INTELLECTUAL PROPERTY RIGHTS (IPR) L T P C  
3 0 0 3**

**UNIT I 9**

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property - Immovable Property and - Intellectual Property.

**UNIT II 9**

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

**UNIT III 9**

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT) – TRIPS Agreement.

**UNIT IV 9**

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.



**UNIT V****9**

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

**TOTAL: 45 PERIODS****TEXT BOOK**

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

**REFERENCES**

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000. [www.ipmatters.net/features/000707\\_gibbs.html](http://www.ipmatters.net/features/000707_gibbs.html).

**GE 2072****INDIAN CONSTITUTION AND SOCIETY****L T P C****3 0 0 3****UNIT I****9**

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

**UNIT II****9**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

**UNIT III****9**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

**UNIT IV****9**

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

**UNIT V****9**

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Durga Das Basu, " Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
2. R.C.Agarwal, " (1997) Indian Political System ", S.Chand and Company, New Delhi.
3. Maciver and Page, " Society: An Introduction Analysis ", Mac Milan India Ltd.,New Delhi.
4. K.L.Sharma, " (1997) Social Stratification in India: Issues and Themes ", Jawaharlal Nehru University, New Delhi.

## REFERENCES

1. Sharma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, " (1998) Indian Political System ", New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, " Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.
4. Yogendra Singh, " (1997) Social Stratification and Charge in India ", Manohar, New Delhi.

**CE 2026**

**TRAFFIC ENGINEERING AND MANAGEMENT**

**L T P C  
3 0 0 3**

## OBJECTIVE

- The students acquire comprehensive knowledge of traffic surveys and studies such as 'Volume Count', 'Speed and delay', 'Origin and destination', 'Parking', 'Pedestrian' and 'Accident surveys'. They achieve knowledge on design of 'at grade' and 'grade separated' intersections. They also become familiar with various traffic control and traffic management measures.

**UNIT I INTRODUCTION 9**  
Significance and scope, Characteristics of Vehicles and Road Users, Skid Resistance and Braking Efficiency (Problems), Components of Traffic Engineering- Road, Traffic and Land Use Characteristics

**UNIT II TRAFFIC SURVEYS AND ANALYSIS 9**  
Surveys and Analysis - Volume, Capacity, Speed and Delays, Origin and Destination, Parking, Pedestrian Studies, Accident Studies and Safety Level of Services- Basic principles of Traffic Flow.

**UNIT III TRAFFIC CONTROL 9**  
Traffic signs, Road markings, Design of Traffic signals and Signal co-ordination (Problems), Traffic control aids and Street furniture, Street Lighting, Computer applications in Signal design

**UNIT IV GEOMETRIC DESIGN OF INTERSECTIONS 9**  
Conflicts at Intersections, Classification of 'At Grade Intersections, - Channallised Intersections - Principles of Intersection Design, Elements of Intersection Design, Rotary design, Grade Separation and interchanges - Design principles.

**UNIT V TRAFFIC MANAGEMENT 9**  
Traffic Management- Transportation System Management (TSM) - Travel Demand Management (TDM), Traffic Forecasting techniques, Restrictions on turning movements, One-way Streets, Traffic Segregation, Traffic Calming, Tidal flow operations, Exclusive Bus Lanes, Introduction to Intelligent Transportation System (ITS).

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. Kadiyali L R, Traffic Engineering and Transport Planning, Khanna Technical Publications, Delhi, 2000.
2. Khanna K and Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2001.

## REFERENCES

1. Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management
2. Guidelines of Ministry of Road Transport and Highways, Government of India.
3. Subhash C.Saxena, A Course in Traffic Planning and Design, Dhanpat Rai Publications, New Delhi, 1989.
4. Transportation Engineering – An Introduction, C.Jotin Khisty, B.Kent Lall, Prentice Hall of India Pvt Ltd, 2006.

**CE 2027**

**HOUSING PLANNING AND MANAGEMENT**

**L T P C  
3 0 0 3**

## OBJECTIVE

- The objective of the course is to train the students to have a comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects. The course focuses on cost effective construction materials and methods. Emphasis has also been given on the principles of sustainable housing policies and programmes.

### **UNIT I INTRODUCTION TO HOUSING 9**

Definition of Basic Terms – House, Home, Household, Apartments, Multi storeyed Buildings, Special Buildings, Objectives and Strategies of National Housing Policies, Principle of Sustainable Housing, Housing Laws at State level, Bye-laws at Urban and Rural Local Bodies – levels - Development Control Regulations, Institutions for Housing at National, State and Local levels

### **UNIT II HOUSING PROGRAMMES 9**

Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods, Open Development Plots, Apartments, Rental Housing, Co-operative Housing, Slum Housing Programmes, Role of Public, Private and Non-Government Organizations

### **UNIT III PLANNING AND DESIGN OF HOUSING PROJECTS 9**

Formulation of Housing Projects – Site Analysis, Layout Design, Design of Housing Units (Design Problems)

### **UNIT IV CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS 9**

New Constructions Techniques – Cost Effective Modern Construction Materials, Building Centers – Concept, Functions and Performance Evaluation

### **UNIT V HOUSING FINANCE AND PROJECT APPRAISAL 9**

Appraisal of Housing Projects – Housing Finance, Cost Recovery – Cash Flow Analysis, Subsidy and Cross Subsidy, Pricing of Housing Units, Rents, Recovery Pattern (Problems).

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi, 1999.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 1997.

## REFERENCES

1. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2002.
2. UNCHS, National Experiences with Shelter Delivery for the Poorest Groups, UNCHS (Habitat), Nairobi, 1994.
3. National Housing Policy, 1994, Government of India.

**OBJECTIVE**

- To understand the distribution of ground water, evaluation of aquifer parameters, solving ground water equations. Ground water quality and development of ground water methods are dealt.

**UNIT I FUNDAMENTALS OF GROUND WATER 9**

Introduction – Characteristic of Ground water – Distribution of water - ground water column – Permeability - Darcy's Law - Types of aquifers - Hydrogeological Cycle – water level fluctuations.

**UNIT II HYDRAULICS OF FLOW 9**

Storage coefficient - Specific field - Heterogeneity and Anisotropy -Transmissivity - Governing equations of ground water flow - Steady state flow - Dupuit Forchheimer assumptions - Velocity potential - Flow nets

**UNIT III ESTIMATION OF PARAMETERS 9**

Transmissivity and Storativity – Pumping test - Unsteady state flow - Thiess method - Jacob method - Image well theory – Effect of partial penetrations of wells - Collectors wells.

**UNIT IV GROUND WATER DEVELOPMENT 9**

Infiltration gallery - Conjunctive use - Artificial recharge Rainwater harvesting - Safe yield -Yield test – Geophysical methods – Selection of pumps.

**UNIT V WATER QUALITY 9**

Ground water chemistry - Origin, movement and quality - Water quality standards - Saltwater intrusion –Environmental concern

**TOTAL: 45 PERIODS****TEXT BOOKS**

- Raghnath H.M., “Ground Water Hydrology”, Wiley Eastern Ltd., 2000.
- Todd D.K., “Ground Water Hydrology”, John Wiley and Sons, 2000.

**REFERENCE**

- C Walton, “Ground Water Resource Evaluation”, McGraw-Hill Publications.

**OBJECTIVE**

- At the end of the semester, the student shall have a clear concept of irrigation water management practices of the past, present and future. He/she shall also be able to appreciate the importance due and duly given to stake holders.

**UNIT I IRRIGATION SYSTEM REQUIREMENTS 9**

Irrigation systems – Supply and demand of water – Cropping pattern – Crop rotation – Crop diversification – Estimation of total and peak crop water requirements – Effective and dependable rainfall – Irrigation efficiencies.

**UNIT II IRRIGATION SCHEDULING 8**

Time of irrigation – Critical stages of water need of crops – Criteria for scheduling irrigation – Frequency and interval of irrigation.

<b>UNIT III</b>	<b>MANAGEMENT</b>	<b>9</b>
Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.		
<b>UNIT IV</b>	<b>OPERATION</b>	<b>9</b>
Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study		
<b>UNIT V</b>	<b>INVOLVEMENT OF STAKE HOLDERS</b>	<b>10</b>
Farmer's participation in System operation – Water user's associations – Farmer councils – Changing paradigms on irrigation management – Participatory irrigation management		

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Dilip Kumar Majumdar, "Irrigation Water Management – Principles and Practice", Prentice Hall of India Pvt. Ltd., New Delhi, 2000
2. Hand book on Irrigation Water Requirement, R.T. Gandhi, et. al., Water Management Division, Department of Agriculture, Ministry of Agriculture, New Delhi

**REFERENCES**

1. Hand Book on Irrigation System Operation Practices, Water Resources Management and Training Project, Technical report No. 33, CWC, New Delhi, 1990
2. Maloney, C. and Raju, K.V., "Managing Irrigation Together", Practice and Policy in India, Stage Publication, New Delhi, India, 1994.

<b>CE 2030</b>	<b>COASTAL ZONE MANAGEMENT</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVE**

- At the end of the semester, the student shall be able to understand the coastal processes, coastal dynamics, impacts of structures like docks, harbours and quays leading to simple management perspectives along the coastal zone.

<b>UNIT I</b>	<b>COASTAL ZONE</b>	<b>9</b>
Coastal zone – Coastal zone regulations – Beach profile – Surf zone – Off shore – Coastal waters – Estuaries – Wet lands and Lagoons – Living resources – Non living resources.		
<b>UNIT II</b>	<b>WAVE DYNAMICS</b>	<b>10</b>
Wave classification – Airy's Linear Wave theory – Deep water waves – Shallow water waves – Wave pressure – Wave energy – Wave Decay – Reflection, Refraction and Diffraction of waves – Breaking of waves – Wave force on structures – Vertical – Sloping and stepped barriers – Force on piles.		
<b>UNIT III</b>	<b>WAVE FORECASTING AND TIDES</b>	<b>9</b>
Need for forecasting - SMB and PNJ methods of wave forecasting – Classification of tides – Darwin's equilibrium theory of tides – Effects on structures – seiches, Surges and Tsunamis.		
<b>UNIT IV</b>	<b>COASTAL PROCESSES</b>	<b>8</b>
Erosion and depositional shore features – Methods of protection – Littoral currents – Coastal aquifers – Sea water intrusion – Impact of sewage disposal in seas.		
<b>UNIT V</b>	<b>HARBOURS</b>	<b>9</b>
Structures near coast – Selection of site – Types and selection of break waters – Need and mode of dredging – Selection of dredgers – Effect of Mangalore forest.		

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. Richard Sylvester, "Coastal Engineering, Volume I and II", Elseiner Scientific Publishing Co., 1999
2. Quinn, A.D., "Design & Construction of Ports and Marine Structures", McGraw-Hill Book Co., 1999

## REFERENCES

1. Ed. A.T. Ippen, "Coastline Hydrodynamics", McGraw-Hill Inc., New York, 1993
2. Dwivedi, S.N., Natarajan, R and Ramachandran, S., "Coastal Zone Management in Tamilnadu".

**CE 2031**

**WATER RESOURCES ENGINEERING**

**L T P C  
3 0 0 3**

## OBJECTIVE

- The student is exposed to the different phases in Water Resources viz planning, collection of relevant data on water resources and also on National Water Policy. Reservoir planning, management and economic analysis aspects are covered in detail.

## UNIT I

### GENERAL

**9**

Water resources survey – Water resources of India and Tamilnadu – Description of water resources planning – Economics of water resources planning, physical and socio economic data – National Water Policy – Collection of meteorological and hydrological data for water resources development.

## UNIT II

### NETWORK DESIGN

**9**

Hydrologic measurements – Analysis of hydrologic data – Hydrologic station network – Station network design – Statistical techniques in network design.

## UNIT III

### WATER RESOURCE NEEDS

**9**

Consumptive and non-consumptive water use - Estimation of water requirements for irrigation, for drinking and navigation - Water characteristics and quality – Scope and aims of master plan - Concept of basin as a unit for development - Water budget and development plan.

## UNIT IV

### RESERVOIR PLANNING AND MANAGEMENT

**9**

Reservoir - Single and multipurpose – Multi objective - Fixation of Storage capacity -Strategies for reservoir operation - Sedimentation of reservoirs - Design flood-levees and flood walls - Channel improvement.

## UNIT V

### ECONOMIC ANALYSIS

**9**

Estimation of cost and Evaluation of Benefits - Discount rate - Discounting factors - Discounting techniques – Computer Applications.

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. Linsley R.K. and Franzini J.B, "Water Resources Engineering", McGraw-Hill Inc, 2000.
2. Douglas J.L. and Lee R.R., "Economics of Water Resources Planning", Tata McGraw-Hill Inc. 2000.
3. Duggal, K.N. and Soni, J.P., "Elements of Water Resources Engineering", New Age International Publishers

## REFERENCES

1. Chaturvedi M.C., "Water Resources Systems Planning and Management", Tata McGraw-Hill Inc., New Delhi, 1997.
2. Goodman Alvin S., "Principles of Water Resources Planning", Prentice-Hall, 1984.
3. Maass et al. Design of Water Resources Systems, Macmillan, 1968.

**OBJECTIVE**

- Student gains knowledge on various IRC guidelines for designing flexible and rigid pavements. Further, he/she will be in a position to assess quality and serviceability conditions of roads.

**UNIT I TYPE OF PAVEMENT AND STRESS DISTRIBUTION ON LAYERED SYSTEM 9**

Introduction - Pavement as layered structure - Pavement types - flexible and rigid -Stress and deflections in pavements under repeated loading

**UNIT II DESIGN OF FLEXIBLE PAVEMENTS 9**

Flexible pavement design - Empirical - Semi empirical and theoretical Methods - Design procedure as per latest IRC guidelines – Design and specification of rural roads

**UNIT III DESIGN OF RIGID PAVEMENTS 9**

Cement concrete pavements - Modified Westergard approach - Design procedure as per latest IRC guidelines - Joints in rigid pavements - Concrete roads and their scope in India.

**UNIT IV PERFORMANCE EVALUATION AND MAINTENANCE 9**

Pavement Evaluation [Condition and evaluation surveys (Surface Appearance, Cracks, Patches And Pot Holes, Undulations, Ravelling, Roughness, Skid Resistance), Structural Evaluation By Deflection Measurements, Present Serviceability Index]  
Pavement maintenance. [IRC Recommendations Only]

**UNIT V STABILISATION OF PAVEMENTS 9**

Stabilisation with special reference to highway pavements - Choice of stabilisers -Testing and field control –Stabilisation for rural roads in India -use of Geosynthetics (geotextiles & geogrids) in roads.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna tech. Publications, New Delhi, 1989.
2. Wright, P.H., "Highway Engineers", John Wiley & Sons, Inc., New York, 1996
3. Yoder R.J and Witczak M.W., "Principles of Pavement Design", John Wiley, 1975.

**REFERENCES**

1. Design and Specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New Delhi, 2001.
2. Guidelines for the Design of Flexible Pavements, IRC:37 - 2001, The Indian roads Congress, New Delhi.
3. Guideline for the Design of Rigid Pavements for Highways, IRC:58-1998, The Indian Roads Congress, New Delh.

**OBJECTIVE**

- After this course, the student is expected to identify basic deficiencies of various soil deposits and he/she be in a position to decide various ways and means of improving the soil and implementing techniques of improvement.

**UNIT I INTRODUCTION 9**

Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnical problems in alluvial, laterite and black cotton soils -Selection of suitable ground improvement techniques based on soil condition.

**UNIT II DRAINAGE AND DEWATERING 9**

Drainage techniques - Well points - Vacuum and electroosmotic methods - Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only).

**UNIT III INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 9**

Insitu densification of cohesionless and consolidation of cohesive soils -Dynamic compaction and consolidation - Vibrofloatation - Sand pile compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.

**UNIT IV EARTH REINFORCEMENT 9**

Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth – use of Geotextiles for filtration, drainage and separation in road and other works.

**UNIT V GROUT TECHNIQUES 9**

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring – Stabilisation with cement, lime and chemicals - Stabilisation of expansive soils.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Koerner R.M., "Construction and Geotechnical Methods in Foundation Engineering", McGraw-Hill, 1994.
2. Purushothama Raj, P. "Ground Improvement Techniques", Tata McGraw-Hill Publishing Company, New Delhi, 1995

**REFERENCES**

1. Moseley M.P., Ground Improvement Blackie Academic and Professional, Chapman and Hall, Glassgow, 1993.
2. Jones J.E.P., Earth Reinforcement and Soil Structure, Butterworths, 1995.
3. Koerner, R.M., "Design with Geosynthetics", (3<sup>rd</sup> Edition) Prentice Hall, New Jersey, 2002
4. Jewell, R.A., "Soil Reinforcement with Geotextiles", CIRIA special publication, London, 1996
5. Das, B.M., "Principles of Foundation Engineering", Thomson Books / Cole, 2003.



**OBJECTIVE**

- At the end of this program the, student is expected to assess the dynamic properties of soil and various design parameters required for the design of machine foundation as well as design of foundation for various reciprocating machines.

**UNIT I INTRODUCTION 9**  
Vibration of elementary systems-vibratory motion-single degree freedom system-free and forced vibration with and without damping

**UNIT II WAVES AND WAVE PROPAGATION 9**  
Wave propagation in an elastic homogeneous isotropic medium- Raleigh, shear and compression waves-waves in elastic half space

**UNIT III DYNAMIC PROPERTIES OF SOILS 9**  
Elastic properties of soils-coefficient of elastic, uniform and non-uniform compression - shear-effect of vibration dissipative properties of soils-determination of dynamic properties of soil-codal provisions

**UNIT IV DESIGN PROCEDURES 9**  
Design criteria -dynamic loads - simple design procedures for foundations under reciprocating machines - machines producing impact loads - rotary type machines

**UNIT V VIBRATION ISOLATION 9**  
Vibration isolation technique-mechanical isolation-foundation isolation-isolation by location-isolation by barriers- active passive isolation tests.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. S.Prakesh & V.K Puri, Foundation for machines, McGraw-Hill 1993
2. Srinivasulu, P & Vaidyanathan, Hand book of Machine Foundations, McGraw-Hill, 1996

**REFERENCES**

1. Swamisaran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt. Ltd, 1999
2. Kramar S.L, "Geotechnical Earthquake Engineering", Prentice Hall International series, Pearson Education (Singapore) Pvt. Ltd.
3. Kameswara Rao, "Dynamics Soil Tests and Applications", Wheeler Publishing, New Delhi, 2003
4. Kameswara Rao, "Vibration Analysis and Foundation Dynamics", Wheeler Publishing, New Delhi, 1998
5. IS code of Practice for Design and Construction of Machine Foundations, McGraw-Hill, 1996.
6. Moore P.J., "Analysis and Design of Foundation for Vibration", Oxford and IBH, 1995.

**OBJECTIVE**

- Student gains the knowledge on the mechanics of rock and its applications in underground structures and rock slope stability analysis.

**UNIT I CLASSIFICATION AND INDEX PROPERTIES OF ROCKS 7**

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose.

**UNIT II ROCK STRENGTH AND FAILURE CRITERIA 11**

Modes of rock failure – Strength of rock – Laboratory and field measurement of shear, tensile and compressive strength – Stress strain behaviour in compression – Mohr-coulomb failure criteria and empirical criteria for failure – Deformability of rock.

**UNIT III INITIAL STRESSES AND THEIR MEASUREMENTS 10**

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – technique for measurements of insitu stresses.

**UNIT IV APPLICATION OF ROCK MECHANICS IN ENGINEERING 9**

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence.

**UNIT V ROCK BOLTING 8**

Introduction – Rock bolt systems – rock bolt installation techniques – Testing of rock bolts – Choice of rock bolt based on rock mass condition.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Goodman P.E., "Introduction to Rock Mechanics", John Wiley and Sons, 1999.
2. Stillborg B., "Professional User Handbook for rock Bolting", Tran Tech Publications, 1996.

**REFERENCES**

1. Brow E.T., "Rock Characterisation Testing and Monitoring", Pergaman Press, 1991.
2. Arogyaswamy R.N.P., "Geotechnical Application in Civil Engineering", Oxford and IBH, 1991.
3. Hock E. and Bray J., "Rock Slope Engineering, Institute of Mining and Metallurgy", 1991.

**CE 2036 ENVIRONMENTAL IMPACT ASSESSMENT OF CIVIL ENGINEERING PROJECTS****OBJECTIVE**

- This subject deals with the various impacts of infrastructure projects on the components of environment and method of assessing the impact and mitigating the same.
- The student is expected to know about the various impacts of development projects on environment and the mitigating measures.

**UNIT I INTRODUCTION 8**

Impact of development projects under Civil Engineering on environment - Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations – Legal provisions on EIA

<b>UNIT II</b>	<b>METHODOLOGIES</b>	<b>9</b>
Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives		
<b>UNIT III</b>	<b>PREDICTION AND ASSESSMENT</b>	<b>9</b>
Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA		
<b>UNIT IV</b>	<b>ENVIRONMENTAL MANAGEMENT PLAN</b>	<b>9</b>
Plan for mitigation of adverse impact on environment – options for mitigation of impact on water, air and land, flora and fauna; Addressing the issues related to the Project Affected People – ISO 14000		
<b>UNIT V</b>	<b>CASE STUDIES</b>	<b>10</b>
EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects – Waste water treatment plants.		
		<b>TOTAL: 45 PERIODS</b>

**TEXT BOOKS**

1. Canter, R.L., "Environmental Impact Assessment", McGraw-Hill Inc., New Delhi, 1996.
2. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.

**REFERENCES**

1. John G. Rau and David C Hooten (Ed.), "Environmental Impact Analysis Handbook", McGraw-Hill Book Company, 1990.
2. "Environmental Assessment Source book", Vol. I, II & III. The World Bank, Washington, D.C., 1991.
3. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.

<b>CE 2037</b>	<b>INDUSTRIAL WASTE MANAGEMENT</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVE**

- This subject deals with the pollution from major industries and methods of controlling the same. The student is expected to know about the polluting potential of major industries in the country and the methods of controlling the same.

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>8</b>
Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – Environmental legislations related to prevention and control of industrial effluents and hazardous wastes		
<b>UNIT II</b>	<b>CLEANER PRODUCTION</b>	<b>8</b>
Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.		
<b>UNIT III</b>	<b>POLLUTION FROM MAJOR INDUSTRIES</b>	<b>9</b>
Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts		

**UNIT IV TREATMENT TECHNOLOGIES 11**  
Equalisation – Neutralisation – Removal of suspended and dissolved organic solids - Chemical oxidation – Adsorption - Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering - Disposal

**UNIT V HAZARDOUS WASTE MANAGEMENT 9**  
Hazardous wastes - Physico chemical treatment – solidification – incineration – Secure land fills

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. M.N.Rao & A.K.Dutta, "Wastewater Treatment", Oxford - IBH Publication, 1995.
2. W .W. Eckenfelder Jr., "Industrial Water Pollution Control", McGraw-Hill Book Company, New Delhi, 2000.

**REFERENCES**

1. T.T.Shen, "Industrial Pollution Prevention", Springer, 1999.
2. R.L.Stephenson and J.B.Blackburn, Jr., "Industrial Wastewater Systems Hand book", Lewis Publisher, New Yark, 1998
3. H.M.Freeman, "Industrial Pollution Prevention Hand Book", McGraw-Hill Inc., New Delhi, 1995.
4. Bishop, P.L., "Pollution Prevention: Fundamental & Practice", McGraw-Hill, 2000.

**CE 2038 AIR POLLUTION MANAGEMENT L T P C  
3 0 0 3**

**OBJECTIVE**

- This subject covers the sources, characteristics and effects of air and noise pollution and the methods of controlling the same. The student is expected to know about source inventory and control mechanism.

**UNIT I SOURCES AND EFFECTS OF AIR POLLUTANTS 9**  
Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozon layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

**UNIT II DISPERSION OF POLLUTANTS 9**  
Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

**UNIT III AIR POLLUTION CONTROL 12**  
Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

**UNIT IV AIR QUALITY MANAGEMENT 8**  
Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality

**UNIT V NOISE POLLUTION 7**  
Sources of noise pollution – Effects – Assessment - Standards – Control methods – Prevention

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996.

## REFERENCES

1. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New York, 1997.
2. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi, 1991.
3. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, New Delhi, 1985.
4. Garg, S.K., "Environmental Engineering Vol. II", Khanna Publishers, New Delhi
5. Mahajan, S.P., "Pollution Control in Process Industries", Tata McGraw-Hill, New Delhi, 1991.

**CE 2039**

**MUNICIPAL SOLID WASTE MANAGEMENT**

**L T P C  
3 0 0 3**

## OBJECTIVE

- This subject covers the various sources and characterisation of municipal solid wastes and the on-site/off-site processing of the same and the disposal methods. The student is expected to know about the various effects and disposal options for the municipal solid waste.

### **UNIT I SOURCES AND TYPES OF MUNICIPAL SOLID WASTES 9**

Sources and types of solid wastes - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization; Effects of improper disposal of solid wastes – public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

### **UNIT II ON-SITE STORAGE & PROCESSING 9**

On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options.

### **UNIT III COLLECTION AND TRANSFER 9**

Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions.

### **UNIT IV OFF-SITE PROCESSING 9**

Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions.

### **UNIT V DISPOSAL 9**

Dumping of solid waste; sanitary land fills – site selection, design and operation of sanitary landfills – Leachate collection & treatment

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. George Tchobanoglous et.al., "Integrated Solid Waste Management", McGraw-Hill Publishers, 1993.
2. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, "Waste Management", Springer, 1994.

## REFERENCES

1. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000
2. R.E.Landreth and P.A.Rebers, "Municipal Solid Wastes – problems and Solutions", Lewis Publishers, 1997.
3. Bhide A.D. and Sundaresan, B.B., "Solid Waste Management in Developing Countries", INSDOC, 1993.

**CE 2040**

**ECOLOGICAL ENGINEERING**

**L T P C**  
**3 0 0 3**

## OBJECTIVE

- This subject deals with the scope and applications of ecological principles for wastewater treatment and reuse. The student is expected to be aware of the various effects of industrialisation on ecology and ecological based waste purification methods.

### **UNIT I PRINCIPLES AND CONCEPTS 9**

Scope and applications of Ecological Engineering – Development and evolution of ecosystems – principles and concepts pertaining to species, populations and community

### **UNIT II ECOSYSTEM FUNCTIONS 10**

Energy flow and nutrient cycling – Food chain and food webs – biological magnification, diversity and stability, immature and mature systems. Primary productivity – Biochemical cycling of nitrogen, phosphorous, sulphur and carbon dioxide; Habitat ecology - Terrestrial, fresh water, estuarine and marine habitats.

### **UNIT III ECOLOGICAL ENGINEERING METHODS 9**

Bio monitoring and its role in evaluation of aquatic ecosystem; Rehabilitation of ecosystems through ecological principles – step cropping, bio-wind screens, Wetlands, ponds, Root Zone Treatment for wastewater, Reuse of treated wastewater through ecological systems.

### **UNIT IV ECOLOGICAL EFFECTS OF INDUSTRIALISATION 9**

Ecological effects of exploration, production, extraction, processing, manufacture & transport.

### **UNIT V CASE STUDIES 8**

Case studies of integrated ecological engineering systems

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. Odum, E.P., "Fundamental of Ecology", W.B.Sauders, 1990.
2. Kormondy, E.J., "Concepts of Ecology", Prentice Hall, New Delhi, 1996

## REFERENCES

1. Mitch, J.W. and Jorgensen, S.E., Ecological Engineering – An Introduction to Ecotechnology, John Wiley and Sons, 1996.
2. Colinvaux, P., Ecology, John Wiley and Sons, 1996.
3. Etnier, C & Guterstam, B., "Ecological Engineering for Wastewater Treatment", 2<sup>nd</sup> Edition, Lewis Publications, London, 1996.

**UNIT I CONSTRUCTION CONTRACTS 9**

Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts

**UNIT II TENDERS 10**

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Transparency in Tenders Act.

**UNIT III ARBITRATION 8**

Comparison of Actions and Laws – Agreements – Subject Matter – Violations – Appointment of Arbitrators – Conditions of Arbitration – Powers and Duties of Arbitrator – Rules of Evidence – Enforcement of Award – Costs

**UNIT IV LEGAL REQUIREMENTS 9**

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for Planning – Property Law – Agency Law – Local Government Laws for Approval – Statutory Regulations

**UNIT V LABOUR REGULATIONS 9**

Social Security – Welfare Legislation – Laws relating to Wages, Bonus and Industrial Disputes, Labour Administration– Insurance and Safety Regulations – Workmen’s Compensation Act – Indian Factory Act – Tamil Nadu Factory Act – Child Labour Act - Other Labour Laws

**TOTAL: 45 PERIODS****REFERENCES**

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M.Tripathi Private Ltd., Bombay, 1982
2. Tamilnadu PWD Code, 1986
3. Jimmie Hinze, Construction Contracts, Second Edition, McGraw Hill, 2001
4. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, Sixth Edition, McGraw Hill, 2000.

**OBJECTIVE**

- At the end of this course the student shall be able to choose appropriate bridge structure and design it for given site conditions.

**UNIT I INTRODUCTION 9**

Design of through type steel highway bridges for IRC loading - Design of stringers, cross girders and main girders - Design of deck type steel highway bridges for IRC loading - Design of main girders

**UNIT II STEEL BRIDGES 9**

Design of pratt type truss girder highway bridges - Design of top chord, bottom chord, web members - Effect of repeated loading - Design of plate girder railway bridges for railway loading - Wind effects - Design of web and flange plates - Vertical and horizontal stiffeners.

**UNIT III REINFORCED CONCRETE SLAB BRIDGES 9**  
Design of solid slab bridges for IRC loading - Design of kerb - Design of tee beam bridges - Design of panel and cantilever for IRC loading

**UNIT IV REINFORCED CONCRETE GIRDER BRIDGES 9**  
Design of tee beam - Courbon's theory - Pigeaud's curves - Design of balanced cantilever bridges - Deck slab - Main girder - Design of cantilever - Design of articulation.

**UNIT V PRESTRESSED CONCRETE BRIDGES 9**  
Design of prestressed concrete bridges - Preliminary dimensions - Flexural and torsional parameters - Courbon's theory - Distribution coefficient by exact analysis - Design of girder section - Maximum and minimum prestressing forces - Eccentricity - Live load and dead load shear forces - cable zone in girder –Check for stresses at various sections - Check for diagonal tension - Diaphragms - End block - Short term and long term deflections.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 1990.
2. Rajagopalan, N. Bridge Superstructure, Alpha Science International, 2006

**REFERENCES**

1. Phatak D.R., "Bridge Engineering", Satya Prakashan, New Delhi, 1990.
2. Ponnuswamy S., "Bridge Engineering", Tata McGraw-Hill, New Delhi, 1996.

**CE 2042 STORAGE STRUCTURES L T P C**  
**3 0 0 3**

**OBJECTIVE**

- The main objective of this course is to impart the principles involved in designing structures which have to store different types of materials. The student at the end of the course shall be able to design concrete and steel material retaining structures.

**UNIT I STEEL WATER TANKS 12**  
Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams – Design of staging – Base plates – Foundation and anchor bolts – Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder – Design of staging and foundation.

**UNIT II CONCRETE WATER TANKS 12**  
Design of Circular tanks – Hinged and fixed at the base – IS method of calculating shear forces and moments – Hoop tension – Design of intze tank – Dome – Ring girders – Conical dome – Staging – Bracings – Raft foundation – Design of rectangular tanks – Approximate methods and IS methods – Design of under ground tanks – Design of base slab and side wall – Check for uplift.

**UNIT III STEEL BUNKERS AND SILOS 7**  
Design of square bunker – Jansen's and Airy's theories – IS Codal provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams – Design of cylindrical silo – Side plates – Ring girder – stiffeners.



**UNIT IV CONCRETE BUNKERS AND SILOS 7**  
Design of square bunker – Side Walls – Hopper bottom – Top and bottom edge beams –  
Design of cylindrical silo – Wall portion – Design of conical hopper – Ring beam at junction

**UNIT V PRESTRESSED CONCRETE WATER TANKS 7**  
Principles of circular prestressing – Design of prestressed concrete circular water tanks

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Rajagopalan K., Storage Structures, Tata McGraw-Hill, New Delhi, 1998.
2. Krishna Raju N., Advanced Reinforced Concrete Design, CBS Publishers and Distributors, New Delhi, 1998.

**CE 2043 DESIGN OF PLATE AND SHELL STRUCTURES L T P C**  
**3 0 0 3**

**OBJECTIVE**

- At the end of this course the student shall understand the rudimentary principles involved in the analysis and design of plates and shells.

**UNIT I THIN PLATES WITH SMALL DEFLECTION 9**  
Laterally loaded thin plates – governing differential equations – Simply supported and fixed boundary conditions

**UNIT II RECTANGULAR PLATES 9**  
Simply supported rectangular plates – Navier’s solution and Levy’s method.

**UNIT III THIN SHELLS 9**  
Classification of shells-structural actions – membrane theory

**UNIT IV ANALYSIS OF SHELLS 9**  
Analysis of spherical dome – cylindrical shells – folded plates

**UNIT V DESIGN OF SHELLS 9**  
Design of spherical dome – cylindrical shells – folded plates

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Bairagi N K, A text book of Plate Analysis, Khanna Publishers, New Delhi, 1996.
2. G.S. Ramaswamy, Design and Construction of Shell Structures, CBS Publishers, New Delhi, 1996
3. S. Timoshenko & S. Woinowsky – Krieger, “Theory of Plates and Shells”, McGraw Hill Book Company

**REFERENCES**

1. Szilard R, Theory and analysis of plates, Prentice Hall Inc, 1995
2. Chatterjee B. K., Theory and Design of Concrete Shells, Oxford & IBH, New Delhi, 1998
3. Billington D. P., Thin Shell Concrete Structures, McGraw-Hill, 1995.

**OBJECTIVE**

- At the end of this course the student should have understood the problems associated with large heights of structures with respect to loads (wind and earthquake and deflections of the structure). He should know the rudimentary principles of designing tall buildings as per the existing course.

**UNIT I INTRODUCTION 9**

The Tall Building in the Urban Context - The Tall Building and its Support Structure - Development of High Rise Building Structures - General Planning Considerations. Dead Loads - Live Loads-Construction Loads -Snow, Rain, and Ice Loads - Wind Loads-Seismic Loading – Water and Earth Pressure Loads - Loads - Loads Due to Restrained Volume Changes of Material - Impact and Dynamic Loads - Blast Loads -Combination of Loads.

**UNIT II THE VERTICAL STRUCTURE PLANE 9**

Dispersion of Vertical Forces- Dispersion of Lateral Forces - Optimum Ground Level Space - Shear Wall Arrangement - Behaviour of Shear Walls under Lateral Loading. The Floor Structure or Horizontal Building Plane Floor Framing Systems-Horizontal Bracing- Composite Floor Systems The High - Rise Building as related to assemblage Kits Skeleton Frame Systems - Load Bearing Wall Panel Systems - Panel – Frame Systems - Multistory Box Systems.

**UNIT III COMMON HIGH-RISE BUILDING STRUCTURES AND THEIR BEHAVIOUR UNDER LOAD 9**

The Bearing Wall Structure- The Shear Core Structure - Rigid Frame Systems- The Wall - Beam Structure: Interspatial and Staggered Truss Systems - Frame - Shear Wall Building Systems - Flat Slab Building Structures - Shear Truss - Frame Interaction System with Rigid - Belt Trusses - Tubular Systems-Composite Buildings - Comparison of High - Rise Structural Systems Other Design Approaches Controlling Building Drift Efficient Building Forms - The Counteracting Force or Dynamic Response.

**UNIT IV APPROXIMATE STRUCTURAL ANALYSIS AND DESIGN OF BUILDINGS 9**

Approximate Analysis of Bearing Wall Buildings The Cross Wall Structure - The Long Wall Structure The Rigid Frame Structure Approximate Analysis for Vertical Loading - Approximate Analysis for Lateral Loading - Approximate Design of Rigid Frame Buildings-Lateral Deformation of Rigid Frame Buildings The Rigid Frame - Shear Wall Structure - The Vierendeel Structure - The Hollow Tube Structure.

**UNIT V OTHER HIGH-RISE BUILDING STRUCTURE 9**

Deep - Beam Systems -High-Rise Suspension Systems - Pneumatic High -Rise Buildings - Space Frame Applied to High - Rise Buildings - Capsule Architecture.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Woltang Schueller " High - rise building Structures", John Wiley and Sons, New York 1976.
2. Bryan Stafford Smith and Alex Coull, " Tall Building Structures ", Analysis and Design, John Wiley and Sons, Inc., 1991.

**REFERENCES**

1. Coull, A. and Smith, Stafford, B. " Tall Buildings ", Pergamon Press, London, 1997.
2. LinT.Y. and Burry D.Stotes, " Structural Concepts and Systems for Architects and Engineers ", John Wiley, 1994.
3. Lynn S.Beedle, Advances in Tall Buildings, CBS Publishers and Distributors, Delhi, 1996.
4. Taranath.B.S., Structural Analysis and Design of Tall Buildings, Mc Graw Hill,1998.

**OBJECTIVE**

- At the end of this course the student shall be able to appreciate modular construction, industrialised construction and shall be able to design some of the prefabricated elements and also have the knowledge of the construction methods using these elements.

**UNIT I INTRODUCTION 9**

Need for prefabrication – Principles – Materials – Modular coordination – Standardization – Systems – Production – Transportation – Erection.

**UNIT II PREFABRICATED COMPONENTS 9**

Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls

**UNIT III DESIGN PRINCIPLES 9**

Disuniting of structures- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation.

**UNIT IV JOINT IN STRUCTURAL MEMBERS 9**

Joints for different structural connections – Dimensions and detailing – Design of expansion joints

**UNIT V DESIGN FOR ABNORMAL LOADS 9**

Progressive collapse – Code provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

**TOTAL: 45 PERIODS****TEXT BOOKS**

- CBRI, Building materials and components, India, 1990
- Gerostiza C.Z., Hendrikson C. and Rehat D.R., Knowledge based process planning for construction and manufacturing, Academic Press Inc., 1994

**REFERENCES**

- Koncz T., Manual of precast concrete construction, Vols. I, II and III, Bauverlag, GMBH, 1971.
- Structural design manual, Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 1978.

**OBJECTIVE**

- At the end of this course the student should be able to appreciate the forces generated on structures due to normal wind as well as gusts. He should also be able to analyse the dynamic effects created by these wind forces.

**UNIT I INTRODUCTION 9**

Terminology – Wind Data – Gust factor and its determination - Wind speed variation with height – Shape factor – Aspect ratio – Drag and lift.

**UNIT II EFFECT OF WIND ON STRUCTURES 9**

Static effect – Dynamic effect – Interference effects (concept only) – Rigid structure – Aeroelastic structure (concept only).

<b>UNIT III</b>	<b>EFFECT ON TYPICAL STRUCTURES</b>	<b>9</b>
Tail buildings – Low rise buildings – Roof and cladding – Chimneys, towers and bridges.		
<b>UNIT IV</b>	<b>APPLICATION TO DESIGN</b>	<b>9</b>
Design forces on multistorey building, towers and roof trusses.		
<b>UNIT V</b>	<b>INTRODUCTION TO WIND TUNNEL</b>	<b>9</b>
Types of models (Principles only) – Basic considerations – Examples of tests and their use.		

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Peter Sachs, "Wind Forces in Engineering, Pergamon Press, New York, 1992.
2. Lawson T.V., Wind Effects on Buildings, Vols. I and II, Applied Science and Publishers, London, 1993.

**REFERENCES**

1. Devenport A.G., "Wind Loads on Structures", Division of Building Research, Ottawa, 1990.
2. Wind Force on Structures – Course Notes, Building Technology Centre, Anna University, 1995.

<b>CE 2047</b>	<b>COMPUTER AIDED DESIGN OF STRUCTURE</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVE**

- The main objective of this programme is to train the student in the use of computers and creating a computer code as well as using commercially available software for the design of Civil Engineering structures.

<b>UNIT I</b>	<b>INTRODUCTION</b>	<b>9</b>
Fundamentals of CAD - Hardware and software requirements -Design process - Applications and benefits.		
<b>UNIT II</b>	<b>COMPUTER GRAPHICS</b>	<b>9</b>
Graphic primitives - Transformations -Wire frame modeling and solid modeling -Graphic standards –Drafting packages		
<b>UNIT III</b>	<b>STRUCTURAL ANALYSIS</b>	<b>9</b>
Fundamentals of finite element analysis - Principles of structural analysis -Analysis packages and applications.		
<b>UNIT IV</b>	<b>DESIGN AND OPTIMISATION</b>	<b>9</b>
Principles of design of steel and RC Structures -Applications to simple design problems – Optimisation techniques - Algorithms - Linear Programming – Simplex method		
<b>UNIT V</b>	<b>EXPERT SYSTEMS</b>	<b>9</b>
Introduction to artificial intelligence - Knowledge based expert systems -Rules and decision tables –Inference mechanisms - Simple applications.		

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Groover M.P. and Zimmers E.W. Jr., "CAD/CAM, Computer Aided Design and Manufacturing", Prentice Hall of India Ltd, New Delhi, 1993.
2. Krishnamoorthy C.S.Rajeev S., "Computer Aided Design", Narosa Publishing House, New Delhi, 1993

## REFERENCES

1. Harrison H.B., "Structural Analysis and Design", Part I and II Pergamon Press, Oxford, 1990.
2. Rao S.S., "Optimisation Theory and Applications", Wiley Eastern Limited, New Delhi, 1977.
3. Richard Forsyth (Ed), "Expert System Principles and Case Studies", Chapman and Hall, London, 1989.

**CE 2048**

**INDUSTRIAL STRUCTURES**

**L T P C**  
**3 0 0 3**

## OBJECTIVE

- This course deals with some of the special aspects with respect to Civil Engineering structures in industries. At the end of this course the student shall be able to design some of the structures.

**UNIT I PLANNING 9**  
Classification of Industries and Industrial structures – General requirements for industries like cement, chemical and steel plants – Planning and layout of buildings and components.

**UNIT II FUNCTIONAL REQUIREMENTS 9**  
Lighting – Ventilation – Acoustics – Fire safety – Guidelines from factories act.

**UNIT III DESIGN OF STEEL STRUCTURES 9**  
Industrial roofs – Crane girders – Mill buildings – Design of Bunkers and Silos

**UNIT IV DESIGN OF R.C. STRUCTURES 9**  
Silos and bunkers – Chimneys – Principles of folded plates and shell roofs

**UNIT V PREFABRICATION 9**  
Principles of prefabrication – Prestressed precast roof trusses- Functional requirements for Precast concrete units

**TOTAL: 45 PERIODS**

## TEXT BOOKS

1. Reinforced Concrete Structural elements – P. Purushothaman.
2. Pasala Dayaratnam – Design of Steel Structure – 1990.

## REFERENCES

1. Henn W. Buildings for Industry, vols.I and II, London Hill Books, 1995.
2. Handbook on Functional Requirements of Industrial buildings, SP32 – 1986, Bureau of Indian Standards, New Delhi 1990.
3. Course Notes on Modern Developments in the Design and Construction of Industrial Structures, Structural Engineering Research Centre, Madras, 1982.
4. Koncz, J, Manual of Precast Construction Vol I & II Bauverlay GMBH, 1971.

**OBJECTIVE**

- This course is designed to give an insight into the latest developments regarding smart materials and their use in structures. Further, this also deals with structures which can self adjust their stiffness with load.

**UNIT I INTRODUCTION 9**

Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effectors.

**UNIT II MEASURING TECHNIQUES 9**

Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

**UNIT III SENSORS 9**

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVDT – Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

**UNIT IV ACTUATORS 9**

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magnetostructure Material – Shape Memory Alloys – Electro rheological Fluids– Electro magnetic actuation – Role of actuators and Actuator Materials.

**UNIT V SIGNAL PROCESSING AND CONTROL SYSTEMS 9**

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Non-Linear.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Brain Culshaw – Smart Structure and Materials Artech House – Borton. London-1996.
2. Srinivasan ,A.V and Michael McFarland . D, “ Smart Structures – Analysis and Design , Cambridge University Press, 2001.

**REFERENCES**

1. L. S. Srinath , Experimental Stress Analysis , Tata McGraw-Hill, 1998.
2. J. W. Dally & W. F. Riley , Experimental Stress Analysis , Tata McGraw-Hill, 1998.

**OBJECTIVE**

- At the end of this course the student shall have a basic knowledge of finite element method and shall be able to analyse linear elastic structures, that he has studied about in core courses, using finite element method.

**UNIT I INTRODUCTION – VARIATIONAL FORMULATION 9**

General field problems in Engineering – Modelling – Discrete and Continuous models – Characteristics – Difficulties involved in solution – The relevance and place of the finite element method – Historical comments – Basic concept of FEM, Boundary and initial value problems – Gradient and divergence theorems – Functionals – Variational calculus Variational formulation of VBPS. The method of weighted residuals – The Ritz method.

**UNIT II FINITE ELEMENT ANALYSIS OF ONE DIMENSIONAL PROBLEMS 10**

One dimensional second order equations – discretisation of domain into elements – Generalised coordinates approach – derivation of elements equations – assembly of elements equations – imposition of boundary conditions – solution of equations – Cholesky method – Post processing – Extension of the method to fourth order equations and their solutions – time dependant problems and their solutions – example from heat transfer, fluid flow and solid mechanics.

**UNIT III FINITE ELEMENT ANALYSIS OF TWO DIMENSIONAL PROBLEMS 10**

Second order equation involving a scalar-valued function – model equation – Variational formulation – Finite element formulation through generalised coordinates approach – Triangular elements and quadrilateral elements – convergence criteria for chosen models – Interpolation functions – Elements matrices and vectors – Assembly of element matrices – boundary conditions – solution techniques.

**UNIT IV ISOPARAMETRIC ELEMENTS AND FORMULATION 8**

Natural coordinates in 1, 2 and 3 dimensions – use of area coordinates for triangular elements in - 2 dimensional problems – Isoparametric elements in 1,2 and 3 dimensional Lagrangean and serendipity elements – Formulations of elements equations in one and two dimensions - Numerical integration.

**UNIT V APPLICATIONS TO FIELD PROBLEMS IN TWO DIMENSIONALS 8**

Equations of elasticity – plane elasticity problems – axisymmetric problems in elasticity – Bending of elastic plates – Time dependent problems in elasticity – Heat – transfer in two dimensions – incompressible fluid flow

**TOTAL: 45 PERIODS****TEXT BOOK**

1. Chandrupatla, T.R., and Belegundu, A.D., "Introduction to Finite Element in Engineering", Third Edition, Prentice Hall, India, 2003.
2. Bhavikati , S.S., "Finite Element Analysis ", New Age International Publishers , 2005.

**REFERENCES**

1. J.N.Reddy, "An Introduction to Finite Element Method", McGraw-Hill, Intl. Student Edition, 1985.
2. Zienkiewics, "The finite element method, Basic formulation and linear problems", Vol.1, 4/e, McGraw-Hill, Book Co.
3. S.S.Rao, "The Finite Element Method in Engineering", Pergaman Press, 2003.
4. C.S.Desai and J.F.Abel, "Introduction to the Finite Element Method", Affiliated East West Press, 1972.

**OBJECTIVE**

- To get the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

**UNIT I MAINTENANCE AND REPAIR STRATEGIES 9**

Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration

**UNIT II SERVICEABILITY AND DURABILITY OF CONCRETE 11**

Quality assurance for concrete construction concrete properties- strength, permeability, thermal properties and cracking. - Effects due to climate, temperature, chemicals, corrosion - design and construction errors - Effects of cover thickness and cracking

**UNIT III MATERIALS FOR REPAIR 9**

Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, Fibre reinforced concrete.

**UNIT IV TECHNIQUES FOR REPAIR AND DEMOLITION 8**

Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidated structures - case studies.

**UNIT V REPAIRS, REHABILITATION AND RETROFITTING OF STRUCTURES 8**

Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

**TOTAL: 45 PERIODS****TEXT BOOKS**

1. Denison Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical UK, 1991.
2. R.T.Allen and S.C.Edwards, Repair of Concrete Structures, Blakie and Sons, UK, 1987

**REFERENCES**

1. M.S.Shetty, Concrete Technology - Theory and Practice, S.Chand and Company, New Delhi, 1992.
2. Santhakumar, A.R., Training Course notes on Damage Assessment and repair in Low Cost Housing , "RHDC-NBO" Anna University, July 1992.
3. Raikar, R.N., Learning from failures - Deficiencies in Design, Construction and Service - R&D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
4. N.Palaniappan, Estate Management, Anna Institute of Management, Chennai, 1992.
5. Lakshmi pathy, M. etal. Lecture notes of Workshop on "Repairs and Rehabilitation of Structures", 29 - 30<sup>th</sup> October 1999.