ANNA UNIVERSITY TIRUNELVELI : TIRUNELVELI 627 007

AFFILIATED INSTITUTIONS
REGULATIONS – 2008

B.E CIVIL ENGINEERING

CURRICULUM AND SYLLABI

SEMESTER V

Code No.	Course Title	L	T	P	C
THEORY					
CE50	Irrigation Engineering	3	0	0	3
CE51	Structural Analysis I	3	1	0	4
CE52	Railways, Airport and Harbour Engineering	4	0	0	4
CE53	Environmental Engineering I	3	0	0	3
CE54	Foundation Engineering	3	0	0	3
CE55	Design of RC Elements	3	1	0	4
PRACTICAL					
HS510	English Language Laboratory - Cumulative Skills - I	0	0	3	2
CE57	Concrete and Highway Engineering Lab	0	0	3	2
CE58	Soil Mechanics Laboratory	0	0	3	2

SEMESTER VI

Code No.	Course Title	L	T	P	C
THEORY					
MG61	Principles of Management	3	0	0	3
CE61	Structural Analysis – II	3	1	0	4
CE62	Design of Steel Structures	3	1	0	4
CE63	Construction Planning & Scheduling	3	0	0	3
CE64	Environmental Engineering II	3	0	0	3
E1***	Elective – I	3	0	0	3
PRACTICAL					
CE66	Environmental and Irrigation Engineering Drawing	0	0	4	2
CE67	Environmental Engineering Laboratory	0	0	3	2
CE68	Survey Camp	-	-	-	3

HS610	English Language Laboratory - Cumulative Skills - II	0	0	3	2

SEMESTER VII

Code No.	Course Title	L	T	P	C
THEORY					
CE71	Design of RC and Brick Masonry Structures	3	1	0	4
CE72	Estimation and Quantity Surveying	3	0	0	3
CE73	Basics of Dynamics and Aseismic Design	3	0	0	3
CE74	Prestressed Concrete Structures	3	0	0	3
E2***	Elective – II	3	0	0	3
E3***	Elective – III	3	0	0	3
PRACTICAL					
CE76	Computer Aided Design and Drafting Laboratory	0	0	4	2
CE77	Design Project	0	0	4	2

SEMESTER VIII

Code No.	Course Title	L	T	P	C
THEORY					
CE81	Engineering Economics and Cost Analysis	3	0	0	3
E4***	Elective – IV	3	0	0	3
E5***	Elective – V	3	0	0	3
PRACTICAL					
CE82	Comprehension**	0	0	3	0
CE83	Project Work	0	0	12	6

**** No Examination**

LIST OF ELECTIVES

SEMESTER VI

Code No.	Course Title	L	T	P	C
CE601	Hydrology	3	0	0	3
CE602	Cartography	3	0	0	3
CE603	Electronic Surveying	3	0	0	3
CE604	Remote Sensing Techniques and GIS	3	0	0	3
CE605	Architecture	3	0	0	3
GE606	Professional Ethics in Engineering	3	0	0	3
GE607	Total Quality Management	3	0	0	3
GE608	Fundamentals of Nano Technology	3	0	0	3
GE609	Intellectual Property Rights (IPR)	3	0	0	3
GE610	Indian Constitution and Society	3	0	0	3
CE611	Advanced Concrete Technology	3	0	0	3

SEMESTER VII

Code No.	Course Title	L	T	P	C
CE701	Traffic Engineering Management	3	0	0	3
CE702	Housing Planning & Management	3	0	0	3
CE703	Ground Water Engineering	3	0	0	3
CE704	Management of Irrigation Systems	3	0	0	3
CE705	Coastal Zone Management	3	0	0	3
CE706	Water Resources Engineering	3	0	0	3
CE707	Pavement Engineering	3	0	0	3
CE708	Ground Improvement Techniques	3	0	0	3
CE709	Introduction to Soil Dynamics and Machine Foundations	3	0	0	3
CE710	Rock Engineering	3	0	0	3
CE711	Environmental Impact Assessment of Civil Engineering Projects	3	0	0	3
CE712	Industrial Waste Management	3	0	0	3
CE713	Air Pollution Management	3	0	0	3
CE714	Municipal Solid Waste and Management	3	0	0	3
CE715	Ecological Engineering	3	0	0	3
GE716	Contract Laws and Regulations	3	0	0	3

SEMESTER VIII

Code No.	Course Title	L	T	P	C
CE801	Bridge Structures	3	0	0	3
CE802	Storage Structures	3	0	0	3
CE803	Design of Plate and Shell Structures	3	0	0	3
CE804	Tall Buildings	3	0	0	3
CE805	Prefabricated structures	3	0	0	3

CE806	Wind Engineering	3	0	0	3
CE807	Computer Aided Design of Structures	3	0	0	3
CE808	Industrial Structures	3	0	0	3
CE809	Smart Structures and smart Materials	3	0	0	3
CE810	Finite Element Techniques	3	0	0	3
CE811	Repair and Rehabilitation of Structures	3	0	0	3

CE50 IRRIGATION ENGINEERING L T P C
3 0 0 3

OBJECTIVE

At the end of the semester, the student shall understand the need and mode of irrigation. The student also shall know the irrigation management practices of the past, present and future. The structures involved the elementary hydraulic design of different structures and the concepts of maintenance shall also form part. Finally, the student shall be in a position to conceive and plan any type of irrigation project.

UNIT I INTRODUCTION 9

Irrigation – Need and mode of irrigation – Merits and demerits of irrigation – Crop and crop seasons – consumptive use of water – Duty – Factors affecting duty – Irrigation efficiencies – Planning and Development of irrigation projects.

UNIT II IRRIGATION METHODS 8

Canal irrigation – Lift irrigation – Tank irrigation – Flooding methods – Merits and demerits – Sprinkler irrigation – Drip irrigation

UNIT III DIVERSION AND IMPOUNDING STRUCTURES 10

Weirs – elementary profile of a weir – weirs on pervious foundations - Types of impounding structures - Percolation ponds – Tanks, Sluices and Weirs – Gravity dams – Earth dams – Arch dams – Spillways – Factors affecting location and type of dams – Forces on a dam – Hydraulic design of dams.

UNIT IV CANAL IRRIGATION 10

Alignment of canals – Classification of canals – Canal drops – Hydraulic design of drops – Cross drainage works – Hydraulic design of cross drainage works – Canal Head works – Canal regulators – River Training works.

UNIT V IRRIGATION WATER MANAGEMENT 8

Need for optimisation of water use – Minimising irrigation water losses – On farm development works - Participatory irrigation management – Water users associations – Changing paradigms in water management – Performance evaluation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Asawa, G.L., “Irrigation Engineering”, New Age International Publishers, 2000
2. Punima B.C. & Pande B.B .Lal Irrigation and Water Power Engineering, Laxmi Publishing, New Delhi 2007
3. Michael, A.M, Irrigation Theory and Practical, Vikas Publishing Pvt Ltd, 2006
4. Gupta, B.L, & Amir Gupta, “Irrigation Engineering”, Satya Praheshan, New Delhi

REFERENCES

1. Dilip Kumar Majumdar, “Irrigation Water Management (Principles & Practices)”, Prentice Hall of India (P), Ltd, 2000
2. Basak, N.N, “Irrigation Engineering”, Tata McGraw-Hill Publishing Co. New Delhi, 1999
3. Sharma R.K.. “Irrigation Engineering”, S.Chand & Co. 2007.

CE51 STRUCTURAL ANALYSIS I L T P C
3 1 0 4

OBJECTIVE

The members of a structure are subjected to internal forces like axial forces, shearing forces, bending and torsional moments while transferring the loads acting on it. Structural analysis deals with analysing these internal forces in the members of the structures. At the end of this course students will be conversant with classical method of analysis.

UNIT I DEFLECTION OF DETERMINATE STRUCTURES 12

Principles of virtual work for deflections – Deflections of pin-jointed plane frames and rigid plane frames – Willot diagram - Mohr's correction

UNIT II MOVING LOADS AND INFLUENCE LINES (DETERMINATE & INDETERMINATE STRUCTURES WITH REDUNDANCY RESTRICTED TO ONE) 12

Influence lines for reactions in statically determinate structures – influence lines for members forces in pin-jointed frames – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads. Muller Breslau's principle – Influence lines for continuous beams and single storey rigid frames – Indirect model analysis for influence lines of indeterminate structures – Beggs deformeter

UNIT III ARCHES 12

Arches as structural forms – Examples of arch structures – Types of arches – Analysis of three hinged, two hinged and fixed arches, parabolic and circular arches – Settlement and temperature effects.

UNIT IV SLOPE DEFLECTION METHOD 12

Continuous beams and rigid frames (with and without sway) – Symmetry and antisymmetry – Simplification for hinged end – Support displacements

UNIT V MOMENT DISTRIBUTION METHOD 12

Distribution and carry over of moments – Stiffness and carry over factors – Analysis of continuous beams – Plane rigid frames with and without sway – Naylor's simplification.

TUTORIAL: 15 TOTAL: 60 PERIODS

TEXT BOOKS

1. Vaidyanadhan, R and Perumal, P, "Comprehensive Structural Analysis – Vol. 1 & Vol. 2", Laxmi Publications, New Delhi, 2003.
2. L.S. Negi & R.S. Jangid, "Structural Analysis", Tata McGraw-Hill Publications, New Delhi, Sixth Edition, 2003.
3. Punmia B.C., Theory of Structures (SMTS) Vol II Laxmi Publishing Pvt ltd, New Delhi, 2004.

4. BhavaiKatti, S.S, Structural Analysis – Vol. 1 & Vol. 2, Vikas Publishing Pvt Ltd., New Delhi, 2008

REFERENCE

1. Analysis of Indeterminate Structures – C.K. Wang, Tata McGraw-Hill, 1992.

CE52 RAILWAYS, AIRPORTS AND HARBOUR ENGINEERING L T P C
4 0 0 4

OBJECTIVE

This course imparts the student's knowledge of planning, design, construction and maintenance of railway tracks. The students acquire proficiency in the application of modern techniques such as GIS, GPS and remote sensing in Railway Engineering. The student develops skills on airport planning and design with the prime focus on runway and taxiway geometrics. Students become conversant with the definition, purpose, location and materials of coastal structures such as piers, breakwaters, wharves, jetties, quays and spring fenders. The students acquire knowledge on site reconnaissance for location and planning of harbours.

UNIT I RAILWAY PLANNING AND DESIGN 12

Role of Indian Railways in National Development – Railways for Urban Transportation – LRT & MRTS - Engineering Surveys for Track Alignment – Obligatory points - Conventional and Modern methods (Remote Sensing, GIS & GPS, EDM and other equipments) - Permanent Way, its Components and their Functions: Rails - Types of Rails, Rail Fastenings, Concept of Gauges, Coning of Wheels, Creeps and kinks - Sleepers – Functions, Materials, Density – Functions, Materials, Ballastless Tracks - Geometric Design of Railway Tracks – Gradients and Grade Compensation, Super-Elevation, Widening of Gauges in Curves, Transition Curves, Horizontal and Vertical Curves.

UNIT II RAILWAY TRACK CONSTRUCTION, MAINTENANCE AND OPERATION 12

Points and Crossings - Design of Turnouts, Working Principle - Signalling, Interlocking and Track Circuiting - Construction & Maintenance – Conventional, Modern methods and Materials, Track Drainage - Track Modernisation– Automated maintenance and upgrading, Re-laying of Track, Lay outs of Railway Stations and Yards, Rolling Stock, Tractive Power, Track Resistance, Level Crossings.

UNIT III AIRPORT PLANNING AND DESIGN 12

Role of Air Transport, Components of Airports - Airport Planning – Air traffic potential, Site Selection, Design of Components, Cost Estimates, Evaluation and Institutional arrangements Runway Design- Orientation, Cross wind Component, Wind rose Diagram (Problems), Geometric Design and Corrections for Gradients (Problems), Drainage - Taxiway Design – Geometric Design Elements, Minimum Separation Distances, Design Speed, Airport Drainage - Airport Zoning - Clear Zone, Approach Zone, Buffer Zone, Turning Zone, Clearance over Highways and Railways

UNIT IV AIRPORT LAYOUTS, VISUAL AIDS, AND AIR TRAFFIC CONTROL 12

Airport Layouts – Apron, Terminal Building, Hangars, Motor Vehicle Parking Area and Circulation Pattern, Case studies of Airport Layouts - Airport Buildings – Primary functions, Planning Concept, Principles of Passenger Flow, Passenger Facilities - Visual Aids – Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings - Air Traffic Control – Basic Actions, Air Traffic Control Network - Helipads, Hangars, Service Equipments.

UNIT V HARBOUR ENGINEERING 12

Definition of Terms - Harbours, Ports, Docks, Tides and Waves, Littoral Drift, Sounding, Area, Depth, Satellite Ports - Requirements and Classification of Harbours - Site Selection & Selection Investigation – Speed of water, Dredging, Range of Tides, Waves and Tidal Currents, Littoral Transport with Erosion and Deposition, Soundings, Anchoring Grounds, Geological Characteristics, Winds & Storms, Position and Size of Shoals - Shore Considerations- Proximity to Towns/Cities, Utilities, Construction Materials, Coast Lines - Dry and Wet Docks, Planning and Layouts - Entrance, Position of Light Houses, Navigating - Terminal Facilities – Port Buildings, Warehouse, Transit Sheds, Inter-modal Transfer Facilities, Mooring Accessories, Navigational Aids - Coastal Structures- Piers, Breakwaters, Wharves, Jetties, Quays, Spring Fenders - Coastal Shipping, Inland Water Transport and Container Transportation.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Saxena Subhash C and Satyapal Arora, A Course in Railway Engineering, Dhanpat Rai and Sons, Delhi, 1998.
2. Khanna S K, Arora M G and Jain S S, Airport Planning and Design, Nemchand and Brothers, Roorkee, 1994.
3. S P Bindra, A Course in Docks and Harbour Engineering, Dhanpat Rai and Sons, New Delhi, 1993.

REFERENCES

1. Rangwala, Railway Engineering, Charotar Publishing House, 1995.
2. Rangwala, Airport Engineering, Charotar Publishing House, 1996.
3. Oza.H.P. and Oza.G.H., “A course in Docks & Harbour Engineering”. Charotar Publishing Co.1976.
4. J.S. Mundrey, “A course in Railway Track Engineering”. Tata McGraw Hill, 2000.

CE53 ENVIRONMENTAL ENGINEERING – I L T P C
3 0 0 3

OBJECTIVE

To make the students conversant with principles of water supply, treatment and distribution

UNIT I PLANNING FOR WATERSUPPLY SYSTEM 9

Public water supply system -Planning -Objectives -Design period -Population forecasting -Water demand -Sources of water and their characteristics -Surface and Groundwater- Impounding Reservoir Well hydraulics -Development and selection of source - Water quality -Characterization -Water quality standards.

UNIT II CONVEYANCE SYSTEM 9

Water supply -intake structures -Functions and drawings -Pipes and conduits for water- Pipe materials -Hydraulics of flow in pipes -Transmission main design -Laying, jointing and testing of pipes -Drawings appurtenances - Types and capacity of pumps -Selection of pumps and pipe materials.

UNIT III WATER TREATMENT 9

Objectives -Unit operations and processes -Principles, functions design and drawing of Flash mixers, fiocculators, sedimentation tanks and sand filters -Disinfection- Residue Management.

UNIT IV ADVANCED WATER TREATMENT 9

Aerator- Iron and manganese removal, Defluoridation and demineralization -Water softening - Desalination -Membrane Systems -Construction and Operation & Maintenance aspects of Water Treatment Plants -Recent advances -Membrane Processes

UNIT V WATER DISTRIBUTION AND SUPPLY TO BUILDINGS 9

Requirements of water distribution -Components -Service reservoirs -Functions and drawings -Network design -Economics -Computer applications -Analysis of distribution networks -Appurtenances -operation and maintenance -Leak detection, Methods. Principles of design of water supply in buildings -House service connection -Fixtures and fittings -Systems of plumbing and drawings of types of plumbing.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Garg, S.K., Environmental Engineering, Vol.1 Khanna Publishers, New Delhi, 2005.
2. Modi, P.N. Water Supply Engineering, Vol. I Standard Book House, New Delhi, 2005.
3. Punmia, B.C., Ashok K Jain and Arun K Jain, Water Supply Engineering, Laxmi Publications (P) Ltd., New Delhi, 2005

REFERENCES

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2003
2. Syed R.Qasim and Edward M.Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Private Limited, New Delhi – 2006.

CE54 FOUNDATION ENGINEERING L T P C
3 0 0 3

OBJECTIVE

At the end of this course student acquires the capacity to assess the soil condition at a given location in order to sugest suitable foundation and also gains the knowledge to design various foundations.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration-auguring and boring – Water boring and rotatory drilling – Depth of boring – Spacing of bore hole - Sampling – Representative and undisturbed sampling – sampling techniques – Split spoon sampler, Thin tube sampler, Stationary piston sampler – Bore log report – Penetration tests (SPT and SCPT) – Data interpretation (Strength parameters and Liquefaction potential) – Selection of foundation based on soil condition.

UNIT II SHALLOW FOUNDATION 9

Introduction – Location and depth of foundation – codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems - Bearing Capacity from insitu tests (SPT, SCPT and plate load) – Allowable bearing pressure, Settlement – Components of settlement – Determination of settlement of foundations on granular and clay deposits – Allowable settlements – Codal provision – Methods of minimising settlement, differential settlement.

UNIT III FOOTINGS AND RAFTS 9

Types of foundation – Contact pressure distribution below footings and raft - Isolated and combined footings – Types and proportioning - Mat foundation– Types, applications uses and proportioning-- floating foundation.

UNIT IV PILES 9

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil - Static formula - dynamic formulae (Engineering news and Hiley's) – Capacity from insitu tests (SPT and SCPT) – Negative skin friction – uplift capacity – Group capacity by different methods (Feld's rule, Converse Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test – Forces on pile caps – under reamed piles – Capacity under compression and uplift.

UNIT V RETAINING WALLS 9

Plastic equilibrium in soils – active and passive states – Rankine's theory – cohesionless and cohesive soil - Coloumb's wedge theory – condition for critical failure plane - Earth pressure on retaining walls of simple configurations – Graphical methods (Rebhann and Culmann) - pressure on the wall due to line load – Stability of retaining walls.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Murthy, V.N.S, "Soil Mechanics and Foundation Engineering", UBS Publishers Distribution Ltd, New Delhi, 1999.
2. Gopal Ranjan and Rao, A.S.R. "Basic and Applied Soil Mechanics", Wiley Eastern Ltd., New Delhi (India), 2003.

REFERENCES

1. Das, B.M. “Principles of Foundation Engineering (Fifth edition), Thomson Books / COLE, 2003
2. Bowles J.E, “Foundation analysis and design”, McGraw-Hill, 1994
3. Punmia, B.C., “Soil Mechanics and Foundations”, Laxmi publications pvt. Ltd., New Delhi, 1995.
4. Venkatramaiah,C.”Geotechnical Engineering”, New Age International Publishers, New Delhi, 1995

CE55 DESIGN OF RC ELEMENTS L T P C
3 1 0 4

OBJECTIVE

 This course covers the different types of philosophies related to Design of Reinforced Concrete Structures with emphasis on Limit State Method. The design of
Basic elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice for Reinforced
Concrete Structures and Design Aids are included. At the end of course the student
shall be in a position to design the basic elements of reinforced concrete structures.

UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES 12

Concept of Elastic method, ultimate load method and limit state method – Advantages of
Limit State Method over other methods – Design codes and specification – Limit State
philosophy as detailed in IS code – Design of flexural members and slabs by working stress
method – cracked and uncracked sections.

UNIT II LIMIT STATE DESIGN FOR FLEXURE 12

Analysis and design of one way and two way rectangular slab subjected to uniformly
distributed load for various boundary conditions and corner effects – Analysis and design of
singly and doubly reinforced rectangular and flanged beams

UNIT III LIMIT STATE DESIGN FOR BOND, ANCHORAGE,SHEAR & TORSION 12

Behaviour of RC members in bond and Anchorage - Design requirements as per current
code - Behaviour of RC beams in shear and torsion - Design of RC members for combined
bending shear and torsion.

UNIT IV LIMIT STATE DESIGN OF COLUMNS 12

Types of columns – Braced and unbraced columns – Design of short column for axial,
uniaxial and biaxial bending – Design of long columns.

UNIT V LIMIT STATE DESIGN OF FOOTING AND DETAILING 12

Design of wall footing – Design of axially and eccentrically loaded rectangular footing –
Design of combined rectangular footing for two columns only – Standard method of detailing
RC beams, slabs and columns – Special requirements of detailing with reference to erection
process.

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

TEXT BOOKS

1. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, Pvt.
Ltd., New Delhi 2002.
2. Krishna Raju, N., “Design of Reinforced Concrete Structures”, CBS Publishers &
Distributors, New Delhi,2003.

REFERENCES

1. Jain, A.K., “Limit State Design of RC Structures”, Nemchand Publications, Rourkee
2. Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Company Ltd.,
New Delhi.
3. Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Tata McGraw-
Hill Publishing Company Ltd., New Delh

HS510 **English Language Laboratory - Cumulative Skills - I**

Fifth Semester

Regulations 2008

(Common to all B.E / B.Tech.)

0 0 3 2

(To be conducted as a Practical Paper by the Department of English for 3 hrs per week)

OBJECTIVES

- To help the learners improve their communicative skill
- To facilitate the learners to improve the pronunciation of words with proper stress
- To help the learners acquire the skills related to Group Discussion and Interview
- To inculcate the habit of reading among the learners
- To equip the learners face the linguistic demands by spotting out errors in sentences
- To improve the active vocabulary of the learners

COURSE CONTENT

A) Interview **(5 hrs)**

B) Pronunciation - Stress Shift **(5 hrs)**

C) Group Discussion

(15hrs)

D) Reading Comprehension, Error Correction, Vocabulary Target words (1500 words)

(20 hrs)

RECORD LAY OUT

Every student has to maintain a record in which he / she has to incorporate the following details.

A. Hard copy of the application letter and resume

B. Group Discussion

Grouping (each group consisting of 10 members)

Topics* (15 topics – 3 topics to be selected by each group - to be practiced in cycles)

Pre performance preparation

Performance

They have to collect materials related to topics given for Group Discussion

***GD Topics**

1. Advertising is a legalized form of lying- Discuss.
2. Impact of the media and internet on modern youth.
3. Communicative competency in English is the golden key for success in the Global arena.
4. Is EQ more important than IQ?
5. Attitude decides one's altitude in life.
6. Should an aspiring student go for a course which is in demand or for a course which he/she likes?
7. Is westernization a cultural degradation or enrichment?
8. Is coalition government sustainable?
9. Should there be a ban on fashion show?
10. No two generations see eye to eye- Discuss.
11. Is scientific advancement a boon or a bane?
12. Should brain drain be banned?
13. Cyber crimes and steps to prevent and control.
14. Is the press in India really free?
15. Does ragging develop friendship?

C. Reading Comprehension – 10 passages

D. Error correction - 10 sentences for each section

a. concord
b. words followed by prepositions (list to be provided)
c. conjunctions
d. structure
e. usage
f. use of pronouns-antecedent

g. adverbs placement
h. particles
i. use of tenses

E. Use of Vocabulary

10 assignments (each 20 words) using the target words in sentences of their own.

Separate word lists to be allotted to students so that all the words in the target vocabulary are covered

Assignments to be written in the record notebook only after the approval of the Course Teacher

VOCABULARY LIST

The colleges are requested to train the third year B.E./B.Tech. students in the use of following words as part of the syllabus for Cumulative Skill Lab - I and it will be tested for 20 marks during the practical examinations.

(Words from Barron's GRE Test – 'Abase' to 'Dermatologist'- 1500 words – V Semester)

(Words from D+ to Z from Barron's GRE Test will be added in the syllabus for the practical examination in the VI semester)

STRESS SHIFT
WORD LIST

'accident	acci'dental	de'mocracy	demo'cratic
'argument	argumen'tative	'demonstrate	demons'tration
'advice	ad'vise		de'termine
deter'mination			
as'similate	assimil'ation	'different	diffe'rential
as'sociate	associ'ation	'diplomat	diplo'matic
'astronaut	a'stronomy	'dogma	dog'matic
'benefit	bene'ficial	'durable	dura'bility
Bi'ology	bio'logical	dy'namic	'dynamism

‘bomb bom’bard
‘bureaucrat bureau’cracy
‘calculate calcul’ation
‘capable capa’bility
‘category cata’gorical
‘certify cer’tificate
‘collect col’lection
‘commerce com’mercial
com’municate communi’cation
com’pete compe’tition
com’plicate compli’cation
con’serve conser’vation
‘controversy contro’versial
‘credible credi’bility
‘cultivate culti’vation

‘gymnast gym’nastic
‘habit ha’bitual
‘harmony har’monious
‘hero he’roic
‘history his’torical
‘hostile hos’tility
pho’tographer
‘humanise hu’manity
‘hypocrite hy’pocrisy
i’deal ide’alogy
i’dentify identifi’cation
‘incident inci’dental
Indi’vidual individu’ality
‘industry in’dustrial
‘influence influ’ential
‘injury in’jurious
‘irony i’ronic
‘labour la’borious
‘legal le’gality
‘luxury lux’urious
‘magnet mag’netic
‘manifest manifes’tation
‘microscope micros’copic
‘migrant mig’rate
‘mystery mys’terious
‘necessary nec’cessity
‘neglect neg’ligence
‘object(n) ob’ject(v)

‘edit edi’tion
‘educate edu’cation
‘element ele’mental
‘energy ener’getic
‘equal e’quality
‘error er’ratic
‘feasible feas’ibility
‘fertile fer’tility
‘francise franci’see
‘frequent(adj) fre’quent(v)
‘futile fu’tility
‘generalise generali’sation
‘generous gene’rosity
‘global globali’sation
‘grammar gram’matical

‘officer of’ficial
‘opposite oppo’sition
‘origin o’riginate
‘palace pa’latial
‘paralyse pa’ralysis
‘photograph

‘possible possi’bility
‘problem proble’matic
‘record(n) re’cord(v)
‘remedy re’medial
‘scholar scho’lastic
‘scientist scien’tific
‘theme the’matic
‘technical tech’nology
‘volume vo’luminous

MODE OF EVALUATION

INTERNAL ASSESSMENT (100 Marks to be converted to 20)

1. Interview skill **(10 marks)**
2. Pronunciation skill **(10 marks)**
3. Group discussion (20 for materials collection and 20 for performance) **(40 marks)**
4. Test in Reading Comprehension and Error Correction **(40 marks)**

EXTERNAL ASSESSMENT (100 Marks to be converted to 80)

1. Stress shift -10
2. Group discussion -30
3. Vocabulary -20
4. Reading comprehension -30
5. Error correction -10

Part A (40 minutes for the entire group)

1. Reading Comprehension (30 marks)

- Two separate passages on scientific/technical themes to be given.
- There will be 5 testing items (either MCQs or T/F or Cloze type) under each text.
  (5x 2 = 10 testing items each carrying 3 marks)
- 6 such sets will be sent to the respective colleges during the practical.
- Alternate sets to be allotted to students during testing.

2. Error correction (10 marks)

- 10 items ,covering all the specified areas, will be given
- Sentences will have five segments (A,B,C,D,E) with E necessarily standing for 'NO Error'
- Alternate sets to be allotted to students during testing.

3. Vocabulary Testing **(20 marks)**

- 10 words to be tested
- The most exact synonym to be selected out of the five given alternatives.
- Each item carries 2 marks
- Alternate sets to be allotted to students during testing.

PART B

1. Stress shift **(10 Marks)**

While testing the student's proficiency in the use of stress shift each student should be tested with a different question paper (one out of the 10 sets to be given).

2. Group discussion

The students in the section should be put into a group of 10 each .Before the start of group discussion the group leaders should select the topic at random from the given topics. Marks should be allotted individually according to the following criteria.

A. Relevance of content **(10 Marks)**

B. The use of Language and power of argument **(10 Marks)**

C. Soft skills /social skills **(10 marks)**

NB: The responses for the use of vocabulary, error correction, reading comprehension should be entered in the response coding sheet using black or blue ball point pen .Over writing should be marked wrong.

CE57 CONCRETE AND HIGHWAY ENGINEERING

LAB L T P C
0 0 3 2

OBJECTIVE

 To learn the principles and procedures of testing Concrete and Highway Materials

I. TESTS ON FRESH CONCRETE

1. Slump cone test
2. Flow table
3. Compaction factor
4. Vee bee test.

II. TESTS ON HARDENED CONCRETE

1. Compressive strength - Cube & Cylinder
2. Flexure test
3. Modulus Of Elastics

III. TESTS ON BITUMEN

1. Penetration
2. Softening Point
3. Ductility
4. Viscosity
5. Elastic Recovery

IV. TESTS ON AGGREGATES

1. Stripping
2. Proportioning of Aggregates
3. Water Absorption
4. Aggregate impart test

V. TESTS ON BITUMINOUS MIXES

1. Determination of Binder Content
2. Marshall Stability and Flow values
3. Specific Gravity
4. Density.

TOTAL: 45 PERIODS

(EQUIPMENT REQUIRED FOR A BATCH OF 30 STUDENTS)

SL.NO DESCRIPTION OF EQUIPMENTS QUANTITY

1. Concrete cube moulds 6
2. Concrete cylinder moulds 3
3. Concrete Prism moulds 3
4. Sieves 1set
5. Concrete Mixer 1
6. Slump cone 3
7. Flow table 1
8. Vibrator 1
9. Trovels and planers 1 set
10. UTM – 400 KN capacity 1
11. Vee Bee Consistometer 1
12. Aggregate impact testing machine 1
13. Blains Apparatus 1
14. Penetration test apparatus for test on Bitumen 1
15. Ring and ball apparatus 1

16. Ductility testing machine 1
17. Bitumen viscometer (in poises) 1
18. Hot Air oven (amtinent to 250 c 1
19. Centrifuge Bistumen extractor 1
20. Marshall specimen compactor 1
21. Marshall testing machine 1
22. Specific gravity bottles (conical 50ml capacity) 3
23. Weighing balance (0.18 accurancy) 1

CE58 SOIL MECHANICS LABORATORY L T P C
0 0 3 2

OBJECTIVE

At the end of this course, the student acquires the capacity to test the soil to assess its Engineering and Index properties.

1. Grain size distribution - Sieve analysis
2. Grain size distribution - Hydrometer analysis
3. Specific gravity of soil grains
4. Relative density of sands
5. Atterberg limits test
6. Determination of moisture - Density relationship using standard Proctor test.
7. Permeability determination (constant head and falling head methods)
8. Determination of shear strength parameters.
    1. Direct shear test on cohesionless soil
    2. Unconfined compression test on cohesive soil
    3. Triaxial compression test (demonstration only)
9. One dimensional consolidation test (Demonstration only)
10. Field density test (Core cutter and sand replacement methods)

TOTAL: 45 PERIODS

LIST OF EQUIPMENT
(For a batch of 30 students)

SL.NO.	DESCRIPTION OF EQUIPMENTS	QUANTITY
1.	Sieves	2 sets
2.	Hydrometer	2 sets
3.	Liquid and plastic limit apparatus	2 sets
4.	Shinkage limit apparatus	3 sets
5.	Proctor compaction apparatus	2 sets
6.	UTM of minimum of 20KN capacity	1
7.	Direct shear apparatus	1
8.	Thermeometer	2
9.	Field density measuring device	2
10.	Triaxial shear apparatus	1
11.	Three gang consolidation test device	1

MG61 **PRINCIPLES OF MANAGEMENT** **L T P C**

(Common to all Branches) **3 0 0 3**

OBJECTIVE

Knowledge on the principles of management is essential for all kinds of people in all kinds of organizations. After studying this course, students will be able to have a clear understanding of the managerial functions like planning, organizing, staffing, leading and controlling. Students will also gain some basic knowledge on international aspect of management.

UNIT I HISTORICAL DEVELOPMENT 9

Definition of Management – Science or Art – Management and Administration – Development of Management Thought – Contribution of Taylor and Fayol – Functions of Management – Types of Business Organisation.

UNIT II PLANNING 9

Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making.

UNIT III ORGANISING 9

Nature and Purpose – Formal and informal organization – Organization Chart – Structure and Process – Departmentation by difference strategies – Line and Staff authority – Benefits and Limitations – De-Centralization and Delegation of Authority – Staffing – Selection Process - Techniques – HRD – Managerial Effectiveness.

UNIT IV DIRECTING 9

Scope – Human Factors – Creativity and Innovation – Harmonizing Objectives – Leadership – Types of Leadership Motivation – Hierarchy of needs – Motivation theories – Motivational Techniques – Job Enrichment – Communication – Process of Communication – Barriers and Breakdown – Effective Communication – Electronic media in Communication.

UNIT V CONTROLLING 9

System and process of Controlling – Requirements for effective control – The Budget as

Control Technique – Information Technology in Controlling – Use of computers in handling the information – Productivity – Problems and Management – Control of Overall Performance – Direct and Preventive Control – Reporting – The Global Environment – Globalization and Liberalization – International Management and Global theory of Management.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Harold Kooritz & Heinz Weihrich “Essentials of Management”, Tata McGraw-Hill, 1998
2. Joseph L Massie “Essentials of Management”, Prentice Hall of India, (Pearson) Fourth Edition, 2003.

REFERENCES

1. Tripathy PC And Reddy PN, “Principles of Management”, Tata McGraw-Hill, 1999.
2. Decenzo David, Robbin Stephen A, “Personnel and Human Reasons Management”, Prentice Hall of India, 1996
3. JAF Stomer, Freeman R. E and Daniel R Gilbert Management, Pearson Education, Sixth Edition,2004.
4. Fraidoon Mazda, “Engineering Management”, Addison Wesley, 2000.

CE61 STRUCTURAL ANALYSIS – II **L T P C**

3 1 0 4

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

TUTORIAL: 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” –5th 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.

CE62 DESIGN OF STEEL STRUCTURES L T P C

3 1 0 4

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", 3rd 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 (3rd Revision).

CE63 CONSTRUCTION PLANNING & SCHEDULING **L T P C**

3 0 0 3

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, Pitsburgh, 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.

CE64 ENVIRONMENTAL ENGINEERING II

L T P C
3 0 0 3

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 Mintenance 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.

CE66 ENVIRONMENTAL AND IRRIGATION ENGINEERING DRAWING L T P C
0 0 4 2

UNIT I WATER SUPPLY AND TREATMENT 15

Design & Drawing of flash mixer, flocculator, clarifier – Slow sand filter – Rapid sand filter – Infiltration gallery – Intake towers – 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 & oxidation ditch – Trickling filters – 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 Regular – 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)", 4th edition, Tata McGraw-Hill, New Delhi, 2003.
3. Garg S.K., "Irrigation Environmental Engineering and design StructuresI", Khanna Publishers, New Delhi, 17th 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.

CE67 ENVIRONMENTAL ENGINEERING LABORATORY

L T P C
0 0 3 2

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^H 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, 20th 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 EQUIPMENTS

(For a batch of 30 students)

1.	P^H 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 / Cruicibles	-	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 68 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 (decided by the staff in-charge appointed by the Institution)	: 20 marks
2.	Evaluation of Survey Camp Report (Evaluated by the external examiner appointed the University)	: 30 marks
3.	Viva voce examination (evaluated by the internal examiner appointed by the HOD with the approval of HOI and external examiner appointed by the University – with equal Weightage)	: 50 marks

Total : 100 marks

HS610 English Language Laboratory - Cumulative Skills - II

Semester VI

Regulations 2008

(Common to all B.E. / B.Tech.)

(To be conducted as a Practical Paper by the Department of English for 3 hrs per week)

OBJECTIVES

To equip the learners face the linguistic demands of post-degree entrance examinations

To improve the IV level active vocabulary

To reactivate and reinforce the language functions introduced in earlier papers

To help the learner infer message from non-verbal cues and speak fluently on them

To help the learners inculcate the micro skills of debating on a subject

To motivate the learners read English dailies and react critically to news items

To help the learners acquire the skills related to organization of thoughts while writing articles.

COURSE CONTENT

A) Target words **(20 hrs)**

((Words D+ to Z from Barron's GRE Test)

B) Writing articles on media-based themes **(10 hrs)**

C) Debate **(8 hrs)**

D) Channel conversion (Speaking on Non-Verbal representations) **(7 hrs)**

RECORD LAY OUT

Every student has to maintain record in which he/she has to incorporate the following details.

Part I: Use of Vocabulary

- 10 assignments (each 20 words) using the target words in sentences of their own.
- Separate word lists to be allotted to students so that all the words in the target vocabulary are covered.
- Assignments to be written in the record notebook only after the approval of the professor in charge.

Part II: Article based on newspaper reading

- One article (**750 words**) based on any theme emerging out of the news items.
  (According to the methodology suggested)
- It should be written only on the odd pages.
- News items (at least 5) should be collected from English dailies and pasted on the even pages.

Part III: Internal Question Papers on Target Vocabulary Testing & Coding sheets

- Six Question papers to be pasted (2 for synonyms, 2 for antonyms and 2 for sentence completion)
- The corrected coding sheets (6) to be pasted.

The record should be duly signed by the Course Teacher and submitted to the External Examiner for verification during the semester practical.

MODE OF EVALUATION

Internal Assessment (20 marks) (10 marks for the Record and 10 marks for the six tests on Target Vocabulary)
External Assessment (100 marks-to be converted to 80 marks)

The external practical * will consist of two segments (a) Written Test and (b) Testing Speaking

Written Test (1 hr)

a) Testing Target Vocabulary (40 objective type items – 15 synonyms, 15 antonyms and 10 sentence completion)
(40 marks)

b) Writing articles on the theme emerging from the given newspaper, items given (5 newspaper items based on a single theme will be given)

(20 marks)

Testing Speaking (3 + 3 minutes)

a) Debate (Each student will be required to speak for three minutes for or against a given topic)

(20 marks)

b) Speaking on the given diagram / chart / table **(20 marks)**

(*Every learner will be assessed with a different set of question which he / she will choose a random)

CE 71 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

TUTORIAL: 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.

CE 72 ESTIMATION AND QUANTITY SURVEYING

L T P C

3 0 0 3

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, syphon, 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

REFERENCES

1. PWD Data Book.

CE 73 BASICS OF DYNAMICS AND ASEISMIC DESIGN

L T P C

3 0 0 3

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 BOOKS

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

REFERENCES

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

CE 74 PRESTRESSED CONCRETE STRUCTURE L T P C

3 0 0 3

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.

CE 76 COMPUTER AIDED DESIGN & DRAFTING LABORATORY

L T P C

0 0 4 2

OBJECTIVE

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

CE 77 **DESIGN PROJECT** **L T P C**

0 0 4 2

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 81 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 82 COMPREHENSION L T P C

0 0 3 0

OBJECTIVE

The objective of this course which does not carry an examination is to make the student comprehend, through a series of lectures, the knowledge pool he / she has gone through the seven semesters. This should form a basis on which the student shall be able to perform better in competitive examinations and interviews.

TOTAL: 45 PERIODS

CE 83 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

ELECTIVES

CE 601 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

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

REFERENCES

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

CE 602 CARTOGRAPHY

L T P C

3 0 0 3

OBJECTIVE

At the end of the course the student will posses 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, Elsevrir Applied Science Publishers 2nd 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.

CE 603 ELECTRONIC SURVEYING

L T P C

3 0 0 3

OBJECTIVE

At the end of the course the student will posses 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.

UNITII BASIC ELETRONICS 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 o 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.

CE604 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 – Pay load 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 605 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 606 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).

GE 607 TOTAL QUALITY MANAGEMENT

L T P C

3 0 0 3

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.

UNITIII 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.

UNITIVTQM TOOLS & TECHNIQUES II 9

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

UNIT VQUALITY 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.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia, 3rd Edition, Indian Reprint (2006).

REFERENCES

1. James R. Evans and William M. Lindsay, “The Management and Control of Quality”, 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S., “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, 3rd 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.

GE608 FUNDAMENTALS OF NANO TECHNOLOGY L T P C

3 0 0 3

UNIT I INTRODUCTION 10

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 5

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 IVPREPARATIONENVIRONMENTS 10

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. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale charecterisation of surfaces & Interfaces”, 2nd 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.

GE 609 INTELLECTUAL PROPERTY RIGHTS (IPR)

L T P C

3 0 0 3

UNIT I 5

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

UNIT II 10

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 10

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

UNIT IV 10

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 10

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.

TEXT BOOKS

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.

GE 610 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; Castle, 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.

CE611 ADVANCED CONCRETE TECHNOLOGY

UNIT –I : Concrete Making Materials

Cement – Different types – Ordinary Portland Cement – Low-alkali cement – Blended Cement – Portland Pozzolana cement – Portland blast furnace slag cement – Portland slag cement – Sulphate resisting Portland cement – Low-heat Portland cement – Hydrophobic cement – Oil well cement – White cement – Aggregates – Aggregates – Classification – IS Specifications – Properties – Grading – Methods of combining aggregates – Specified Gradings – Testing of Aggregates.

Mineral admixtures – Water – Accelerators – Retarders – Plasticizers – Superplasticizers – Waterproofers – Miscellaneous admixtures.

UNIT –II : Concrete

Properties of Fresh Concrete – workability – compactability – consistency – segregation – bleeding – maturity of concrete – curing – autogenous healing - Hardened Concrete – Strength – Elastic Properties – Creep & Shrinkage – Variability of Concrete Strength – Durability of concrete – Sulphate and Chloride attack on concrete.

UNIT –III : Mix Design

Physical properties of materials required for mix design - Acceptance criteria for concrete – Determining the laboratory design strength of concrete – Quality control of concrete - Methods of concrete mix design – Trial mixes – Nominal mixes – ACI and BIS method of mix design.

UNIT –IV : Special Concrete

Light weight concrete – High strength concrete – High performance concrete – Polymer concrete – Polymer Impregnated Concrete - Steel-fibre-reinforced concrete – Ready mixed concrete concrete – Self compacting concrete.

UNIT –V : Concreting Methods and Tests

Extreme weather concreting – Special concreting methods – Vacuum dewatering – Underwater concrete – Non destructive testing – Semi-destructive testing techniques – Developments in rebar technology – Smart concrete.

Text Book:

1. A.R.Santhakumar, “Concrete Technology”, Oxford University Press, 2003.

References:

1. Neville, "Properties of Concrete, Prentice Hall, 1995, London.
2. Shetty, M.S. “Concrete Technology”, S.Chand & Co., New Delhi, 2003.
3. Neville & Brooks, Concrete Technology, Longman Publishing Co.,

CE 701 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 702 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 o f 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.

CE 703 GROUND WATER ENGINEERING

L T P C

3 0 0 3

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 Anisotrophy -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

1. Raghunath H.M., “Ground Water Hydrology”, Wiley Eastern Ltd., 2000.
2. Todd D.K., “Ground Water Hydrology”, John Wiley and Sons, 2000.

REFERENCE

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

CE 704 MANAGEMENT OF IRRIGATION SYSTEMS

L T P C

3 0 0 3

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.

UNIT III MANAGEMENT 9

Structural and non-structural strategies in water use and management – Conjunctive use of surface and ground waters – Quality of irrigation water.

UNIT IV OPERATION 9

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Performance indicators – Case study

UNIT V INVOLVEMENT OF STAKE HOLDERS 10

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.

CE 705 COASTAL ZONE MANAGEMENT

L T P C

3 0 0 3

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.

UNIT I COASTAL ZONE 9

Coastal zone – Coastal zone regulations – Beach profile – Surf zone – Off shore – Coastal waters – Estuaries – Wet lands and Lagoons – Living resources – Non living resources.

UNIT II WAVE DYNAMICS 10

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.

UNIT III WAVE FORECASTING AND TIDES 9

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.

UNIT IV COASTAL PROCESSES 8

Erosion and depositional shore features – Methods of protection – Littoral currents – Coastal aquifers – Sea water intrusion – Impact of sewage disposal in seas.

UNIT V HARBOURS 9

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 706 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.

CE 707 PAVEMENT ENGINEERING

L T P C

3 0 0 3

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. Design and Specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New Delhi, 2001

REFERENCES

1. Yoder R.J and Witczak M.W., “Principles of Pavement Design”, John Wiley, 1975.
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.

CE 708 GROUND IMPROVEMENT TECHNIQUES

L T P C

3 0 0 3

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 - Vaccum 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 - Vibrofloation - 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 Blockie 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", (3rd 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.

CE 709 INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATIONS

L T P C

3 0 0 3

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.

CE 710 **ROCK ENGINEERING**

L T P C

3 0 0 3

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 IVAPPLICATION 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 711 ENVIRONMENTAL IMPACT ASSESSMENT OF CIVIL ENGINEERING PROJECTS

L T P C
3 0 0 3

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

UNIT II METHODOLOGIES 9

Methods of EIA –Check lists – Matrices – Networks – Cost-benefit analysis – Analysis of alternatives

UNIT III PREDICTION AND ASSESSMENT 9

Assessment of Impact on land, water and air, noise, social, cultural flora and fauna; Mathematical models; public participation – Rapid EIA

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN 9

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

UNIT V CASE STUDIES 10

EIA for infrastructure projects – Bridges – Stadium – Highways – Dams – Multi-storey Buildings – Water Supply and Drainage Projects

TOTAL: 45 PERIODS

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.

CE 712 INDUSTRIAL WASTE MANAGEMENT

L T P C

3 0 0 3

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.

UNIT I INTRODUCTION 8

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

UNIT II CLEANER PRODUCTION 8

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

UNIT III POLLUTION FROM MAJOR INDUSTRIES 9

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 713 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-ozone 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 Yark, 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 714 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 715 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”, 2nd Edition, Lewis Publications, London, 1996.

GE 716 CONTRACT LAWS AND REGULATIONS

L T P C

3 0 0 3

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.

CE 801 BRIDGE STRUCTURES

L T P C

3 0 0 3

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 802 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 803 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 Plublishers, 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.

CE 804 **TALL BUILDINGS**

L T P C

3 0 0 3

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. WOLFGANG 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.

CE 805 PREFABRICATED STRUCTURES

L T P C

3 0 0 3

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 – Standarization – 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

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

REFERENCES

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

CE 806 **WIND ENGINEERING**

L T P C

3 0 0 3

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).

UNIT III EFFECT ON TYPICAL STRUCTURES 9

Tail buildings – Low rise buildings – Roof and cladding – Chimneys, towers and bridges.

UNIT IV APPLICATION TO DESIGN 9

Design forces on multistorey building, towers and roof trusses.

UNIT V INTRODUCTION TO WIND TUNNEL 9

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, Ottowa, 1990.
2. Wind Force on Structures – Course Notes, Building Technology Centre, Anna University, 1995.

CE 807 COMPUTER AIDED DESIGN OF STRUCTURE

L T P C

3 0 0 3

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.

UNIT I INTRODUCTION 9

Fundamentals of CAD - Hardware and software requirements -Design process - Applications and benefits.

UNIT II COMPUTER GRAPHICS 9

Graphic primitives - Transformations -Wire frame modeling and solid modeling -Graphic standards –Drafting packages

UNIT III STRUCTURAL ANALYSIS 9

Fundamentals of finite element analysis - Principles of structural analysis -Analysis packages and applications.

UNIT IV DESIGN AND OPTIMISATION 9

Principles of design of steel and RC Structures -Applications to simple design problems – Optimisation techniques - Algorithms - Linear Programming – Simplex method

UNIT V EXPERT SYSTEMS 9

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 808 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.

UNIIT 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.

CE 809 SMART MATERIALS AND SMART STRUCTURES

L T P C

3 0 0 3

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 LVOT – 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 orheological 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.

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.

CE 810 FINITE ELEMENT TECHNIQUES

L T P C

3 0 0 3

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 Largrangean 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.

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.

CE 811 REPAIR AND REHABILITATION OF STRUCTURES

L T P C

3 0 0 3

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, Gunite 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. Lakshmipathy, M. etal. Lecture notes of Workshop on "Repairs and Rehabilitation