COIMBATORE INSTITUTE OF TECHNOLOGY
(Autonomous Institution Affiliated to Anna University, Chennai)

DEPARTMENT OF CIVIL ENGINEERING

B.E. - Full Time

THIRD TO EIGHTH SEMESTER SYLLABUS

(For the students admitted during <u>2013-2014</u> onwards)

COIMBATORE INSTITUTE OF TECHNOLOGY

(Government Aided Autonomous Institution Affiliated to Anna University and

Accredited by NBA

Coimbatore - 641 014.

CONTENTS

COIMBATORE INSTITUTE OF TECHNOLOGY
(Autonomous Institution Affiliated to Anna University, Chennai)
DEPARTMENT OF CIVIL ENGINEERING

VISION AND MISSION OF THE INSTITUTE

Vision of CIT

The Institute strives to inculcate a sound knowledge in engineering along with realised social responsibilities to enable its students to combat the current and impending challenges faced by our country and to extend their expertise to the global arena.

Mission of CIT

The mission of CIT is to "impart high quality education and training to its students to make them World-class engineers with a foresight to the changes and problems, and pioneers to offer innovative solutions to benefit the nation and the world at large".

COIMBATORE INSTITUTE OF TECHNOLOGY
(Autonomous Institution Affiliated to Anna University, Chennai)
DEPARTMENT OF CIVIL ENGINEERING

VISION AND MISSION OF THE DEPARTMENT OF CIVIL ENGINEERING

VISION OF DEPARTMENT OF CIVIL ENGINEERING

"To provide quality education in Civil Engineering and to become a state-of-the-art source of world-class Civil Engineers and Researchers"

MISSION OF DEPARTMENT OF CIVIL ENGINEERING

"To provide the students with a broad and thorough education in fundamentals, applications, design and execution, that equips them with necessary skills to become successful professional engineers"

COIMBATORE INSTITUTE OF TECHNOLOGY
(Autonomous Institution Affiliated to Anna University, Chennai)

DEPARTMENT OF CIVIL ENGINEERING
PROGRAMME EDUCATIONAL OBJECTIVES (PEO's) OF CIVIL ENGINEERING

The following Programme Educational Objectives are designed based on the department mission

PEO 1: To impart profound knowledge in fundamentals, techniques and design of Civil Engineering system that encourages them to develop newer techniques in their professional practice

PEO 2: To equip the graduates with suitable skills making them industry ready when they leave the portals of the Institute and to become a competent distinguished Professional Civil Engineer.

PEO 3: To inculcate an aspiration for research and development in Civil Engineering and Allied Fields.

PEO 4: Function ethically in their Professional Civil Engineering Roles.

PEO 5: Engage in life-long continuous learning through independent study and participation in professional conferences, seminars and workshops.

PEO 6: To educate them to be successful leaders and innovators capable of meeting complex challenges.

COIMBATORE INSTITUTE OF TECHNOLOGY
(Autonomous Institution Affiliated to Anna University, Chennai)
DEPARTMENT OF CIVIL ENGINEERING
PROGRAMME OUTCOMES (PO's) OF CIVIL ENGINEERING

Students in the Civil Engineering Programme should at the time of their graduation be in possession of the following

PO1: Graduates can confidently apply appropriate mathematical, scientific and technical knowledge to Civil Engineering problems.

PO2: Graduates will be able to, plan and analyze experimental and simulation data and design and build civil engineering structures.

PO3: Graduates will be competent in planning, designing and executing different types of Civil Engineering projects.

PO4: Graduates will excel in teamwork and enjoy working with multi-disciplinary team.

PO5: Graduates will be able to solve well defined and open-ended engineering problems.

PO6: Graduates will understand the principles of professional ethics, protecting the public health, safety and welfare of people, respect the copyright and patents.

PO7: Graduates will be able to generate techno-economic viability reports and communicate the same through written, oral and graphical methods.

PO8: Graduates with a background of sciences, social sciences and humanities understand the impact of engineering projects on the quality of life and physical environment.

PO9: Graduates will realize the importance to be an active member in professional societies for continuous updating of knowledge.

PO10: Graduate will be aware of the importance of research and development in the field of Civil Engineering and engage themselves in research and development.

PO11: Graduates will be always looking forward to the emerging technologies and equip and implement them in their professional practice.

PO12: Graduates will be able to use technical, financial and managerial skills in industry, management and business.

PO13: Graduates will be able to exploit opportunities in public policy and administration.

PO14: Graduates will understand leadership qualities, attitudes and acquire skills to be an effective leader in their chosen field.

PO15: Graduates will be able to contribute to the nation's economic growth in creating better infrastructure.

COIMBATORE INSTITUTE OF TECHNOLOGY

Coimbatore - 641 014.

B.E. CIVIL ENGINEERING - Full Time

SUBJECTS OF STUDY

(III TO VIII SEMESTER)

III SEMESTER

Subject code	Subject	L	T	P	C
Theory					
13CE31	Mathematics III	3	1	0	4
13CE32	Mechanics of Solids I	3	1	0	4
13CE33	Mechanics of Fluids	3	1	0	4
13CE34	Surveying I	3	0	0	3
13CE35	Concrete Technology	3	0	0	3
Theory & Practical					
13CE36	Geology for Civil Engineers	3	0	2	4
Practical					
13CE37	Survey Practical I	0	0	3	2
13CE38	Fluid Mechanics Laboratory	0	0	3	2
13CE49	Science of Creativity and Professional Ethics	2	-	-	-
	Total Credits				**26**

IV SEMESTER

Subject code	Subject	L	T	P	C
Theory					
13CE41	Numerical Methods	3	0	0	3
13CE42	Mechanics of Solids II	3	1	0	4
13CE43	Applied Hydraulics & Hydraulic Machinery	3	1	0	4
13CE44	Surveying II	3	0	0	3
13CE45	Construction Technology	3	0	0	3
13CE46	Basic Structural Design (Masonry, Timber and Steel)	3	1	0	4
Practical					
13CE47	Survey Practical II	0	0	3	2
13CE48	Hydraulic Machinery Laboratory	0	0	3	2
13CE49	Science of Creativity and Professional Ethics	2	0	0	2
	Total Credits				**27**

V SEMESTER

Subject code	Subject	L	T	P	C
Theory					
13CE51	Transportation Engineering I	3	0	0	3
13CE52	Structural Analysis I	3	1	0	4
13CE53	Mechanics of Soils	3	0	0	3
13CE54	Design of R.C Structural Elements	3	1	0	4
13CE55	Water Supply Engineering	3	0	0	3
13CE56	Computer Aided Building Drawing*	1	0	3	3
Practical					
13CE57	Strength of Materials Lab	0	0	3	2
13CE58	Highway Engineering Lab	0	0	3	2
13CE69	Mini Project – Design Project / Case Study (Industrial Visit/ Field Visit)	-	-	2	-
	Total Credits				**24**

VI SEMESTER

Subject code	Subject	L	T	P	C
Theory					
13CE61	Transportation Engineering II	3	0	0	3
13CE62	Structural Analysis II	3	1	0	4
13CE63	Foundation Engineering	3	0	0	3
13CE64	Design of Steel Structures	3	1	0	4
13CE65	Design of Reinforced Concrete Structures	3	1	0	4
13CE66	Design and Drawing*	2	0	4	4
Practical					
13CE67	Concrete Lab	0	0	3	2
13CE68	Soil Mechanics Lab	0	0	3	2
13CE69	Mini Project – Design Project / Case Study (Industrial Visit/ Field Visit)	0	0	2	2
	Total Credits				**28**

*Note: Final Examination will be of 4Hours duration and evaluation will be done by two internal examiners. Continuous assessment pattern will be followed.

VII SEMESTER

Subject code	Subject	L	T	P	C
Theory					
13CE71	Earthquake Resistant Design of Structures	3	0	0	3
13CE72	Irrigation Engineering	3	0	0	3
13CE73	Sanitary Engineering	3	0	0	3
13CE74	Elective I	3	0	0	3
13CE75	Elective II	3	0	0	3
Practical					
13CE76	Computer Applications Laboratory	0	0	3	2
13CE77	Environmental Engineering Lab	0	0	3	2
13CE88	Project Work & Viva Voce	-	-	6	-
	Total Credits				**19**

VIII SEMESTER

Subject code	Subject	L	T	P	C
Theory					
13CE81	Construction Management	3	0	0	3
13CE82	Hydraulic Structures	3	0	0	3
13CE83	Remote Sensing & GIS	3	0	0	3
13CE84	Elective III	3	0	0	3
13CE85	Elective IV	3	0	0	3
Practical					
13CE86	Geoinformatics Lab	0	0	3	2
13CE87	Quantity Surveying & Valuation	0	0	3	2
13CE88	Project Work & Viva Voce	-	-	6	6
	Total Credits				**25**

Total Credits: 200

LIST OF ELECTIVE SUBJECTS

Sub. Code	Subject	L	T	P	C
13CEE01	Prestressed Concrete Structures	3	0	0	3
13CEE02	Advanced Concrete Structures	3	0	0	3
13CEE03	Advanced Steel Structures	3	0	0	3
13CEE04	Experimental Stress Analysis	3	0	0	3
13CEE05	Health Monitoring of Structures	3	0	0	3
13CEE06	Prefabricated and Industrial Structures	3	0	0	3
13CEE07	Analysis and Design of Deep Foundations	3	0	0	3
13CEE08	Soil Structure Interaction	3	0	0	3
13CEE09	Environmental Impact Assessment	3	0	0	3
13CEE10	Solid and Hazardous Waste Management	3	0	0	3
13CEE11	Building Services and Systems Engineering	3	0	0	3
13CEE12	Renewable Energy Resources	3	0	0	3
13CEE13	Town Planning and Architecture	3	0	0	3
13CEE14	Construction Equipments and Techniques	3	0	0	3
13CEE15	Water Power Engineering	3	0	0	3
13CEE16	Engineering Hydrology	3	0	0	3
13CEE17	Finite Element Method	3	0	0	3
13CEE18	Theory of Plates	3	0	0	3
13CEE19	Optimization in Civil Engineering	3	0	0	3
13CEE20	Smart Materials And Structures	3	0	0	3
13CEE21	Disaster Management	3	0	0	3
13CEE22	Pavement Design	3	0	0	3
13CEE23	Design of Bridges	3	0	0	3
13CEE24	Industrial Waste Water Treatment and Disposal	3	0	0	3
13CEE25	Pollution and Control Engineering	3	0	0	3
13CEE26	Principles of Sustainable Development	3	0	0	3
13CEE27	Safety Engineering	3	0	0	3
13CEE28	Principles of Economics	3	0	0	3
13CEE29	Public Administration	3	0	0	3
13CEE30	Indian Economy	3	0	0	3
13CEE31	Principles of Management	3	0	0	3
13CEE32	Engineering Risk & Benefit Analysis	3	0	0	3
13CEE33	Accounting for Engineers	3	0	0	3
13CEE34	Infrastructure Planning and Management	3	0	0	3

<table>
<tr><td></td><td>**13CE31 MATHEMATICS III**</td><td>**L**</td><td>**T**</td><td>**P**</td><td>**C**</td></tr>
<tr><td></td><td></td><td>**3**</td><td>**1**</td><td>**0**</td><td>**4**</td></tr>
</table>

ASSESSMENT: THEORY
COURSE OBJECTIVES:
The objective is to incorporate the ideas of complex variables, partial differential equations and its applications and Fourier transforms that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many engineering fields.
COURSE OUTCOMES:
> **CO1:** The students will be able to apply complex variable ideas to solve civil engineering problems.
> **CO2:** The students will be able to solve partial differential equations and apply them in solving civil engineering problems.
> **CO3:** The students will be able to work with Fourier transform ideas to analyze and solve communication oriented problems

COMPLEX DIFFERENTIATION
Analytic functions–Definitions and properties–Cauchy Riemann equations in Cartesian and polar coordinates-construction of analytic functions– Conformal mappings–Bilinear Transformation -the mappings of the form w= z+a, az, 1/z, z^2, e^z, sinz, cosz, -Simple problems.   **(9)**

COMPLEX INTEGRATION
Cauchy's integral theorem-Integral formula-Taylor's and Laurent's series (without proof)-Types of singularities, Poles and residues-Cauchy's residue theorem-Applications-Contour integration using circular and semicircular contours.   **(9)**

PARTIAL DIFFERENTIAL EQUATIONS
Formation by elimination of arbitrary constants and functions solution by direct method-solution of first order non-linear PDE-standard types- Lagrange's linear equation-Linear higher order homogeneous PDE with constant coefficients.

(9)

FOURIER TRANSFORMS
Fourier integral theorem (without proof)-Infinite Fourier transform – infinite Fourier sine and cosine transforms-properties and problems-Convolution theorem-Parseval's identity-Finite Fourier sine and cosine Transforms- properties and problems.   **(9)**

BOUNDARY VALUE PROBLEMS
Vibration of strings-one dimensional wave equations, one dimensional heat flow- unsteady state and steady state -Two dimensional heat flow steady state in Cartesian coordinates-Separation of variables-Fourier series solution.   **(9)**

Theory: 45
Tutorial: 15
Total: 60

TEXT BOOKS
1. Kandasamy P., "Engineering Mathematics", Volume – II & IIIS.Chand&Co., 2004.
2. Veerarajan T., "Engineering Mathematics", Third Edition, FifthReprint, Tata Mc Graw – Hill Publishing Company Ltd, 2008.
3. Venkataraman,M.K., "Engineering Mathematics III", Revised andEnlarged Fourteenth Edition, The National Publishing Company,2008.
4. Venkataraman.M.K., "Engineering Mathematics III-A",(Eleventh Edition), The National Publishing Company, 2008.

REFERENCE BOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", (EighthEdition) John Wiley & Sons (Asia) Private Limited., - (2008).
2. Grewal, B.S., "Higher Engineering Mathematics", (ForthEdition) Khanna Publishers – 2007).

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X			X										
2	X	X			X										
3	X	X			X										

13CE32 MECHANICS OF SOLIDS I L T P C
                                   3 1 0 4

ASSESSMENT: THEORY
COURSE OBJECTIVE:
To understand the properties of solids in terms of its strength and the behaviour. All these should be achieved conceptually with worked out examples.
COURSE OUTCOMES:
CO1: The students will be able to *understand the basic concepts of stresses in terms of axial, bending and tension forces.*
CO2: The students will be able to *understand the concept of strain energy, moment of inertia and complex stress systems.*
CO3: The students will be able to *draw BMD and SF diagram for beams of various end condition.*
CO4: The students will be able to *solve problems related to torsion, springs and stress in cylinders.*

CONCEPT OF STRESS AND STRAIN
Simple stresses and strains at a point -Normal and shear Stresses - Hooke's Law - Young's modulus - Bars subjected to axial Forces - simple problems - Thermal stresses - Simple statically Indeterminate problems like compound bars. Changes in dimensions and volume - Poisson's ratio - Modulus of Rigidity - Surface and volume strains - Bulk modulus - Relation between Elastic constants - Simple Tension Test on a Mild Steel rod - Stress-strain diagram - Concept of Factor of Safety and permissible stresses.   **(9)**

STRAIN ENERGY PRINCIPLES AND COMPLEX STRESSES
Strain energy -Resilience - Stresses due to suddenly applied loads and impact loads.

Complex stresses – Components of stress on inclined planes - Expression for stressed element subjected to two normal stresses with shear – Principal stresses and Principal planes - Mohr's circle of stress.   **(9)**

BEAMS – SFD & BMD / BENDING STRESS & SHEAR STRESSES
Types of Beams - Types of loads and loading diagrams – Shear force and Bending Moment - Relationship between loading intensity, shear force and bending moment - Shear force and bending moment diagrams for statically determinate beams. Theory of simple bending -Stress distribution due to shear force and bending moment - Design of beams - Beams of uniform strength - Flitched beams - Beams of Two materials - Leaf springs.   **(9)**

TORSION AND SPRINGS
Torsion of solid and hollow circular shafts - Power transmitted through shafts - Strain energy due to torsion – Combined bending and torsion -Close coiled and open coiled helical springs.   **(9)**

THIN AND THICK CYLINDER
Stresses in thin walled Cylindrical and spherical shells – Wire wound cylindrical Vessels – Thick cylinder - Lame's equations - Compound cylinders - Shrink fit.   **(9)**

Theory: 45
Tutorial: 15
Total: 60

TEXT BOOK:
1.EgorP.Popov,"Introduction to Mechanics of Solids", Prentice Hall of India, New Delhi, 2003.
2. Beer F P, Johnston E R, DeWolf J T and Mazurek D, "Mechanics of Materials", McGraw-Hill Higher Education, 6th edition, 2011

REFERENCE BOOKS:
1. Sadhu Singh, "Strength of Materials", KhannaPublishers,New Delhi, 2012.
2. Prakash Rao D.S., "Strength of Materials" Volume I, Universities Press (India) Limited., Hyderabad, 2002.
3. Lehri, RS.,Lehri., AS., "Strength of Materials", S K Kotaria& Press, New Delhi, 2009.
4. Timonshenko, S.P, Gere, J.M., "Mechanics of Materials", CBS Publishers, New Delhi, 2002. .
5. Rajput, RK., "Strength of Materials", S.Chand& Company Ltd., New Delhi, 2007.

6. Punmia BC, Ashok Jain and Arun Jain, "Strength of Materials and Theory of Structures" Vol 1, Laxmi Publications, New Delhi, 2000.
7. Bansal RK, "Strength of Materials", Laxmi Publications, New Delhi, 2010.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x		x				x				
2	x	x	x		x					x		x			x
3	x	x		x				x				x			
4	x	x	x		x		x				x			x	

13CE33 MECHANICS OF FLUIDS

	L	T	P	C
	3	1	0	4

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To impart a thorough knowledge about the behavior of fluids, especially liquids, at rest or in motion and practical applications of the fluid properties and flow concepts
COURSE OUTCOMES:
CO1: The students will be able to apply the knowledge of Fluid properties in real situation
CO2: The students will be able to apply the knowledge attained in solving field problems in the area of storage
CO3: The students will be able to apply the practical application of similitude and model study
CO4: The students will be able to apply the knowledge attained in solving field problems in the area of liquid flow

PROPERTIES OF FLUIDS & FLUID PRESSURE
Introduction of basic properties – Viscosity – compressibility – surface tension – real and ideal fluids - Fluid pressure – Various methods of measurements.   **(8)**

HYDROSTATICS
Total pressure and centre of pressure on plane submerged surfaces – simple problems – Buoyancy – Centre of buoyancy – Metacentre and metacentric height – conditions of equilibrium of floating and submerged bodies - Fluid mass subjected to uniform linear acceleration – fluid containers subjected to constant rotation   **(10)**

CONCEPTS OF FLUID FLOW
Classification of fluid flow – velocity and acceleration – velocity potential and stream function-continuity equation – Euler's equation of motion – Bernoulli's equation – applications – venturimeter, orifice meter, pitot tube – simple problems – Velocity and discharge through orifices and mouthpieces
                                    (9)
DIMENSIONAL ANALYSIS AND MODEL STUDIES
    Fundamental dimensions - dimensional homogeneity – Dimensional analysis by Rayleigh's method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies – Distorted Models
                                    (9)

FLOW THROUGH PIPES
Laminar flow in circular pipes – Hagen – Poisueills's equation – Turbulent flow – Darcy–Weisbach equation – major and minor losses – transmission of power through pipes – parallel, series pipes – flow through long pipes – flow between reservoirs – flow through siphon pipes – water hammer   **(9)**

Theory: 45
Tutorial: 15
Total: 60

TEXT BOOK:

1. Modi.P.N, &Seth.S.M., " Hydraulics, Fluid Mechanics & Hydraulic Machinery", Metropolitan Book Company, New Delhi, 2013.

REFERENCE BOOKS:

1. Bansal.R.K., "Text Book of Fluid Mechanics and Hydraulic Machines", M/s.Lakshmi Publications, Madras,2005.
2. Kumar.K.L, "Engineering Fluid Mechanics", M/s.S.Chand Co., Madras.2003.
3. Ramamrutham.S, "Fluid Mechanics, Hydraulics & Fluid Machinery", M/s.DhanpatRai& Sons, New Delhi, 1998.
4. Arora K.R., "Fluid Mechanics, Hydraulics and Hydraulic Machines", Standard Publishers & Distributors, 1998.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X			X		X								
2	X	X	X		X		X			X					
3	X		X		X		X			X					X
4	X	X	X		X		X			X					

13CE34 SURVEYING I

	L	T	P	C
	3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To impart knowledge about the measurement of various heights and distances using chain, compass surveying etc., and also about theodolite surveying.

COURSE OUTCOMES:
CO1: *The students will be able to demonstrate the basic concepts in survey field.*
CO2: *The students will be able to solve, design and execute the course of levelling and determine the correct elevations of intermediate points.*
CO3: *The students will be able to understand and interpret maps; acquire data from a map needed for the site selection, development and design of various civil engineering projects.*

INTRODUCTION AND CHAIN SURVEYING
Definition of surveying - Principles - classification - field and office work - scales - conventional signs.

Chain Surveying - equipment - chains, tapes, ranging rods, arrows, cross staff, pegs - Ranging and chaining - reciprocal ranging - methods of chaining - overcoming obstacles - setting perpendiculars, gradients - Base, check and tie lines - well conditioned triangles - Traversing - Plotting - Errors in chaining and their corrections. **(9)**

COMPASS SURVEYING
Prismatic compass - surveyor's compass-Bearings – systems and conversions - Local attraction - True and magnetic meridians - magnetic declination-dip-Traversing-Plotting- adjustment of error by graphical and analytical methods. **(9)**

PLANE TABLE SURVEYING AND MINOR INSTRUMENTS
Instruments and accessories - merits and demerits – methods - Radiation -Intersection - Traversing - Resection - Three and two Point problems.

Minor instruments – Hand level, Abney level, Indian pattern clinometers, CylonGhat tracer, Sextant, Planimeter, and Pentagraph. **(9)**

LEVELLING
Levels and staves - Spirit level - sensitiveness - Benchmarks - Temporary and permanent adjustments - methods -Differential, fly,check, profile and block levelling - Booking, reduction – Arithmetic checks - correction for curvature and refraction -Reciprocal levelling
- Intervisibility of stations - Errors in levelling. Longitudinal and cross sections - plotting - calculation of areas and volumes. Contouring - characteristics and uses of contours - plotting - Earthwork volume capacity of reservoirs. **(9)**

THEODOLITE SURVEYING:
Transit Theodolite - vernier, micrometer and micro-optic theodolites-description and uses-Fundamental lines of a Transit theodolites-Temporary and Permanent adjustments - Horizontal angles - reiteration and repetition-vertical angles. Methods of traversing conditions for closure-closing error and distribution-Gale's Traverse table - plotting by Coordinates-Omitted Measurements – Gross errors. **(9)**

Total: 45

TEXT BOOK:
1. Kanetkar, T.P.," Surveying and Levelling", Volumes I and II, United Book Corporation, 2011.

REFERENCE BOOKS:
1) Punmia,B.C.,"Surveying", Volumes I & II, Laxmi Publications, NewDelhi, 2005.
2) Arora.K.R., "Surveying", Volume I, Standard Book House, Delhi 6, 2013.

Mapping of Course Outcome with Program Outcome

<table>
<tr><th colspan="16">Mapping of CO's and PO's</th></tr>
<tr><th rowspan="2">CO's</th><th colspan="15">PO's</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th></tr>
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13CE35 CONCRETE TECHNOLOGY   L   T   P   C
                                3   0   0   3

ASSESSMENT : THEORY
COURSE OBJECTIVES:
To impart knowledge about concrete making materials, properties of fresh and hardened concrete, special concretes, mix design and non-destructive testing.
COURSE OUTCOMES:
CO1: *Students will be able to understand about properties of concrete making materials*
CO2: *Students will be able to explain mix design procedures as per Indian Standard Codes.*
CO3: *Students will be able to explain fresh and hardened properties of concrete and special concretes*

CEMENT
Types of cement - properties and specific uses of various cements - Tests of cement - Fineness - Setting time - Consistency- Soundness - compressive strength.
AGGREGATES
Properties of aggregates - shape, texture, bond, strength, soundness and thermal properties - grading - bulking of sand – Tests on aggregates - Flakiness index - Elongation index - Crushing value - Impact value - Abrasion value.   **(9)**

WATER
Quality of water for mixing and curing - use of Sea water for mixing concrete.
ADMIXTURES
Air-entraining agents - Accelerators - Retarders - Pozzolona - Water proofing agents - workability agents – plasticizers – super plasticizers
CONCRETE MIX DESIGN
Factors affecting mix proportion - Water cement ratio – Aggregate cement ratio - Mix design by I.S. method and ACI method.   **(9)**

MANUFACTURE OF CONCRETE
Measurement of materials - Volume batching and weigh batching - mixing of concrete - Types of mixers - Transporting of concrete placing of concrete - compaction of concrete – Methods of compacting concrete - Tamping - Vibration - Vibroprocessing – Jolting - Rolling - Centrifugation - Curing of concrete - Different methods of curing.   **(9)**

PROPERTIES AND TESTS ON FRESH AND HARDENED CONCRETE:
FRESH CONCRETE
Workability - Workability Tests - Slump Test - Compacting factor Test – Flow test – Kelly Ball test – Vee Bee consistometer test – segregation and Bleeding.
HARDENED CONCRETE
Compressive Strength of concrete - Modulus of Rupture –Tensile Strength - Modulus of elasticity - Bond stress - Shrinkage of concrete - Factors affecting shrinkage of concrete - creep – Factors influencing creep - Factors affecting permeability – Thermal properties   **(9)**

QUALITY CONTROL
Sampling - Frequency of sampling - Standard deviation - acceptance criteria as per IS 456 - 2000.
SPECIAL CONCRETES:
Light weight concrete - Fibre Reinforced Concrete - Ready Mixed concrete - High density Concrete - Polymer Concrete – Ferrocement– Shotcreting – Hot weather concreting – Cold weather concreting – high strength concrete – High performance concrete – Self compacting concrete – Ready mixed Concrete.   **(9)**
                                                          Total : 45

TEXT BOOK:
1. Shetty M.S., "Concrete Technology", S.Chandand Company Ltd, New Delhi, 2005.
REFERENCE BOOKS:
1 Neville.A.M., "Properties of Concrete", ELBS, 2011.
2. Santhakumar A.R., "Concrete Technology" Oxford University Press, New Delhi, 2012
3. Krishnasamy K.T. , "Concrete Technology", DhanpatRai, New Delhi, 2012.
4. Gambhir M.L., "Concrete Technology", Tata McGraw Hill Publishing Company Limited, New Delhi, 2009.

5. IS 456- 2000 Indian Standard Code of Practice for Plain and Reinforced Concrete, BIS, New Delhi.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x			x					x	x				
2	x	x			x					x	x				
3	x	x			x					x	x				

13CE36 GEOLOGY FOR CIVIL ENGINEERS

L	T	P	C
3	0	2	4

ASSESSMENT : THEORY & PRACTICAL
COURSE OBJECTIVES:
To impart knowledge about various geological problems encounter during civil engineering projects like infrastructure development and mega projects like dams, tunnel and landslide. It also imparts knowledge about the methods used to explore the sub surface for natural resources.
COURSE OUTCOMES:
CO1: Students will be able to acquire fundamental knowledge in structural geology & crystallography
CO2: Students will be able to explain the concepts of minerals identification and its uses
CO3: Students will be able to explain the Fundamental principles of Geophysical methods and Engineering properties of Rocks

GENERAL GEOLOGY
The need for imparting geological training to the engineers. Weathering, soils, Geological action of wind, Rivers, Glacier ground water - Earthquake and Interior of the earth, Age of the earth.   **(9+6)**

STRUCTURAL GEOLOGY & CRYSTALLOGRAPHY
Contours, Dip, Apparent Dip, True Dip, strike, thickness of strata, folds, faults, joints, unconformities, outlier, Inlier's, overlap, offlap. Outline of elementary crystallography - symmetry elements, goniometer, miller's indices, study of the symmetry elements and forms of the normal class of the cubic, tetragonal, Hexagonal, orthorhombic, monoclinic and triclinic systems.   **(9+6)**

MINERALOGY
Physical properties of minerals - characteristic features of the following minerals and mineral groups. Quartz group - Rock crystal, Chalcedony, Agate, Flint, Jasper, opal Felspar group - Orthoclase, Microcline, Plagioclase Felspars. Pyroxene group - Hypersthene, Augite.Amphibole group - Hornblende only.Mica group - Muscovite, Biotite, Phlogopite and Lapidolite.Nepheline, chlorite, olivine, garnet, Beryl, sillimanite ,Kyanite, Staurolite, Serpentine, Asbestos, Talc, clayminerals, Bauxite, Apatite,Corundum, Hematite, Magnetite, Limonite, chromite, Calcite, Dolomite, Barite, Gypsum, Galena,Pyrite, Fluorite and Graphite – Identification of minerals and its uses.   **(9+6)**

PETROLOGY & STRATIGRAPHY
Elementary classification, textures and structures of the three groups of rocks - forms and mode of occurrence of igneous rocks, detailed description, distribution and economic uses of the following rock types: Igneous Rocks - Granite, Syenite,Diorite, Gabbro, Pyroxenite, Dolerite, Rhyolite, Trachyte, Andesite, Basalt. Sedimentary Rocks - Conglomerate, Breccia, Sandstone, shale, limestone, laterite. Metamorphic Rocks - Slate, Phyllite, Schist, Gneiss, Quartzite, Marble, Granulite. Outline of stratigraphy of India with particular reference to the following: Dharwars (Archaeans), Cuddapahs, Vindhyans, Gondwanas, Trichy Cretaceous, Deccan Traps, Tertiary with special emphasis on formation containing Lignite/petroleum. Identification of rocks, description, distribution and uses.**(9+6)**

APPLIED GEOLOGY
Landslide and related phenomenon, Geology of Reservoir and dam sites, Geology of Tunneling, Geology of Building stones, Building sites and Road metals,Geology of coastal protection, Fundamental principles of Geophysical methods. Engineering properties of Rocks.   **(9+6)**

Total : 45+30=75

TEXT BOOK:
1. Parbinsingh., "A Text book of General Engineering Geology", Katson Publishing House, Ludhiana, 2012.

REFERENCE BOOKS:
1. Krynine and Judd , "Principles of Engineering Geology and Geotechnics"., Tata McGraw Hill, New Delhi, 1998.
2. Tyrrell , "Principles of Petrology", B.I .Publications, Bombay,1998.
3. Billings, "Structural Geology", Asia Publishing House,New Delhi,1989.
4. SathyaNarayanaswamy.B.S., Engineering Geology Laboratory Manual, LCSE – New Delhi.
5. Gurappa.K.M., Structural Geology Maps and Problems.
6. Gohale.N.E., Manual of Geological Map, CBS Publishers , New Delhi, 1987.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1		x	x		x	x				x					
2	x				x	x	x				x			x	
3	x		x				x						x		

13CE37 SURVEY PRACTICAL I

	L	T	P	C
	0	0	3	2

ASSESMENT: PRACTICAL
COURSE OBJECTIVES:

      To impart knowledge about practical applications and solutions of surveying, both in the field and in construction industries.

COURSE OUTCOMES:

      CO1: The students will be able to practically apply various simple surveying techniques, both in field and construction industries

      CO2: The students will be able to design the course of a traverse, calculate the bearings and azimuths of the sides and calculate the adjusted coordinates of the stations

      CO3: The students will be able to interpret contour maps; acquire data from a map needed for the site selection, development and design of various civil engineering projects

List of Experiments:

1. Chain Surveying I - Unfolding and folding a chain, Aligning, Ranging, Chaining, Offsets.
2. Chain Surveying II - Traverse.
3. Compass Survey I - Measurement of bearings.
4. Compass Survey II - Traverse.
5. Plane Table Surveying I - Triangulation Problem to find the distance between inaccessible points.
6. Plane Table Surveying II - Traverse.
7. Plane Table Surveying III - Three Point Problem.
8. Plane Table Surveying IV - Two point problem.
9. Levelling I - Study of levels and levelling staff.
10. Levelling II - Fly levelling using Dumpy level.
11. Levelling III - L.S. and C.S.
12. Levelling IV - Contouring.

Mapping of Course Outcome with Program Outcome

Mapping of CO's and PO's															
CO's	**PO's**														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X		X	X		X			X	X			X	X
2	X	X		X	X		X			X	X			X	X
3	X	X		X	X		X			X	X			X	X

13CE38   FLUID MECHANICS LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT: PRACTICAL
COURSE OBJECTIVES:
To impart knowledge about practical applications of concepts of Fluid Mechanics and Machinery.

COURSE OUTCOMES:
 CO1:The students will be able to apply the knowledge in velocity and pressure measuring devices
CO2: The students will be able to apply the knowledge attained in solving field problems in the area of storage
CO3: The students will be able to apply the knowledge attained in solving field problems in the area of liquid flow
CO4: The students will be able to apply the knowledge in finding out the losses occurred in pipe flow

LIST OF EXPERIMENTS:

1. Calibration of venturimeter
2. Calibration of Orificemeter
3. Calibration of Bendmeter
4. Calibration of Nozzlemeter
5. Flow through pipes – Major losses
6. Flow through pipes – Minor losses
7. Flow through Orifices
8. Flow through Mouthpieces
9. Flow over Notches
10. Verification of Bernoulli's Theorem

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X	X		X					X	X				
2	X	X	X	X	X					X	X		X		
3	X	X	X	X	X					X	X		X		
4	X	X	X		X					X	X				X

13CE41 NUMERICAL METHODS	L	T	P	C
	3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To develop effective understanding,formulation and solving skills of Numerical methods to apply into civil engineering field.
COURSE OUTCOMES:

  CO1: The students will be able to solve various linear equations using numerical methods
  CO2: The Students will be able to solve differential equaions and apply in various civil engineering problems
  CO3: The Students will be able to work with numerical methods to solve integration problems in civil engineering
  CO4: The Students will be able to solve for Eigen values and Eigen vectors, and apply in Civil Engineering Problems.

LINEAR SIMULTANEOUS ALGEBRAIC EQUATION
Direct methods: Gauss-elimination, Gauss-Jordon, Cholesky and Partition methods. Iterative methods: Jacobi and Gauss-Siedel methods. **(9)**

FINITE DIFFERENCE METHODS
Applications: Shear force, Bending moment and Deflection variation in statically determinate beams – Deflection in Statically indeterminate beams – Vibration of beams – Bending of laterally loaded thin plates. **(9)**

NUMERICAL INTEGRATION
Trapezoidal Rule, Simpson's one third Rule – Gaussian quadrature formula – Application of quadrature rule to deflection of non - prismatic simple beams. **(9)**

EIGEN VALUES AND EIGEN VECTORS
Iterative method (Power method) – Jacobi method – Applications: Principal stresses and Principal planes –Principal moment of inertia and principal axes – Application of finite difference in eigen value problems to buckling of columns. **(9)**

ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS
Ordinary Differential Equations: Taylor series method – modified Euler's method – Runge-kutta method of fourth order - Milne's predictor - corrector method. Partial Differential Equations:
Finite difference approximation – solution of partial differential equations – Laplace equation – Liebmann's iteration process- Poisson's equation - parabolic equation – Bender-schmidt and Crank-Nicholson scheme – Hyperbolic equation. **(9)**

Total : 45

TEXT BOOKS:
1. Krishna Raju, N. and Muthu K.U., "Numerical Methods for Engineering Problems", Macmillan India Limited, 1990.
2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K., "Numerical Methods", S. Chand &Company Limited, 2005.

REFERENCE BOOKS:
1. Jain.M.K, Iyengar.S.R.K, and Jain.R., "Numerical Methods for Scientific and Engineering Computation", New Age International (P) Ltd, Publishers, 2004.
2. Scarborough.J.B, "Numerical Mathematical Analysis", Oxford and IBH Publishing Company, 1992.
3. Rajasekaran.S., " Numerical Methods in Science and Engineering (A Practical approach)", A.H. Wheeler & Co.1987.

Mapping of Course Outcome with Program Outcome

<table>
<tr><th colspan="16">Mapping of CO's and PO's</th></tr>
<tr><th rowspan="2">CO's</th><th colspan="15">PO's</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th></tr>
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13CE42 MECHANICS OF SOLIDS II

	L	T	P	C
	3	1	0	4

ASSESSMENT: THEORY
COURSE OBJECTIVES:
The subject of Mechanics of Solids cuts broadly across all branches of engineering profession. At the end of this course, the student will have knowledge about behaviour of members subjected to various types of forces. The subject can be mastered best by solving numerous problems.

COURSE OUTCOME:
CO1: The students will be able to explain the concepts in beams, cylinder and columns.
CO2: The students will be able to find the deflection and determinacy of beams.
CO3: The students will be able to understand the theory and behaviour of columns using various formula. It helps them to gain the knowledge of theory of failures.
CO4: The students will be able to understand concepts of unsymmetrical bending and shear centre.

DEFLECTION OF DETERMINATE BEAMS
Governing differential equation – Macaulay's method – Moment area method – Conjugate beam method. **(9)**

STATICALLY INDETERMINATE BEAMS
Analysis of propped cantilevers and fixed beams – Continuous beams -Theorem of Three moments.
CABLE STRUCTURES
Suspension cables - cables with two and three hinged stiffening girders. **(9)**

THEORY OF COLUMNS
Short columns -Stresses due to combined bending and axial Force - core of section – Elastic buckling of long columns- Euler's theory for long Columns - limitations of Euler's theory - Rankine's formula.**(9)**

THEORIES OF FAILURE
Maximum principal stress theory, maximum shear stress theory, strain energy theory, shear strain energy theory & maximum principal strain theory–Strain rosettes - Theories of failure and their Importance in design.
(9)
UNSYMMETRICAL BENDING AND SHEAR CENTRE
Significance of shear centre - Location of shear centre for Thin walled open sections with one axis of symmetry. Analysis of stresses and deflections due to unsymmetrical Bending. **(9)**

Theory :45
Tutorial : 15
Total : 60

TEXT BOOK
1.EgorP.Popov,"Introduction to Mechanics of Solids", Prentice Hall of India, New Delhi, 2003.
2. Beer F P, Johnston E R, DeWolf J T and Mazurek D, "Mechanics of Materials", McGraw-Hill Higher Education, 6th edition, 2011

REFERENCE BOOKS
1. Sadhu Singh, "Strength of Materials",KhannaPublishers,New Delhi, 2012.
2. Prakash Rao D.S., "Strength of Materials" Volume I, Universities Press (India) Limited., Hyderabad, 2002.
3. Lehri, RS.,Lehri., AS., "Strength of Materials", S K Kotaria& Press, New Delhi, 2009.
4. Timonshenko, S.P, Gere, J.M., "Mechanics of Materials", CBS Publishers, New Delhi, 2002.
5. Rajput,R.K., "Strength of Materials", S.Chand& Company Ltd., New Delhi, 2007.
6. Punmia BC, Ashok Jain and Arun Jain, "Strength of Materials and Theory of Structures" Vol 1, Laxmi Publications, New Delhi, 2000.
7. Bansal RK, "Strength of Materials", Laxmi Publications, New Delhi, 2010.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x		x				x				
2	x	x	x		x					x		x			x
3	x	x		x				x				x			
4	x	x	x		x		x				x			x	

13CE43   **APPLIED HYDRAULICS AND**
                HYDRAULIC MACHINERY

L	T	P	C
3	1	0	4

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To impart a thorough knowledge about the applications of fluid flow concepts in open channels and an understanding of hydraulic machines

COURSE OUTCOMES:
CO1: The students will be able to design pumps
CO2: The students will be able to design turbines and liquid Jets
CO3: The students will be able to design open channels carrying water

UNIFORM FLOW IN OPEN CHANNELS
Uniform flow – Chezy's equation – Manning's equation – hydraulically best section for rectangular, trapezoidal and circular channels – circular sections running partially full – Flow over notches and weirs – flumes   **(9)**

NON-UNIFORM FLOW IN OPEN CHANNELS
Non-uniform flow – critical depth – specific energy – flow characteristics – hydraulic jump – backwater curves – surges in channels   **(9)**

IMPACT OF JETS
Impulse momentum principle – its applications on impact of liquid jets on plates and vanes at rest and in motion – moment of momentum equation – its applications on plates and vanes mounted on wheels – jet propulsion   **(9)**

TURBINES
Classifications – Applications of Impact of Jets on Vanes to Turbines – velocity triangles – work done and efficiencies – Study of Pelton wheel, Francis turbine and Kaplan turbine – characteristics curves – performance of turbines – specific speed – unit quantities – model testing of turbines – selection of turbines   **(9)**

PUMPS
Classification - Centrifugal pumps – work done – minimum starting speed – NPSH – characteristic curves – multistage pumps – specific speed – model testing

Reciprocating pump – work done – effect of acceleration and friction on pressure head – maximum speed of the pump – air-vessels – work saved against friction   **(9)**

                                               Theory: 45
                                            Tutorial: 15
                                            Total: 60

TEXT BOOK:

1. Modi.P.N, &Seth.S.M., " Hydraulics, Fluid Mechanics & Hydraulic Machinery", Metropolitan Book Company, New Delhi, 2013.

REFERENCE BOOKS:

1. Bansal.R.K., "Text Book of Fluid Mechanics and Hydraulic Machines", M/s.Lakshmi Publications, Madras,2005.
2. Kumar.K.L, "Engineering Fluid Mechanics", M/s.S.Chand Co., Madras.2003.
3. Ramamrutham.S, "Fluid Mechanics, Hydraulics & Fluid Machinery", M/s.DhanpatRai& Sons, New Delhi, 1998.

4. Arora K.R., "Fluid Mechanics, Hydraulics and Hydraulic Machines", Standard Publishers & Distributors, 1998.

Mapping of Course Outcome with Program Outcome

Mapping of CO's and PO's															
CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X	X		X		X			X					
2	X	X	X		X		X			X					
3	X	X	X		X		X			X				X	

13CE44   SURVEYING – II

	L	T	P	C
	3	0	0	3

ASSESSMENT : THEORY
COURSE OBJECTIVES:
To impart knowledge about the measurements of heights and distances using tachometry, triangulation etc., to introduce the fundamentals of horizontal and vertical curves and also to introduce modern survey instruments like total station, GPS etc.

COURSE OUTCOME
CO1: Students will be able to understand to problems in the civil engineering field with rise of surveying applications.
CO2: The students will be able to work with modern surveying instruments with better operating knowledge and collect field notes with higher accuracy.
CO3: The students will be able to analyze errors in surveying measurements based on their sources.
CO4: The students will be able to design various types of curves for smooth travel and can also calculate the area of land parcels with linear, circular or irregular boundary segments.

TACHEOMETRY
Systems - stadia, tangential - principles, instruments required. Stadia system - fixed hair method - horizontal and inclined sights – staff held vertical -horizontal distance and elevation formulae-movable hair method- Determination of stadia constants of the tachometer - use of analytic lens.
Tangential system - subtense measurements - subtense bar, Tachometric Tables, Direct reading tacheometer.   **(9)**

TRIANGULATION
Introduction - different net works - Grades of triangulation – Signals and towers - Field work - selection of triangulation stations – inter visibility and heights of stations.
Base Line - Choice - instrument and accessories - Measurement of base line - corrections - Satellite stations – need reduction to centre.
TRIGNOMETRIC LEVELLING
Corrections - Curvature and refraction - Axis signal correction - methods of trignometrical levelling - single and reciprocal observations.   **(9)**

TRIANGULATION ADJUSTMENT
Terms and definitions used - laws of weights - true and most probable values - weighted observations.
Method of equal shifts - Principle of least squares - Normal equations.   **(9)**

HORIZONTAL CURVES
Horizontal curves - Elements of simple curve - setting out with chain and tape - with Theodolites by deflection angles - Obstructions in curve ranging, compound and reverse curve (Parallel tangents only) - Transition curves - different kinds - functions and requirements – setting out the combined curve by Theodolites.   **(9)**

VERTICAL CURVES AND MODERN SURVEYING TECHNIQUES
Vertical curves - summits and sags - setting out vertical curve by tangent corrections.
Principle uses and advantages of electronic theodolites and electronic distance meters. Basic principles of remote sensing - GIS - GPS.   **(9)**
                                                                                               Total : 45

TEXT BOOKS
1. Kanetkar, T.P. and Kulkarni, S.V.," Surveying and Levelling", Volumes I and II, Pune VidyarthiGrihaPrakashan, Pune 2011.

REFERENCE BOOKS
1. Mahajan, Santhos K., "Advanced Surveying", DhanpatRai& Sons, NaiSarak, Delhi, 1987.
2. Punmia,B.C.,"Surveying", Volumes I & II, Laxmi Publications, New Delhi, 2005.

3. Arora.K.R., "Surveying", Volume I, Standard Book House, Delhi-6, 2013.
4. Bannister A. and Raymond S., Surveying, ELBS, Seventh Edition, 1998.
5. Clark D., Plane and Geodetic Surveying, Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Sixth Edition, 2004.
6. Schofield,W., Engineering Surveying, Butterworth – Heinemann, London, Fifth Edition, 2001
7. Jack C. Mccormac, " Surveying", John Wiley & Sons, 2012.

Mapping of Course Outcome with Program Outcome

Mapping of CO's and PO's															
CO's	**PO's**														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X		X	X					X	X			X	
2	X				X		X			X	X			X	
3	X				X	X	X			X					
4	X	X	X	X	X					X	X		X		

13CE45 CONSTRUCTION TECHNOLOGY

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To impart knowledge about various types of foundations, masonry floors, stairs, roofs, doors and windows. It also provides knowledge regarding anti termite treatment, damp prevention, fire protection, acoustics and other techniques used in construction technology.

COURSE OUTCOMES:
CO1: The students will be able to acquire basic knowledge in constructing various types of buildings
CO2: The students will be able to earn knowledge in the construction materials and their usage in real time construction
CO3: The students will be able to plan and design the various types of buildings by using modern construction materials.

FOUNDATIONS
Introduction - Building components - site selection – Functions of foundations -Requirements of good foundation - Types of foundations- Selection, description and construction of Spread footing – Combined footing - Strap footing - Raft foundation - Grillage foundation –Types of piles - Pile driving - Under reamed pile foundation for black cotton soils. Setting out foundation - Excavation of foundation trenches -Timbering of trenches - Excavation in ground with sub-soil Water –Antitermite treatment - Pre-construction &post Construction treatment. **(9)**

MASONRY
Types of bonds in brickwork - Tools for brick laying - Supervision of brick work -Reinforced brick masonry. Dressing of stones - Tools used - Types of surface finishes - Appliances for lifting stones - Classification of stonemasonry - Joints in stone masonry -Concrete masonry - Types of concrete blocks - construction -Hollow clay block masonry. **(9)**

ROOFS AND FLOORS
Pitched roof - Lean to roof - couple roof – Couple close roof –Types of roof trusses and its erection- Purlins - Types of roof and roof coverings Drainage in roofs. Ground floors - Component of floors - materials for construction- Flooring Types - Upper floors - Steel joist and stone or precast slab floors - Jack arch floors. Causes and effect of dampness - Methods of damp proofing - Materials used for damp proofing course – Damp proof coarse treatment in buildings. **(9)**

STAIRS,DOORS AND WINDOWS
Requirement of a good stair - classification of stairs and its details -Construction details - Problems in Geometric design - Ramps, elevators and escalators. Types of doors and windows -Details. Formwork - requirements - shuttering for columns – Shuttering for beam and slab floor - Formwork for stairs & Walls. Shoring - underpinning - various types of scaffolding. **(9)**

PLASTERING,PAINTING AND INSULATION
Plastering and pointing - Tools for plastering - Methods of plastering - - Types of plastering-Defects in Plastering - Different types of pointing. Painting,varnishing & Distempering. Fire protection - Fire resisting properties of common building materials - Fire safety equipment's for buildings – Thermal Insulation and sound insulations. **(9)**

Total: 45

TEXT BOOK:
1. Punmia.B.C, "Building Construction", Laxmi Publications Pvt.Ltd, New Delhi, 2003.

REFERENCES BOOKS:
1. Sharma.S.K and Kaul.B.K, "Building Construction", S.ChandandCo., New Delhi , 1987.
2. Sushil Kumar., "Building Construction", Standard Publishersdistributors, New Delhi, 1998.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x			x	x		x				x
2	x	x	x			x			x		x	x		x	x
3	x	x	x			x			x	x	x	x	x		

Mapping of CO's and PO's

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To learn the design of structural components made of steel, timber and masonry.

COURSE OUTCOMES:
CO1: *The students will be able to design masonry walls, timber beams and columns, tension, compression member, beam and plastic analysis as per the current I.S codes.*
CO2: *The students will be able to analyze and understand the behaviour of structural elements.*
CO3: *The students will be able to make changes in design depending upon the availability of materials.*
CO4: *The students will be able to interpret the structural design of different elements.*

DESIGN OF BRICK MASONRY STRUCTURES
Classification of masonry structures - Design considerations of brick masonry -Permissible stresses. Load bearing walls - Non-load bearing walls. Design of load bearing walls and Columns – Pressure calculation for masonry walls. **(9)**

DESIGN OF TIMBER STRUCTURES
Properties of structural timbers - Factors affecting the Strength - Permissible stresses - Grading of timber. Joints in timber structures - Design of bolted, nailed joints. Timber beams (rectangular) - Solid columns - Combined bending and direct stress. **(9)**

CONCEPTS OF STRUCTURAL STEEL DESIGN
Working Stress Design – Limit State Design - Stress–strain relation of Mild steel – Modified stress-strain diagram – Assumptions in Plastic theory – Collapse load – load factor – plastic bending – Plastic hinge – Plastic moment of resistance – Plastic modulus – Shape factor – Plastic Analysis – Kinematic theorem, Static theorem and Uniqueness theorem – Propped cantilevers – Fixed beams and Continuous beams – Portal Frames **(9)**

CONNECTIONS
Bolted and welded connections for axial forces- eccentric connections with bolt and weld. **(9)**

TENSION AND COMPRESSION MEMBERS
Design of tension members subjected to axial tension- tension member subjected to bending – lug angles. Design of compression members with single rolled steel sections – Angle struts.
BEAMS
Design of Simple beams (laterally supported) of rolled sections for flexure, shear, web crippling and buckling and deflection. **(9)**

Theory : 45
Tutorial : 15
Total : 60

TEXT BOOKS
1. Arya.,."Structural Design in Steel, Masonry and Timber", Nem Chand and Bros, Roorkee, 1988.
2. Ramchandra, VirendraGehlot, "Limit State Design of Steel Structures", Scientific Publishers, Jodhur, 2010.
3. Bhavikatti.S.S. "Design of steel structures by Limit State Design", I.K International Pvt.Ltd., 2009.

REFERENCE BOOKS
1. Subramanian.N,"Design of Steel Structures",Oxford University Press,New Delhi,2008.
2. IS: 1905 – Code of Practice for Structural use of Unreinforced Masonry, 1987.
3. SP 20 (S & T),"Hand Book on Masonry Design and Construction", Bureau of Indian Standards, 1991.
4. S.P.6 (1), ISI "Hand Book for Structural Engineers – Structural Steel Sections, BIS, 1964.
5. IS: 883, "Code of Practice for Design of Structural Timber in Building", Bureau of Indian Standards, 1994.
6. IS: 2366, "Code of Practice for Nail- Jointed Timber Constructions", Bureau of Indian Standards, 1983.

7. IS: 800, "Code of Practice for use of Structural Steel in General Building Construction", Bureau of Indian Standards , 2007.
8. IS: 816," Code of Practice for Used of Metal arc Welding in General Construction in Mild steel, Bureau of Indian Standards , 1969.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x		x		x						x				
2	x	x	x		x					x					
3				x	x		x								
4					x		x			x	x				

13CE47 SURVEY PRACTICAL II

	L	T	P	C
	0	0	3	2

ASSESSMENT: PRACTICAL
COURSE OBJECTIVES:
To impart knowledge about practical applications and solutions of surveying both in the field and construction industries.

COURSE OUTCOMES:

CO1: The students will be able to practically apply various simple and advanced surveying techniques, both in field and construction industries

CO2: The students will be able to design the course of a traverse, calculate the bearings and azimuths of the sides and calculate the adjusted coordinates of the stations

CO3: The students will be able to calculate the heights and distances of an object using various principles

CO4: The students will be able to mark the foundation of a building

LIST OF EXPERIMENTS:

1. Study of Theodolites.
2. Electronic Distance Meter.
3. Theodolite - Measurement of Horizontal and Vertical angles.
4. Theodolite traverse - closed traverse and open traverse.
5. Heights and Distances - Using base line of known length.
6. Heights and Distances - Using the stadia Tachometric principles.
7. Heights and Distances - Using Tangential Tacheometry -Sub tense bar.
8. Setting out simple curve - by chain and tape method.
9. Setting out a building - Foundation marking.
10. Demonstration of Electronic Total station, Electronic Planimenter

Mapping of Course Outcome with Program Outcome

Mapping of CO's and PO's															
CO's	**PO's**														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X	X	X	X					X	X			X	X
2	X	X	X	X	X					X	X			X	X
3	X	X	X	X	X		X			X	X			X	X
4	X	X	X	X	X		X			X	X			X	X

13CE48 HYDRAULIC MACHINERY LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT: PRACTICAL
COURSE OBJECTIVES:
To impart knowledge about practical applications of concepts of Fluid Mechanics and Machinery.

COURSE OUTCOMES:
CO1: The students will be able to find out the performance of various pumps
CO2: The students will be able to find out the performance of various turbines
CO3: The students will be able to find out the efficiency of impact of jets on vanes
.

LIST OF EXPERIMENTS:

1. Impact of jets on Vanes
2. Performance study of Single stage Centrifugal Pump
3. Performance study of Two stage Centrifugal Pump
4. Performance study of Three stage Centrifugal Pump
5. Performance study of Jet Pump
6. Performance study of Submersible Pump
7. Performance study of Reciprocating Pump
8. Performance study of Gear oil Pump
9. Performance study of Impulse Turbine
10. Performance study of Reaction Turbine

Mapping of Course Outcome with Program Outcome

Mapping of CO's and PO's															
CO's	**PO's**														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X		X	X		X			X	X				
2	X	X		X	X		X			X	X				
3	X	X		X	X					X	X				

13CE49   **SCIENCE OF CREATIVITY AND**   **L**   **T**   **P**   **C**
               PROFESSIONAL ETHICS   **2**   **0**   **0**   **2**

ASSESSMENT: THEORY
COURSE OBJECTIVE:
To inculcate among the students the importance of spirituality, yoga and procedures to manage stress and strain. To impart the knowledge of professional and management skills.

COURSE OUTCOMES:

CO1: The students will be able to manage stress and strain in their profession in future.

CO2: The students will have knowledge of introspection procedures, practical considerations and guidelines for their living.

CO3:The students will understand the principles of professional ethics,

CO4: The students will be active in the areas of protecting the public health, safety and welfare of people, respect the copyright and patents.

CO5:The students will be able to understand the impact of social sciences and humanities on the quality of life and physical environment..

INTRODUCTION
Science of creativity and personality development – objectives – evolution of the universe - **c**reation theory – evolution theory – theory of permanence– theory of mithya – big-bang theory – static and dynamic States – ethereal particles - panchabhudas – evolution of life **-** science and spiritualism – physical transformation of biomagnetism - harmony in life – self, family,society and nature - cause and effect system.   **(6)**

LIFE FORCE, MIND AND CONCIOUSNESS
Life force – origin – potentiality of the life force – pathway to realize universal force - premordial state - almighty – mind – existence andpurpose of mind – greatness and mystery - role of mind in shaping one's personality - ten stages – totality – wisdom – consciousness - sixth sense– action, word and deed – six temperaments.   **(6)**

TECHNIQUES FOR SELF EVALUTION
Blockades for personality development – six impurities - introspection –analysis of thought – moralization of desire –eradication of worries –neutralization of anger – realization of self or actualization of the universe– understanding of morality, duty and charity – yoga - different types - kundalini yoga – nine centers – removal of six imprints – meditation and its benefits.   **(6)**

HUMAN BODY
Body structure – endocrine glands and six chakras – seven thadus – health and nature – medicines - understanding the need, habit, environmental conditions, society and evolutionary process of life – physical exercise and its importance – regulating food, work, rest, sex and thought.   **(6)**

PROFESSIONAL ETHICS
Engineering Ethics – variety of moral issues – moral autonomy – professions and professionalism - professional ideals and virtues – engineers as responsible experiments – safety and risk – reducing risk – collegiability and loyalty – professional rights – intellectual property rights – multinational corporations – environmental ethics – engineering as managers.   **(6)**
                                             Total: 30

TEXT BOOKS
1. YogirajVethathri Maharishi, "Karma Yoga – The Holistic Unity", Vethathri Publications, 1986.
2. Mike Martin and Roland Schinzinger,"Ethics in Engineering", McGraw Hill, NewYork2004.

REFERENCE BOOKS

1. Charles D. Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999.
2. Laura Schlesinger, "How Could You Do That: The Abdication of Character, Courage, and Conscience", Harper Collins, NewYork, 1996.
3. Stephen Carter, "Integrity", Basic Books, NewYork, 1996.
4. Tom Rusk, "The Power of Ethical Persuasion: From Conflict to Partnership at work and in Private Life", Viking, NewYork, 1993.2. Laura Schlesinger, "How Could You Do That: The Abdication of Character, Courage, and Conscience", Harper Collins, NewYork, 1996.
5. Naagarazan R.S., "A Textbook on Professional Ethics and Human Values", New Age International Publishers, New Delhi, 2009.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1				x		x		x					x	x	
2						x		x					x		
3				x		x		x	x				x	x	
4				x									x		
5						x		x						x	

13CE51 TRANSPORTATION ENGINEERING I

	L	T	P	C
	3	0	0	3

ASSESSMENT: THEORY

COURSE OBJECTIVES:
To impart basic concepts in highway planning, geometrics, construction and traffic engineering.

COURSE OUTCOMES:

CO1: *The students will be able to analyse the present situation of the road network and to rectify the realignment according to the necessary condition*
CO2: *The students will be able to compute the highway geometrical design*
CO3: *The students will be able to analyse the various characteristics of highway materials and test this quality*
CO4: *The students will be able to determine the present and future demand of the road traffic*
CO5: *The students will be able to apply the various traffic measures and control in real world.*

HIGHWAY PLANNING
Role of IRC, CRRI and NHAI-Classification of roads-Road patterns-Planning Surveys-Master Plan and Phasing of master plan- Highway alignment –Factors –Engineering surveys-Drawings and reports –Highway project-New and re alignment project. Maximum dimension of road vehicles and loaded weight-Passenger Car Units- Pavement failures –Flexible and rigid-Types-Causes-Maintenance-Pavement evaluation. **(9)**

HIGHWAY GEOMETRIC DESIGN
Cross section elements –Friction, roughness, light reflecting characteristics-camber-Width of carriage way, medians-Kerbs-Road margins-Cross section of roads in embankment and cutting –Width of formation IRC standards-Right of way-Recommended road width for different classes of roads-Sight distance-Design of Horizontal Alignments-Design Speed-Radius of Horizontal Curves-Super elevation- Widening of pavement on horizontal curves-Transition curves-Types- Length-Examples. Design of vertical alignment-Gradient-Types-Gradient for different terrains-Vertical curves –Summit curves, Valley curves- Examples. **(9)**

MATERIALS
Properties of road aggregates and tests – Bituminous materials – Types- Requirements – Tests-Bituminous mixes- Pavements –Flexible –Rigid –comparison-Soil subgrade, sub base and base course, wearing course and their evaluation. Highway construction – Earthwork and preparation of subgrade- Bituminous pavements – Types –Construction procedure.Construction of cement concrete pavement. **(9**)

TRAFFIC ENGINEERING
Scope- Characteristics- Road user-Vehicle-Traffic studies – Volume, Speed, Origin and Destination, Capacity, Parking and Accidents. **(9)**

TRAFFIC OPERATIONS
Traffic regulations- Traffic control devices - Traffic signs – Traffic signals - Road markings - Traffic islands - Control of access on highways - Design of intersections - Grade separated intersections - Express ways. **(9)**
Total: 45

TEXT BOOKS:
1. Khanna.S.K and Justo.C.E.G.,"Highway Engineering" , Khanna Publishers, Roorkee, 2001.

REFERENCE BOOKS:

1. Sharma S.K., "Principles, Practice and Design of Highway Engineering", S.Chand&co., New Delhi, 2012.
2. Kadayali., "Principles, Practice and Highway Engineering", Khanna Publishers, New Delhi, 2007.
3. Smith T.N and Hurd E.W "Traffic Engineering", McGraw Hill, New Delhi, 2003.
4.IRC Codes 15-2002, 37-2001, 38-1988, 52-1988, 62-1976, 66-1976, 73-1980, 58-2002 & IRC SP 23-1993.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X			X					X	X	X	X		
2	X	X			X							X	X		
3	X	X			X						X	X	X		
4	X	X			X							X	X		
5	X	X	X		X			X			X	X	X	X	

13CE52 STRUCTURAL ANALYSIS I

L	T	P	C
3	1	0	4

ASSESSMENT: THEORY
COURSE OBJECTIVES:
At the end of the course the student should be able to understand the different concepts of the analysis like equilibrium, energy approach, basics of arches, moving load concept on bridges, and basics of the force method using consistent deformation method.

COURSE OUTCOME:
CO1: *The students will be able to explain the basic concepts in structural analysis.*
CO2: *The students will be able to understand the various energy principles and apply them in structures.*
CO3: *The students will be able to analyse structures with moving loads and draw influence line diagrams.*
CO4: *The students will be able to analyse arches, statically indeterminate beams and trusses.*

FUNDAMENTALS OF STRUCTURAL ANALYSIS
Determination of static indeterminacy and kinematic indeterminacy-Deficiency for beams, frames and pin jointed trusses - Behaviour of Structures - Principle of superposition- Analysis of Pinjointed space trusses by Method of Tension coefficient. **(9)**

ENERGY CONCEPTS
Energy principles - Strain energy - Complementary energy - Principle of Virtual work - Principle of virtual displacement and virtual force - Castigliano's Theorems - Engessor's Theorem - Maxwell Betti's Theorem - Application of the above principles to find the deflections of statically determinate beams and plane trusses-Theorem of least work- Analysis of statically indeterminate beams (upto 2 degrees). **(9)**

MOVING LOADS AND INFLUENCE LINES
Moving loads - Absolute maximum shear force and bending moment in simply supported beams - Determination of equivalent UDL - influence lines for shear force, bending moment and reactions in statically determinate beams and influence lines for forces in members of statically determinate plane trusses - Reversal of forces in members of plane trusses. Influence lines for shear force, bending moment and reactions in statically indeterminate beams by Muller-Breslau's Principle - Application of Muller Breslau Principle to beams with degree of static indeterminacy not exceeding one. **(9)**

ANALYSIS OF ARCHES:
Analysis of three hinged arches of parabolic and circular profiles – Analysis of two hinged symmetric parabolic and circular arches. Settlement and temperature effects - Influence lines for bending moment, normal thrust and radial shear at sections of an arch. **(9)**

CONSISTENT DEFORMATION METHOD:
Application of Consistent Deformation method to the analysis of statically indeterminate beams and statically indeterminate plane trusses subjected to loads, lack of fit settlement and temperature effects - Analysis of Trussed Beams. **(9)**

Theory : 45
Tutorial : 15
Total : 60

TEXT BOOKS:
1. Guptha.S.P and Pandit.G.S, "Theory of Structures,Vol.I& II", Tata McGraw Hill, New Delhi, 2012.
2. Rajasekaran.S and Sankarasubramanian. G., "Computational Structural Mechanics" Prentice Hall of India, New Delhi, 2012.
REFERENCE BOOKS:
1. Bhavikatti.S.S, "Structural Analysis" Vol.I& II, Vikas Publishing House (P) Ltd., New Delhi, 2011.
2. Prakash Rao., D.S., "Structural Analysis", Universities Press, Hyderabad, 2001.
3. Armenakas.A.E., "Classical Structural Analysis" Mc-Graw Hill Book Co., NewYork, 1995.
4. Reddy.C.S, "Basic Structural Analysis", Tata Mc-Graw Hill, New Delhi, 2012.
5. Junnarkar and Shah., "Mechanics of Structures" Vol.II, Charotar Publishing House, Anand, 2012.

6. Punmia.B.C and A.K.Jain "Strength of Materials and Theory of Structures", Vol.II, Laxmi Publications, New Delhi, 2005.
7. Wang.C.K, "Intermediate Structural Analysis", Tata Mc-Graw Hill, New Delhi, 2010.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X	X		X		X			X					
2	X	X	X		X		X			X					
3	X	X	X		X		X			X					
4	X	X	X		X		X			X					

The table above has a merged title header "Mapping of CO's and PO's" spanning all columns.

13CE53 MECHANICS OF SOILS

	L	T	P	C
	3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
Undergoing this course enables the student to gain adequate knowledge on engineering properties of soil.
COURSE OUTCOMES:
CO1: *The students will be able to Understand the type, properties and behaviour of soil.*
CO2: *The students will be able to understand the concept of application of laws of mechanics in soil engineering.*
CO3: *The students will be able to test the soil for the estimation of stress, strength and safety.*
CO4: *The students will be able to analyse the structure built using soil.*

INTRODUCTION
Soil formation and soil types – Civil engineering problems related to soils – Nature of soil – Simple definitions – Phase relationships – Classification – IS Classification system. Compaction – Factors affecting compaction – Laboratory and field compaction methods.   **(9)**

SOIL WATER
Principles of water flow – Darcy's law – Permeability – Laboratory Methods – Field measurement of permeability – Effective stress concept – Dry and saturated soils.   **(9)**

STRESS DISTRIBUTION AND CONSOLIDATION
Stress distribution in soil media – Bousinesq's Analysis – Westergaard's Analysis – Intensity of vertical stress using influence charts. Consolidation – measurement of compressibility – e-log P curves – Terzaghi's one dimensional consolidation theory – Determination of coefficient of consolidation   **(9)**

SHEAR STRENGTH
Shear at a point – Mechanism of shear resistance – Mohr– Coluomb failure criterion – measurement of shear strength – Direct shear test – Triaxial shear test – Unconfined compression strength test - Vane shear test – Shear strength of clay soil – Shear strength of sand.   **(9)**

STABILITY OF SLOPES:
Types of slopes – Stability of infinite slope – Stability of Finite slope – Total stress Analysis – Swedish circle method – Use of Taylor's stability number – Slope failure mechanicsm – Effect of Tension cracks.   **(9)**

Total : 45

TEXT BOOKS:
1. Gopal Ranjan and Rao, ASR, "Basic and Applied Soil Mechanics" New Age International (P) Limited Publication, New Delhi, Second Edition, 2010.
2. Venkataramaiah, "Geotechnical Engineering", New Age International Ltd., New Delhi Third Edition, 2012.
3. Punmia , B.C, "Soil Mechanics and Foundation Engineering", Laxmi Publications, New Delhi, Sixteenth Edition, 2005.

REFERENCE BOOKS:
1. Alam Singh, "Modern Geotechnical Engineering", IBS Publications, New Delhi, 2010.
2. Muni Budhu,"Soil Mechanics and Foundation Engineering", Wiley India Publication, New Delhi, Second Edition, 2010.
3. Braja M. Dass and Khaled Sobhan " Principles of Geotechnical Engineering" Cengage learning, 2013.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1		X		X	X		X				X				X
2	X	X	X		X		X			X		X			
3	X	X		X		X				X					
4	X	X	X	X	X		X		X	X	X			X	

13CE54 DESIGN OF R.C STRUCTURAL ELEMENTS

L	T	P	C
3	1	0	4

ASSESSMENT: THEORY
COURSE OBJECTIVES:
The course will focus on explaining the background of current design specifications for reinforced concrete structures.
COURSE OUTCOMES:
CO1:*The students will be able to define problems for design of reinforced concrete elements that meet code requirements based on strength, stiffness and serviceability considerations.*
CO2: *The students will be able to design slabs as per IS codal Provisions*
CO3: *The students will be able to understand the concepts on detailing and various methods in design*

INTRODUCTION
Materials for concrete - Stress - Strain curve for concrete in compression - Concrete mix proportioning - Design concrete mix and nominal concrete mix - Types of reinforcement Specifications as per IS1786 : 2008 - Plain and deformed bars - Stress - strain curve for reinforcing steel. Concept of WSD (No problems) and LSD – Difference between WSD and LSD - Characteristic loads and strengths – partial safety factor - Various limit states. Design for Flexure by LSD **-** Design of singly and doubly reinforced rectangular and flanged sections - Design of lintels – detailing.   **(9)**

DESIGN FOR SHEAR, BOND AND TORSION:
Design for shear - concept of bond and anchorage - Design for torsion - IS code provision for the design of beams – Design of continuous beams using B.M. and S.F. coefficients as per IS code - detailing.   **(9)**

DESIGN OF SLABS:
Types of slabs - IS code regulations - Stiffness requirements - Design of one-way simply supported and continuous slab using BM and SF co-efficient as per IS code - Principles of Rankine - Grashof's method (no problems) - design of two way, simply supported and continuous slab as per IS code – Detailing. Design of staircase slab - Design of waist slab for dog-legged stair case - Detailing of Tread– Riser type of stair case (Concept only) – Detailing. Design of flat slab as per IS 456-2000-Detailing   **(9)**

DESIGN OF COLUMNS
IS-code regulations - Design of short rectangular and circular columns subjected to axial compressive load - Design of short columns subjected to combined axial compressive load and uni-axial and biaxial bending moments using Design Aids (SP 16) – Design of long columns - Detailing.   **(9)**

DESIGN OF FOOTINGS
Design of wall footings - Design of isolated, square and rectangular footings. - Combined rectangular and trapezoidal footings – Detailing.   **(9)**

Theory : 45
Tutorial : 15
Total : 60

TEXT BOOKS:
1. Unnikrishna Pillai and Devados Menon, "Reinforced Concrete Design", Tata Mc Graw Hill Publishing Co, New Delhi, 2011.
2. Ashok K Jain, "Reinforced Concrete Limit State Design". New Chand Bros, Roorkee, 2012.

REFERENCE BOOKS:
1. Purusothaman.P, "Reinforced Concrete Structural Elements Behaviour Analysis and Design", Tata McGraw hill Publishing Co., Limited, New Delhi, 1987.
2. Park.R and Paulay T., " Reifnorced Concrete Structures", John Wiley and Sons, New York, 1975.

3. Sinha, N.C., and Roy, S.K., "Fundamentals of Reinforced Concrete", S.Chand and Company, New Delhi, 2013.
4. Sinha,S.N., "Reinforced Concrete Design", Tata Mc Graw – Hill Publishing Co, Ltd., New Delhi, 2012.
5. MacGregor J.G., "Reinforced Concrete Mechanics and Design", Prentice Hall, New Jersey, 2011.
6. Varghese,P.C, "Limit State Design of R.C.Structures", Prentice Hall of India, 2001.
7. Mallick,S.K., and Gupta, A.P., "Reinforced Concrete", Oxford & IBH Publishing Co., New Delhi, 2012.
8. IS: 456 - 2000 Indian Standard Code of Practice for Reinforced Concrete, Bureau of Indian Standards, New Delhi.
9. SP- 16 – 1980 Design Aids for reinforced Concrete, Bureau of Indian Standards, New Delhi.
10. SP - 34 – 1987, Hand Book on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x			x			x				
2	x	x	x					x			x				x
3	x	x	x					x			x				x

13CE55 WATER SUPPLY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
This course aims at exposing the students of Civil Engineering about the Water Quality and its perspectives in dwelling regions.
COURSE OUTCOME:
CO1: The students will be able to understand various water supply perspectives.
CO2: The students will be able to demonstrate various sources of water and their yield.
CO3: The students will be able to explain ways of transmitting water and their treatment.
CO4: The students will be able to understand various methods of storage and distribution of water.

WATER SUPPLY PERSPECTIVES
Objectives of public water supply scheme - Components of water supply project and scheme – Planning and financial aspects – Design period - Water quality parameters: physical, chemical, and biological - MTFT and MFT tests - MPN and Thomas formulae- Water analysis and drinking water standards of India - Population forecasts: short and long term methods - Water demands and variation in demand pattern- Fire demand and MUDM formulae. **(9)**

SOURCES OF WATER
Surface and ground water sources - Factors to be considered - Assessment of capacity of impounding reservoirs: Mass in-flow curve and analytical methods- Elementary ground water hydrology -
Assessment of yield of wells by steady-state methods (no derivation) – Field testing of wells for the yield – Construction, development and sanitary protection of wells – Intake structures and their selection. **(9)**

TRANSMISSION OF WATER
Different categories of pipes used in transmission – Analysis and design of pressure pipes – Application of nomograms in the design - Pipe materials and their selection - Laying, jointing and testing of pipes – Pumping of water and selection of pumps – HP requirements and operating point of pumps – pumping station and its requirement – Various valves used in transmission. **(9)**

TREATMENT OF WATER
Unit operations and unit processes - Conventional and unconventional treatment units - Objectives, principles, operation , analysis and design of flash mixer, flocculator, sedimentation and rapid- sand filtration units - Objectives and principles of disinfection - Chlorination and its methods – Principles, objectives, and operation of aeration, water softening, iron and manganese removal and fluoride removal. **(9)**

STORAGE AND DISTRIBUTION OF WATER
Necessity and classification of storage tanks - Ground level and elevated reservoirs - Balancing and distribution reservoirs- Location and assessment of capacity of distribution reservoir - Methods and systems of distribution of water - Objectives, requirements and functions of a distribution network- Application, merits and demerits of various types of distribution networks - Analysis and design of distribution network by equivalent pipe method and Hardy-Cross method of balancing – Maintenance and leak detection - Corrosion and its control - Langelier saturation index(LSI) - Appurtenances in distribution network and in buildings. **(9)**

Total: 45

TEXT BOOKS:
1. Garg S.K. "Environmental Enginnering (Vol-I) Water Supply Engineering", Khanna Publishers, New Delhi, 2010.
2. Birdie G.S, "Water Supply and Sanitary Engineering",DhanapatRai Publications, New Delhi, 2000.

REFERENCE BOOKS
1. Raju , B.S.N , "Water Supply and Waste Water Engineering",Tata McGraw – Hill Co, New Delhi ,1995.
2. Duggal,K.N., "Elements of Environmental Engineering", S.CHand& Co, New Delhi, 2002.

3. Punmia B.C, Ashok Jain and Arun Jain, "Water Supply Engineering", Laxmi Publications - Pvt. Ltd., New Delhi, 2004.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x	x	x	x		x	x				
2	x	x	x		x	x	x	x		x	x				
3	x			x	x	x	x	x		x	x	x		x	
4	x			x	x	x	x	x		x	x	x		x	

13CE56 COMPUTER AIDED BUILDING DRAWING

L	T	P	C
1	0	3	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To enable the students to develop manual and computer Aided Drafting skills for planning.
COURSE OUTCOME:
CO1: *The students will be able to develop manual and computer Aided Drafting skills for planning.*
CO2: *The students will be able to demonstrate architectural drafting techniques*
CO3: *The students will be able to work with various other drawings like plumbing and electrical layouts.*

DRAFTING TECHNIQUES
Architectural lines and pencils used - Architect's scales, templates, flexible rules, overlays, under lays - Architectural lettering - Layout of Architectural Drawing for presentation and submission.   **(8 + 12)**

BASIC HOUSE DESIGN
Concept of one, one and half and two storey - Split level design. Study of Function, location, shape and size and planning of the following building areas.
- Living areas - living rooms, dining room entry way, foyer, patios and porches.
- Sleeping areas - bedrooms with and without attached toilets.
- Service areas - Kitchen, cabinets, Toilets, washing places, garages.
- Fixing the size of doors, windows and sunshades.   **(8 + 12)**

PREPARATION OF DRAWINGS
Detailed drawings of floor plans, elevations and sections to show various features in a building. Preparation of plot plans with a study of property lines – location of building on the site - Landscape plot plans with topo sketches (contour maps)   **(7 + 11)**

PREPARATION OF WORKING DRAWINGS
Detailed drawings of different types of doors, windows with specifications.
Detailed layout design and drawing of different types of staircases.
Detailed planning and drawing of electrification and Plumbing layout in buildings.
Preparation and submission of building drawing using AutoCAD.   **(7 + 10)**
Total: 30+45 = 75

TEXT BOOK:
1. Shah.M.G, Kale.C.M and Patki.S.Y, "Building Drawing", Tata McGraw Hill Book Co., 2004

REFERENCES BOOKS:
1. CloisE.Kicklighter., "Architecture, Residential Drawing and Design", The Good Heart - Willcox Company Inc., 2000.
2. Donald E. Hepler and Paul I. Wallach., "Architecture, Drafting and Design", Tata McGraw Hill Book Co., New Delhi, 1998.

* NOTE: Final Examination will be of 4 Hrs. duration and evaluation will be done by two internal examiners. Continuous assessment pattern will be followed.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	X		x		x		x		x				
2	x	x	X	x	x	x		x	x	x	x				x
3	x	x	X		x		x		x		x				

13CE57 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT: PRACTICAL
COURSE OBJECTIVE:
To study the properties of materials subjected to different type of loading.

COURSE OUTCOME:
CO1: The students will be able to test the materials for different kinds of loading.
CO2: The students will be able to analyse the behaviour of different material under different loading.
CO3: The students will be able to understand the failure pattern of various materials under different loading.

TESTS ON METALS
Tension, Shear, bending, and hardness tests on metal specimens and deflection test on spring.

TESTS ON TIMBER
Tension, Compression, bending, cleavage, hardness and impact tests on wooden specimens.

TESTS ON BRICK
Compression test on brick specimens – Water absorption – Efflorescence.

REFERENCE BOOKS:

1.Rajput.R.K, "Strength of Materials", S.K Kataria and Sons, New Delhi, 2007.

2. I.S: 3495 Part I to IV – 1976, "Methods of Test for Burnt Clay Building Bricks", Bureau of Indian Standards, New Delhi.

Mapping of Course Outcome with Program Outcome

<table>
<tr><th colspan="16">Mapping of CO's and PO's</th></tr>
<tr><th rowspan="2">CO's</th><th colspan="15">PO's</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th></tr>
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13CE58 HIGHWAY ENGINEERING LABORATORY

	L	T	P	C
	0	0	3	2

COURSE OBJECTIVES:
It is imperative to carryout tests on pavement materials like aggregate and bitumen for the scientific designing and economic utilization. Different tests are carried out to know and classify the pavement materials into different groups depending upon their physical strength and stability characteristics.

COURSE OUTCOMES:
CO1: *The students will be able to carry out different tests and classify the pavement materials into different groups depending upon their physical strength and stability characteristics.*
CO2: *The students will be able to work with all equipments usable for highway engineering.*
CO3: *The students will be able to understand the results obtained and apply in fields.*

1 TESTS ON COARSE AGGREGATE
1) Los Angeles Abrasion Test
2) Impact Test
3) Shape Test
4) Water Absorption and Specific Gravity Test.
5) Sieve Analysis Test
6) Bulk Density Test

2 TESTS ON BITUMEN
1) Ductility Test
2) Viscosity Test
3) Softening Point Test
4) Penetration Test
5) Binder Content Test

REFERENCE BOOKS:
1. Highway Material Testing – S.K.Khanna& C.E.G. Justo, 2007.
2. Bureau of Indian Standard Code of Practice for
   Particle Size andShape IS 2386 – Part I
   Specific gravity, Density, Voids, Adsorption and Bulking IS 2386 –   Part III
   Mechanical Properties IS 2386 – 1963 Part IV
   Soundness IS 2386 -1963 Part V

Mapping of Course Outcome with Program Outcome

Mapping of CO's and PO's															
CO's	**PO's**														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x			x						x				
2	x	x	x							x	x	x			
3	x	x	x							x	x	x			

13CE61 TRANSPORTATION ENGINEERING II

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES
To impart the engineering concepts in railways, airport and harbour.

COURSE OUTCOMES:
CO1: *The students will be able to analyse the present situation of the rail network alignment and to study the realignment according to the necessary condition*
CO2 : *The students will be able to compute the Railway geometrical design*
CO3 : *The students will be able to determine the runway wind flow diagram and runway geometrics*

INTRODUCTION AND ELEMENTS OF RAILWAY ENGINEERING
Comparison of railway and highway transport – organization of Indian railways – Railway board – Zonal railways, different production units, undertakings, organizations, divisions- railway terminology – Permanent way – Gauges – Railway Track cross section – coning of wheels – Rails – Sections – Length – failures, wear on rails – Long Welded Rails - Rail joints – Creep – effects- remedies – Sleepers – Track fitting and fastenings –Ballast – Sub grade and Embankment –
Track alignment- Surveys. **(9)**

GEOMETRIC DESIGN OF RAILWAY TRACK
Gradients – speed, degree of curves, super elevation and cant deficiency – Negative super elevation- Curves – points and crossings –necessity –Turnouts – Switches – types of switches crossing –components, types – Sleeper at points and crossings. **(9)**

SIGNALS AND CONTROLS OF RAILWAY
Stations and yards – requirements, classification, layout of station – Platform – Loops, siding and level crossing – Loco sheds – Derailing switches, Fouling marks, Butter stop – Sand hump – Signalling – Object engineering principles – classification and types – interlocking of signals and points. **(9)**

AIRPORT
Role of ICAO, FAA, DGCA and AAI – Aircraft characteristics – Airport site selection – Surveys – Drawings – Orientation of Runway, wind rose diagram – ICAO classification of Airports – Runway geometrics – corrections for length – Taxiway geometrics – Layout of airports, Apron, Hangar – Airport markings and Lightings – Air traffic control – ILS. **(9)**

HARBOUR
Definitions: Harbour, port, marine terminal, offshore mooring, anchorage area, turning basin, length, beam, draft, load line, dead weight tonnage, warehouse, Transit shed – Planning, site selection - layout of harbours – classification of harbours – Break water classification and sections of different types of break waters – Docks – Jetty, quay, quay wall – Dolphins – fenders – navigational aids-necessity and types. **(9)**

Total: 45

TEXT BOOKS:
1. Saxena.S.C and Arora.S.P, "A Text book of Railway Engineering", DhanpatRai Publications, New Delhi, 2005.
2. Khanna .S.K. and Arora M.G., "Airport Planning and Design", Nem Chand and Bros., Roorkee, 1994.
3. Oza and Oza., "Elements of Dock and Harbour Engineering", Charotar Publishing House, Anand, 1992.

REFERENCE BOOKS:
1. Robert Horonjett., "The Planning and Design of Airports", McGraw Hill Book Co., 1963.
2. Quinn, "Design and Construction of Port and Marine Structures", McGraw Hill, 1956.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X			X					X	X	X	X		
2	X	X			X							X	X		
3	X	X			X							X	X		

13CE62 STRUCTURAL ANALYSIS II

L	T	P	C
3	1	0	4

ASSESSMENT: THEORY
COURSE OBJECTIVES:
At the end of the course the student should be able to understand the moment distribution methods, slope deflection methods, matrix flexibility and matrix stiffness method and basics of finite element method
COURSE OUTCOMES:

CO1: *The students will be able to understand the analysis of statically indeterminate beams and plane frames using slope deflection method and moment distribution method.*
CO2: *The students will be able to explain the analysis of simple determinate and indeterminate beams, frames and trusses using matrix flexibility method.*
CO3: *The students will be able to analyse simple determinate and indeterminate beams, frames and trusses using matrix stiffness method.*
CO4: *The students will be able to explain the basic concepts in finite element method.*

SLOPE DEFLECTION METHOD
Application of slope deflection method to the analysis of statically indeterminate beams and rigid jointed plane frames - Effects of settlement of supports for beams only (Examples on structures having Kinematic indeterminacy not exceeding three). **(9)**

MOMENT DISTRIBUTION METHOD
Stiffness and carry over factors for prismatic and non prismatic members - Application of the method to the analysis of continuous beams and rigid jointed plane frames - effects of settlement of supports - Symmetric and skew symmetric loadings – Two cycle method - Substitute frame.
Building Frames - Lateral load analysis – Portal method and Cantilever method. **(9)**

MATRIX FLEXIBILITY METHOD
Element flexibility – Structure flexibility – Formulation of Structure flexibility matrix – Determination of forces / displacements – Application to simple determinate and indeterminate beams, frames and trusses. **(9)**

MATRIX STIFFNESS METHOD
Element stiffness – Structure stiffness – Formulation of Structure stiffness matrix – Application to simple determinate and indeterminate beams, frames and trusses. **(9)**

INTRODUCTION TO FINITE ELEMENT METHOD
Basic steps – Concept of an element – Various element shapes – Application of FEM – Limitations – Element stiffness matrix for one dimensional members – Procedure of assembly and solving equations (No problems). **(9)**

Theory : 45
Tutorial : 15
Total : 60

TEXT BOOKS:
1. Gupta.S.P and Pandit.G.S, "Theory of Structures,Vol.I& II", Tata McGraw Hill, New Delhi, 2012.
2. Rajasekaran.S and Sankarasubramanian. G., "Computational Structural Mechanics" Prentice Hall of India, New Delhi, 2012.

REFERENCE BOOKS:
1. Bhavikatti.S.S, "Structural Analysis" Vol.I& II, Vikas Publishing House (P) Ltd., New Delhi, 2011.
2. Prakash Rao., D.S., "Structural Analysis", Universities Press, Hyderabad, 2001.
3. Armenakas.A.E., "Classical Structural Analysis" Mc-Graw Hill Book Co., New York, 1995.
4. Reddy.C.S, "Basic Structural Analysis", Tata Mc-Graw Hill, New Delhi, 2012.
5. Junnarkar and Shah., "Mechanics of Structures" Vol.II, Charotar Publishing House, Anand, 2012.
6. Punmia.B.C and A.K.Jain "Strength of Materials and Theory of Structures", Vol.II, Laxmi Publications, New Delhi, 2005.
7. Wang.C.K, "Intermediate Structural Analysis", Tata Mc-Graw Hill, New Delhi, 2010.

8. Krishnamoorthy C.S., Finite Element Analysis, Theory and Programming - Tata McGraw Hill Company, 2000.
9. Reddy.J.N., " An Introduction to the Finite Element Method", Tata McGrawHill Company, NewDelhi, 2005.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X	X		X		X			X					
2	X	X	X		X		X			X					
3	X	X	X		X		X			X					
4	X	X	X		X		X			X					

13CE63 FOUNDATION ENGINEERING

	L	T	P	C
	3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES
At the end of this course student acquires the capacity to investigate the soil condition and to design suitable foundation.

COURSE OUTCOMES:
CO1: The students will be able to plan and carryout soil Investigation programmes for different engineering projects.
CO2: The students will be able to compute the bearing capacity and settlements of foundations.
CO3: The students will be able to judge suitable foundation for different site conditions.
CO4: The students will be able to analyse and design the suitable foundation and earth retaining structures.

SOIL INVESTIGATION AND CHOICE OF FOUNDATION
Methods of Soil Exploration – Boring – Sampling – Disturbed and undisturbed Sampling – Sampling techniques – Bore log and soil investigation report – Function and requirements of good foundation – Choice of foundation based on soil conditions. **(9)**

BEARING CAPACITY AND SHALLOW FOUNDATIONS
Location and depth of foundations– Bearing capacity of shallow foundations on homogeneous deposit – Terzaghi's Theory – IS Code method – Field tests – Factors influencing Bearing Capacity – Settlement of foundations – Components of settlement – Allowable and maximum differential settlement – Proportioning of footing (No structural design) – Methods of improving bearing capacity – Methods of minimizing settlements. **(9)**

PILE FOUNDATIONS
Need for deep foundations -Types of piles - classification of piles – Load carrying capacity of piles in granular and cohesive soils –Static and Dynamic formulae – Pile carrying capacity by field tests - Pile load test – Group Capacity – Settlement of Pile groups – Negative skin friction. **(9)**

EARTH PRESSURE AND RETAINING WALLS
Earth pressure theory – Plastic equilibrium in soils – active and passive state – Rankine's theory – Coulomb's wedge theory – Earth pressure on retaining walls of simple configurations – Stability of retaining wall – Culmann's graphical method for determining earth pressure. **(9)**

FOUNDATIONS ON EXPANSIVE SOILS AND GROUND IMPROVEMENT METHODS
Shrinkage and expansion of clays – Identification of expansive soils – Measurement of swell and swell pressure – Principles of design of foundations in expansive soils – Ground improvement methods – Preloading – Soil replacement – Densification – Stabilization – Soil reinforcement. **(9)**

Total: 45

TEXT BOOKS:
1. Varghese P.C., "Foundation Engineering", Prentice Hall of India, 2005.
2. Gopal Ranjan and Rao A.S.R., "Basic and Applied Soil Mechanics", New age International (P) Ltd Publications, New Delhi, Second Edition, 2010.

REFERENCE BOOKS:
1. Venkataramaiah.C, "Geotechnical Engineering", New Age International Ltd., New Delhi,2008.
2. Alam Singh., "Modern Geotechnical Engineering", IBS Publications, New Delhi, 2012.
3. Punmia.B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications, New Delhi, Sixteenth Edition, 2005.
4. Braja M. Dass, "Principles of Foundation Engineering", Thomson Brooks Gole, Singapore, 2005.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1			x	x	x		x			x					x
2	x	x	x		x		x		x	x				x	x
3			x		x	x			x					x	x
4		x	x				x		x		x			x	x

Table header: Mapping of CO's and PO's

13CE64   DESIGN OF STEEL STRUCTURES

	L	T	P	C
	3	1	0	4

ASSESSMENT: THEORY
COURSE OBJECTIVES:
The aim of this course is to impart knowledge in the design of steel structures.
COURSE OUTCOMES:
CO1: The students will be able to design the steel structural elements in limit state method as per the current IS code.
CO2: The students will be able to understand the concepts about bolted and welded connections
CO3: The students will be able to understand about the requirements of industrial structures

BOLTED AND WELDED CONNECTIONS
Unstiffened and stiffened seated connections.   **(9)**

COLUMNS:
Design of built-up compression members - Design of lacings and battens - Eccentrically loaded column - column splices - column bases for axial and eccentric loads.   **(9)**

BEAMS:
Built-up Beams - beams with unrestrained compression flange .
WELDED PLATE GIRDER
Design of Welded Plate girder - curtailment of flange – stiffeners and splices.   **(9)**

INDUSTRIAL STRUCTURES AND ROOF TRUSSES
Requirements of industrial structures - Design of gantry girder. Analysis and design of single bay gable frame with Knee bent. Types of roof trusses for different spans - Design of roof trusses for dead, live and wind loads - connections at the Supports - design of purlins.   **(9)**

CHIMNEY
Design of a self supporting steel chimney – Chimney Base.   **(9)**

Theory : 45
Tutorial : 15
Total : 60

TEXT BOOKS:
1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2008.
2. Bhavikatti.S.S. "Design of Steel Structures by Limit State Design", I.K International Pvt.Ltd., New Delhi, 2009.
3. Ramchandra, VirendraGehlot, "Limit State Design of Steel Structures", Scientific Publishers, Jodhur, 2010.

REFERENCE BOOKS:
1. Arya and Ajmani., "Design of Steel Structures", Nemchand Bros, Roorkee, 1989.
2. Ramachandra., "Design of steel structures" - Vol.2, Standard Publishers Distributors, New Delhi, 2002.
3. Vazirani.V.N and Ratwani.N.M.,"Steel Structures", Khanna Publishers, New Delhi, 1985.
4. Ramamrutham.S and Narayanan.R., "Design of Steel Structures", DahanpatRai& Sons, New Delhi,2003.
5. Krishnamachar B.S. and AjithaSimha., "Design of Steel Structures", Tata McGraw Hill Publishing Company Ltd., New Delhi,1985.
6. IS 800-2007, Code of Practice for use of Structural Steel in General Building Construction, Bureau of Indian Standards, New Delhi.

7. I.S. 6533 - 1971 Code of Practice for Design and Construction of Steel Chimney, Bureau of Indian Standards, New Delhi., 1986.
8. SP6(6) ISI Hand Book for "Structural Engineers and Application of Plastic Theory in Design of Steel Structures", 1972.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x		x			x	x				x
2	x	x	x		x		x			x	x				x
3	x	x	x		x		x			x	x				x

13CE65 DESIGN OF REINFORCED CONCRETE STRUCTURES

L	T	P	C
3	1	0	4

ASSESSMENT: THEORY
COURSE OBJECTIVES:
At the end of this course the student should be able to design rigid frames, retaining walls, water tanks, bridges and further understand the plastic theory of RCC and Pre stressed concrete.

COURSE OUTCOMES:
CO1: The students will be able to understand the conceptual design of rigid frames for vertical and horizontal loading, retaining wall, water tank, bridges
CO2: The students will be able to explain plastic design concepts and basics of prestressed concrete element.
CO3: The students will be able to design bridges as per IRC codes

YIELD LINE THEORY
Introduction to yield line theory of slabs - Application to square and rectangular slabs with simply supported or fixed boundary conditions subjected to uniformly distributed and central concentrated loads (by upper bound theorem). Concept of corner lever. Limit Analysis of RCC structures - Fundamental principles, Concept of moment redistribution - moment rotation characteristics - permissible rotation capacity - cambridge method - A.L.L. Baker's method of Limit analysis (Assumptions and procedures only, qualitative treatment).
(9)

RETAINING WALLS
Design of cantilever and counterfort retaining walls for level surface filled with/without uniform surcharge - stability requirements – Description of inclined backfill (no problems). Design of RC walls
(9)

GROUND WATER TANK
Classifications - based on shapes, levels and functions - Principles of design - IS code provision - no tension basis - Design of underground rectangular tank. **(9)**

OVERHEAD WATER TANK
Design of overhead rectangular and circular tanks.Design of staging for rectangular tank. – Descriptions of Intz type tank (no problems). **(9)**

BRIDGES AND DEEP BEAMS
Types of bridges - IRC loadings - design of single span slab bridges for class A (or) class AA loadings only - concept of skew slab bridge. (no problems). Design of deep beams – Design of corbels.
(9)

Theory :45
Tutorial : 15
Total : 60

TEXT BOOKS:
1. Unnikrishna Pillai and Devados Menon, "Reinforced Concrete Design", Tata Mc Graw Hill Publishing Co, New Delhi, 2011.
2. Ashok K Jain, " Reinforced Concrete Limit State Design" ,New Chand Brothers, Roorkee, 2012.
3. Jain, O.P.andJaikrishna "Plain and Reinforced Concrete Vol.I and Vol.II" Nemchand and Brothers, Roorkee, 2007.
4. Vazirani V.N. and Ratwani, N.M.,"Concrete Structures", Khanna Publishers, New Delhi, 2004.

REFERENCES BOOKS:

1. Design aids for Reinforced Concrete to IS : 456 - 1978, Bureau of Indian Standards, New Delhi.
2. Reynolds.C.E.,"'Reinforced Concrete Designer's HandBook" Cement and Concrete Association, London, 2002.
3. Johnson Victor D., "'Essentials of Bridge Engineering" Oxford and IBH Publishing Company, New Delhi, 2003.
4. Krishna Raju N., "Advanced Reinforced Concrete Design", CBS Publishers and Distributors, Delhi, 2003.
5. Syal I.C. and Goel A.K., "Reinforced Concrete Structures", Wheeler and Company, Private Limited, New Delhi, 1998.
6. I.S.456 - 2000 Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi.
7. I.S.3370 (Part I) – 1965 (Reestablished :1999) – Code of Practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.
8. I.S.3370 (Part II) – 1965 (Reestablished :1999) – Code of practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.
9. I.S.3370 (Part III) – 1965 (Reestablished :1999) – Code of practice for Concrete Structures for the Storage of Liquids, Bureau of Indian Standards, New Delhi.
10. I.S.1343- 1980 (Reestablished :1999) – Code of practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi.
11. IRC:5 – 1998 – Standard Specification and Code of Practice for Road Bridges (Section I), Bureau of Indian Standards, New Delhi.
12. IRC:6 – 1966 – Standard Specification and Code of Practice for Road Bridges (Section II), Bureau of Indian Standards, New Delhi.
13. IRC:21 – 2000 – Standard Specification and Code of Practice for Road Bridges (Section III), Bureau of Indian Standards, New Delhi.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's — PO's

CO's	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x			x			x				
2	x	x	x							x			x		
3	x	x	x			x		x		x			x		

13CE66 DESIGN AND DRAWING

	L	T	P	C
	2	0	4	4

ASSESSMENT: THEORY
COURSE OBJECTIVES:
At the end of this course the student should be able to draw as well as understand the structural detailing of structures like slab, beam, staircase, retaining wall, water tank, foundation, plate girder, roof trusses,,etc., This can be achieved by them by preparing the detailing manually.

COURSE OUTCOMES:
CO1: The students will be able to prepare and understand manually structural drawings like R.C Slabs, R.C Beams, R.C Columns, R.C Footings, R.C Stairs, Concrete retaining wall and concrete water tank.
CO2: The students will be able to understand grillage foundation, plate girders, columns, OHT and roof trusses.
CO3: The student will gain the confidence in working out the quality of raw materials needed to be procured for fabrication the structures.

CONCRETE
Detailed design, drawing and bar bending schedule for the following concrete structures are to be prepared.
1. One way floor slab/two way floor slab
2. Continuous beams.
3. Columns with footing.
4. Flat slab.
5. Joints (Beam to Column & Column to Footing).
6. Ground level circular water tank.
7. Over head rectangular water tank.
8. Dog legged staircase.
9. Cantilever retaining wall.
10. Counterfort retaining wall.   **(15 + 23)**

STEEL
Detailed design and drawing of the following steel structures.
1. Plate girder (Welded).
2. Columns with lacings on gussetted base.
3. Industrial Roof truss.
4. Bridge through truss.
5. Chimney.
6. Industrial bent.
7. Gantry girder.
8. Canopy.
9. Light weight purlins.   **(15+22)**
                                         Total : (30 + 45) = 75

TEXT BOOKS:
1. Krishnamurthy,D., "Structural Design and Drawing" Vol.II, CBS Publishers and Distributors, Delhi, 2008.
2. Krishnamurthy,D. "Structural Design and Drawing" Vol.III (Steel Structures), CBS Publishers & Distributors, New Delhi, 2008.

REFERENCE BOOKS:
1. Vazirani, V.N. and Ratwani.N.M, "Design of Steel Structures", Khanna Publishers, Delhi, 1985.
2. KrishnarajuN.,"Structural Design and Drawing", Oxford University Press, 2004.

* NOTE: Final Examination is of 4 hours duration. Two questions will be asked from Part A and two questions from Part B, out of which students have to answer one question in each part. Continuous Assessment pattern will be followed.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x		x	x	x		x				x		x		x
2	x	x	x		x			x		x	x		x		x
3	x	x	x	x						x	x		x		

13CE67   CONCRETE LABORATORY

L	T	P	C
0	0	3	2

ASSESSMENT: PRACTICAL
COURSE OBJECTIVE:
To study the fresh and hardened properties of concrete.

COURSE OUTCOMES:
CO1: The students will be able to perform various tests on fresh and hardened concrete.
CO2: The students will be able to understand different methods as per Bureau of Indian Standards
CO3: The students will be able to explain the usage of various equipment.

TESTS OF CONCRETE
Testing equipments - Concrete mixer - Needle vibrator – Table vibrator - Moulds - Proving ring – Jacks - Dial gauges. Normal consistency and setting time of cement - Strength test for cement - Soundness test for cement -Workability tests - Slump test - Compacting factor test, Kelly ball test, Vee-bee consistometer test . Compression test on cube and cylinder - Split tension test on cylinder - Modulus of rupture of concrete.

REFERENCE BOOKS:
1. Shetty.M.S, "Concrete Technology", S.Chand& Co, New Delhi, 2005.
2. I.S:516-1959, "Methods of Test for Strength of Concrete", Bureau of Indian Standards, New Delhi.
3. I.S:4031-1968, "Method of Physical Tests for Hydraulic Cement", Bureau of Indian Standards, New Delhi.

Mapping of Course Outcome with Program Outcome

CO's	

Mapping of CO's and PO's																
CO's	**PO's**															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	X		x	x	x			x	x				
2	x	x	X		x					x	x			x	
3	x	x	X		x					x	x			x	

13CE68 SOIL MECHANICS LABORATORY

L	**T**	**P**	**C**
0	0	3	2

ASSESMENT: PRACTICAL

COURSE OBJECTIVES:

To study the engineering properties and index properties of soil. Performing soil tests to determine Physical and Engineering propertie such as below:

COURSE OUTCOMES:

CO1: The student will be able to explain the classification of soil.
CO2: The student will be able to estimate Index and Engineering Properties of soil.
CO3: The student will be able to judge and decide on design soil parameters.

1. Specific gravity determination
2. Grain size distribution by sieve analysis& Hydrometer
3. Consistency limits (liquid, Plastic and Shrinkage limits)
4. Coefficient of permeability by Constant head method.
5. Coefficient of permeability by Variable head method.
6. Field density by core cutter method
7. Field density by sand replacement method.
8. Relative density determination
9. Direct shear Test
10. Unconfined compression Test
11. Proctor Compaction Test
12. Consolidation Test (Demonstration only)
13. Vane shear Test
14. CBR Test (Demonstration only)
15. Triaxial test (Demonstration only)

REFERENCE BOOKS:

1. "Soil Engineering Laboratory Instruction Manual", Published by the Department of Civil Engineering. CIT, Coimbatore - 2008.
2. Head, K. H,"Manual of Soil Laboratory Testing (Vol-1 to 3)", John Wiley and Sons, Chichester,1998.
3. Lambe T. W., "Soil Testing for Engineers", John Wiley & Sons, New York, 1990.
4. "I.S. Code of Practice 2720 (Part I to XLI) – Indian Standard Codeof Practice for Methods of Tests for soil.
5. Saibaba Reddy, E. and Rama Sastri, K., "Measurement ofEngineering Properties of Soils", New Age International Publishers,New Delhi, 2002.

Mapping of Course Outcome with Program Outcome

<table>
<tr><th colspan="16">Mapping of CO's and PO's</th></tr>
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<tr><td>3</td><td></td><td>x</td><td>X</td><td>x</td><td></td><td></td><td>x</td><td></td><td></td><td>x</td><td>x</td><td></td><td></td><td></td><td></td></tr>
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13CE71 EARTHQUAKE RESISTANT DESIGN
OF STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To know about the fundamentals of Dynamics of structures and Earthquake Resistant Design of structures as per IS codes.
COURSE OUTCOMES:
CO1: Students will be able to understand the dynamic concepts
CO2: Students will be able to understand the origin, various terminologies and behavior of earthquakes
CO3: Students will be able to do the analysis and design of structures for earthquake forces as per IS 1893.
CO4: Students will be able to understand behavior of masonry structures and design as per IS 13827 and IS13828

STRUCTURAL DYNAMICS
Introduction – Fundamentals of structural dynamics – Single degree of freedom system – Free vibration – forced vibration – Damping - Introduction to multi-degree of freedom system.   **(10)**

ENGINEERING SEISMOLOGY
Elements of Engineering seismology – Definitions – Plate tectonics – Seismic waves – Earthquake History - Behaviour of Structures in past earthquakes –Elastic rebound theory – Seismograph and Accelerograph – Seismic Zoning map of India.   **(8)**

SEISMIC ANALYSIS
Calculation of base shear as per IS 1893-2002 - Static and Dynamic method - Seismic Design concepts.   **(8)**

EARTHQUAKE RESISTANT DESIGN
Design of Beams, Columns – Shear wall – Types of Shear wall – Design of Rectangular Shear wall with boundary elements as per IS 13920 -1993.   **(9)**

IS CODE PROVISIONS
Ductility – Assessment of Ductility – Member / Element Ductility – Structural Ductility – Factors affecting Ductility- Ductile detailing of beams, column, joint and footings and special confining reinforcements - as per IS 13920 - 1993.Behaviour and Design of Masonry Structures as per IS 13827 and IS13828   **(10)**
                                                          Total : 45

TEXT BOOKS:
1. Pankaj Agarwal and Manish Shirikhande, 'Earthquake Resistant Design of Structures', Prentice Hall of India Pvt. Ltd., New Delhi, 2006.
2. Duggal.S.K., "Earthquake Resistant of Structures", Oxford University Press, New Delhi, 2007.

REFERENCE BOOKS:
1. Anil K.Chopra, ' Dynamics of Structures – Theory and Applications to Earthquake Engineering', Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
2. Park and Priestly, 'Seismic Design of Reinforced Concrete and Masonry Buildings', John Wiley & Sons, 1982.
3. IS 1893 -2002, Indian Standard Code of Practice for Earthquake Resistant Design of Structures, Bureau of Indian Standards, New Delhi.
4. IS 13920 - 1993, Indian Standard Code of Practice for Ductile Detailing of RC Structures, Bureau of Indian Standards, New Delhi.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x			x	x		x				x		x		x
2	x	x			x			x		x	x				x
3	x	x	X	x						x	x				
4	x	x	X	x			x	x					x		x

(Table title: **Mapping of CO's and PO's**)

13CE72 IRRIGATION ENGINEERING

	L	T	P	C
	3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To impart knowledge about utilization of water for Irrigation and idea about irrigation system.
COURSE OUTCOMES:

CO1: *The students will be able to demonstrate irrigation practices and irrigation water requirement*
CO2: *The students will be able to analyze and demonstrate source and supply of water*
CO3: *The students will be able to conceive, plan and manage any type of irrigation project efficiently*

WATER REQUIREMENTS
Irrigation – Necessity – Advantages – ill-effects – Types – Methods – Quality of water – Standards – Crops – Seasons - Definitions related to agriculture and irrigation – Rotation of crops – Crop water requirements – Base period – Duty – Delta – Consumptive use – Irrigation Efficiencies – Assessment of irrigation water - Water logging – Causes and effects – Remedies - Drainage – Necessity – Advantages – Types. **(10)**

SOURCES OF WATER
Surface hydrology – Precipitation – Types, forms, Measurement – Evaporation – Transpiration – Infiltration – Run-off – Hydrograph – Unit Hydrograph for single peaked storm – S-curve technique – Flood Estimation. **(8)**

CANAL ENGINEERING
Canals – Classification – Alignment (Theoretical aspect only) – Distribution network –Cross sectional details – Sedimentation in canals – Silt theories – Design of canals based on silt theories and use of charts – Balancing depth of cutting – Design procedure for fixing longitudinal section – Canal losses – Canal maintenance – Canal lining – types – Design of lined canals. **(10)**

RESERVOIR PLANNING
Reservoir – Types, Investigations for reservoir planning – Zones of storage - Capacity – Yield – Mass curve analysis – Capacity for specific demand and yield for given capacity – Fixing reservoir capacity – Reservoir Operation – Economic height of a dam – Reservoir sedimentation and control – Selection of site for reservoir. **(9)**

WATER RESOURCES PLANNING AND MANAGEMENT
India's Water Resources – Water use scenario – Purpose and classification of water resources development projects – Water resources project formulation and evaluation – Planning and management strategies – on farm development works – Participatory approach: Farmer's organization and turn over – WUA – Economical aspects of irrigation. **(8)**
Total: 45

TEXT BOOK
1. Garg.S.K, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi, 2001.

REFERENCE BOOKS
1. Punmia, B. C. and Pande B. B. Lal, "Irrigation and Water Power Engineering", Laxmi Publications, New Delhi, 2001.
2. Micheal, A.M., "Irrigation –theory & Practice", Vikas publishing house, New Delhi, 1990.
3. Sharma, R.K., "Irrigation Engineering &Hydraulic Structures", Oxford and IBH Publishing Company, New Delhi, 1994.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	X		x	x	x	x		x	x				
2	x	x	X		x	x	x	x		x	x				
3	x			x	x	x	x	x		x	x	x		x	

13CE73 SANITARY ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
This course aims at exposing the students of Civil Engineering about the perspectives and management of Sewage in dwelling regions.

COURSE OUTCOMES:
***CO1:** The students will be able to understand various perspectives of sewage disposal.*
***CO2:** The students will be able to explain various sewerage systems*
***CO3:** The students will be able to demonstrate and design various methods of sewage treatment*

SEWAGE DISPOSAL PERSPECTIVES
Definitions, systems, and classifications of sewage – Necessity and current problems in India - Quantity of dry weather flow (DWF) and factors affecting its generation- Storm water and its assessment: rational and empirical methods – Concept of time of concentration – Fluctuations in flow pattern – Design flow of sewage – Characteristics of sewage: physical, chemical, and biological – Microbiology of sewage – BOD, COD and TOC of sewage – Sewage analysis and BOD calculations – Population equivalents. **(9)**

HOUSE DRAINAGE AND SEWERAGE SYSTEM
Principles and general layout of house drainage – Traps and other appurtenances – One pipe and two pipe systems – Anti siphonage pipe and street connection – Systems and layout of sewerage - Separate and combined systems – General considerations in the design of sewers - Design of sewers under various flow situations – Sewer materials and sections – Laying, jointing, and testing of sewers - Sewer appurtenances and storm relief works – Pumping of sewage and HP requirements – Pumping stations and its locations. **(9)**

PRELIMINARY AND PRIMARY TREATMENT OF SEWAGE
Objectives of treatment – Conventional and unconventional treatment units – Objectives, principles, operation, analysis, and design of bar-rack, gritchamber and primary sedimentation units – Velocity control devices in grit chamber – Disposal of rackings, grittings, and primary sludge.

(9)

BIOLOGICAL TREATMENT OF SEWAGE
Necessity – Systems and Processes – Aerobic, anaerobic and anoxic processes –Objectives, principles, operation, analysis, and design of conventional activated sludge process and trickling filter – Modifications of CASP – Standard and high rate trickling filters – Low cost treatments: stabilization ponds, oxidation ditch and aerated lagoons – Rural sanitation –Objectives, principles, operation, analysis and design of septic tanks and dispersion trenches – Objectives and principles of secondary sedimentation tank – Sludge volume index (SVI) and sludge density index (SDI) – Introduction to RBC and UASB processes. **(9)**

SLUDGE TREATMENT AND EFFLUENT DISPOSAL
Objectives of sludge treatment – Types and characteristics of sludge in a typical plant – Essential relationships – Integrated sludge treatment flow sheet – Objectives, principles, operation, analysis and design of conventional and high rate digestors – Energy recovery aspects with respect to methane – Sludge dewatering and drying – Unconventional methods of disposal –Effluent disposal aspects: sewage farming ,land application and dilution methods into lakes, rivers, estuaries and oceans – Self purification and oxygen sag–curve analysis – Trophic status of aquatic bodies. **(9)**
Total: 45

TEXT BOOK
1. Garg S.K. "Sewage Disposal and Air Pollution Engineering "., Khanna Publishers, New Delhi, 2001.

REFERENCES BOOKS
1. Raju , B.S.N , "Water Supply and Waste Water Engineering", Tata McGraw – Hill Co, New Delhi ,1995.

2. Metcalf and Eddy, "Waste Water Engineering Treatment, Disposal, and Reuse", McGraw-Hill Publishing Co; Indian Edn; New Delhi, 2005.
3. "Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Urban Development, GOI, New Delhi, 1985.

Mapping of Course Outcome with Program Outcome

<table>
<tr><td colspan="16">Mapping of CO's and PO's</td></tr>
<tr><td rowspan="2">CO's</td><td colspan="15">PO's</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr>
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13CE76 COMPUTER APPLICATIONS LABORATORY

L	**T**	**P**	**C**
0	0	3	2

ASSESSMENT: PRACTICAL
COURSE OBJECTIVES:
On line training for application to simple problems in Analysis, Design and Planning tools in Civil Engineering which aims the student to understand Civil Engineering Softwares and also develop to address the demand industry ready professionals.

COURSE OUTCOMES:
CO1: *The students will be able to analyse and design beams and frames using various software in civil engineering.*
CO2: *The students will be able to analyse and design different water tanks using various software in civil engineering.*
CO3: *The students will be able to work with various planning software such as MS Project and Primavera*

ANALYSIS AND DESIGN PACKAGES
Introduction to STAAD/pro – Need for computer analysis-analysis of basic structural elements like simply supported beams, cantilever beams, propped cantilever beams, continuous beams and fixed beams. Analysis and design of 2D and 3D frames-Analysis and design of 2D and 3D trusses-Analysis and design of space frame subjected to wind force –sinking of supports –Analysis, design and modelling of 2D frames and bridge deck with moving load-Analysis and design of rectangular and circular- ground level, underground and elevated water tank with bracings. Design of structural elements like slab, beams, columns and footings Using Excel.

PLANNING TOOLS-PRIMAVERA AND MS PROJECT
Introduction to project planner and project management – defining Administrative categories- setting up OBS,WBS and EPS- creating calendars- defining activity duration – predecessor – successor-positive and negative lag- relationships –float- defining resources and roles managing base lines – preparing activity areas and bar/Gantt chart areas- updating and tracking projects using base line-producing reports –layout- filter – formatting, printing layout and reports.

REFERENCES BOOKS:
1. STAAD.Pro – Manual Volume 1 and 2, Bentley Systems India Private Limited, New Delhi.
2. Primavera Project Planner- Planning and Control Guide-Primavera System. Inc, Boston, USA.
3. MS Project Professional- Manual- Microsoft Corporation.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X	X		X		X				X				
2	X	X	X		X		X				X				
3	X		X		X		X				X	x			

13CE77 ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	2

ASSESMENT: PRACTICAL

COURSE OBJECTIVES:

The vital aim of this laboratory course is to train the students of Civil engineering about the analytical and quantitative aspects of water quality and waste water characteristics.

COURSE OUTCOMES:

CO1: The students will be able to demonstrate various tests on water and waste water samples.
CO2: The students will be able to explain the suitability of water for drinking, construction and other purpose.
CO3: The students will be able to explain the suitability of disposal of waste water.

LIST OF EXPERIMENTS:
1. Determination of Acidity of the given Water/Wastewater Sample.
2. Determination of Alkalinity of the given Water/Wastewater Sample.
3. Determination of Hardness of the given Water/Wastewater Sample.
4. Estimation of Chlorides in the given Water/Wastewater Sample.
5. Determination of pH of the given Water/Wastewater Sample.
6. Determination of Dissolved Oxygen Content in the given Water/ Wastewater Sample.
7. Determination of Specific Conductivity of the given Water sample.
8. Assessment of Settleable, Total, Volatile, Fixed, Dissolved and Suspended Solids in Water/Wastewater Sample.
9. Nephelometric-based Turbidity Assessment of the given turbid water.
10. Assessment of Optimum Coagulant Dose (OCD) to treat the given turbid water.
11. Assessment of Available Chlorine in the given Bleaching powder sample.
12. Estimation of Residual Chlorine and Determination of Break-point chlorination of the given Polluted Water/Wastewater Sample.
13. Assessment of Biochemical Oxygen Demand (BOD) of the given Water/Wastewater Sample.
14. Assessment of Chemical Oxygen Demand (COD) of the given Water/Wastewater Sample.
15. Turbidimetric-based Estimation of Sulphates in the given Water/Wastewater Sample.
16. Estimation of Iron and Manganese in the given Ground Water Sample.
17. Determination of Fluorides in the given Ground Water Sample.

REFERENCE BOOKS:

1. APHA, AWWA, and WPCF,"Standard Methods for the Examination of Water and Wastewater", 2005.
2. Sawyer,N.C.,McCarty,P.L. and Parkin, G.F., "Chemistry for Environmental Engineering and Science", Fourth Edition, McGraw Hill Co., Newyork, 2005.
3. IS:10500-1995, "Drinking Water Standards of India", Bureau of Indian Standards, New Delhi.

Mapping of Course Outcome with Program Outcome

Mapping of CO's and PO's															
CO's	**PO's**														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	X		x	x	x	x		x	x				
2	x	x	X		x	x	x	x		x	x				
3	x	x	X		x						x				

13CE81 CONSTRUCTION MANAGEMENT

	L	T	P	C
	3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To impart knowledge about management principles and functions used in construction management. It imparts knowledge related to planning, scheduling and execution of construction projects and maintaining accounts.

COURSE OUTCOMES:
CO1: The students will be able to explain various aspects of construction management principles.
CO2: The students will be able to understand about scheduling of work.
CO3: The students will be able to improve leadership qualities.

CONSTRUCTION PLANNING

Importance – Scope of construction management – Functions of management – Management levels – Types of business organizations - Objectives of planning- steps in planning – Principles of planning – Advantages and Limitations of planning – Stages of planning – Types of plans- Stages of plan by different agencies – Planning by owner – Planning by contractor.

(8)

EXECUTION OF WORKS

Construction contracts – contract documents – Types of contract – Contractual obligations – specifications – Tender – Tender notice – Types of tenders – Tender documents – Earnest money deposit – Security deposit – Scrutiny and acceptance of tender – Contract agreements **(8)**

CONSTRUCTION SCHEDULING

Forms of scheduling : Bar charts – Milestone charts – Network analysis – CPM Network construction: Activities and Events, Fulkerson's rule for numbering events - logic and interdependence in network– Time computations, Floats, Critical path

PERT Network: Time estimates, Beta distribution, expected time , standard deviation, variance, probability of achieving desired time targets for projects.

Resource allocation: Resource aggregation diagrams as per early start and late start- resource smoothing –levelling of resources according to constraints - Minimum project duration subject to resource constraints.

Time cost optimization: Direct and indirect cost related to time – Activity crashing – Normal and crashed duration and corresponding cost – Cost slope- Crashing of network to optimize cost and duration of a project – time and motion studies. **(11)**

CONSTRUCTION FINANCING AND CONTROL

Costs associated with constructed facilities –Estimates – Design estimates, Bid estimates, Control estimates – Effect of scale on construction cost – Means of financing – Cost control- Financial accounting systems – Financial control **(9)**

CONSTRUCTION PERSONNEL MANAGEMENT

Introduction to the field of people management – basic individual psychology – creativity and innovation – Motivation – Motivation theories- leadership – Theories of leadership – Functions of leadership – Communication – Barriers in communication **(9)**

Total: 45

TEXT BOOKS:
1. Seetharaman .S" Construction Engineering and Management", Umeshpublications,New Delhi,1997
2.V.S .Bagad " Principles of Management", Technical publications, Pune, 2009.
3.J.Aldrinraj " Principles of Management" Si Krishna Hitech publishing company Pvt ltd, Chennai

REFERENCE BOOKS
1. Memoria, C.B., and S.V.Kankar ,Personnnel Management, Himalaya publishing co,1997
2. Mahesh varma.,"Construction Equipments" MetroplolitanBookCo., 1985

3.Harpal Singh., " Construction Management and Accounts", Tata McGraw Hill, New Delhi, 1981

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x			x	x	x	x	x		x	x	x			
2	x			x	x	x	x	x		x	x	x			x
3	x	x	X	x	x	x	x	x	x	x	x	x	x	x	x

The header "Mapping of CO's and PO's" spans the full width above.

13CE82 HYDRAULIC STRUCTURES

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To impart knowledge about various structures for storage and distribution of water.

COURSE OUTCOMES:
CO1: The students will be able to design various hydraulic structures associated with water resources engineering.
CO2: The students will be able to demonstrate the construction of various hydraulic structures associated with water resources engineering.
CO3: The students will be able to the explain the maintenance process of various hydraulic structures associated with water resources engineering.

RIVER STRUCTURES
Diversion Head Works - Brief description of component parts - their functions - Design principles - Seepage Theories - Weir, Barrage and impervious floor as a part of diversion head work and their design based on seepage theories - River training works – types (Theoretical aspects only)

(9)

CANAL STRUCTURES
Canal regulators - Types - Functions - Parts of a regulator – Canal falls - Types - Brief Description – design aspects of notch-type canal fall - Cross Drainage works - Types - selection - Design aspects of syphon aqueducts. – Canal outlets and fumes (Theoretical aspects only) **(9)**

STORAGE STRUCTURES – GRAVITY DAMS
Gravity Dams - Description -Forces acting - Elementary and Practical profile -Design (procedure only) of high and low gravity dam – Zoning of gravity dam - Galleries - Types – Joints, Waterstops and Keyways – Types- Spillways – Types - Functions. **(9)**

STORAGE STRUCTURES – EARTHEN DAMS
Earth dams –Various types of sections – Cross-sectional Details - Design data of components - Causes of failure - Typical cross sections to suit site conditions and available materials - Phreatic line - Determination by graphical method – Seepage control in earthen dams. **(9)**

OTHER STORAGE STRUCTURES
Arch Dams – Types (Description only) - Buttress dams – Types (Description only).
Tanks – Classification - Components of tanks - Types of bunds - Design aspects of bunds – Tank surplus weir – tower head sluice – wing wall type sluice (Description only) – Tank regulation arrangements **(9)**

Total : 45

TEXT BOOK:
1. Garg.S.K, "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi, 2001.

REFERENCE BOOKS:
1. Punmia.B.C ,Pande, B.B.Lal., "Irrigation and Water Power Engineering", LaxmiPublicatiions, New Delhi, 2001.
2. SahasraBudhe S.R., "Irrigation Engineering and Hydraulic Structures Including Hydrology and Water Power Engineering",S.K.Kataria Publications, Sixth Edition ,1996(Reprint 2000).

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x		X		x		x	x		x	x				
2	x	x			x		x	x		x	x				
3	x				x		x	x		x	x				

Mapping of CO's and PO's (table caption spanning top)

13CE83 REMOTE SENSING AND GIS

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
At the end of the course the student will posses knowledge of Remote sensing techniques and its applications in the field of civil engineering and GIS.

COURSE OUTCOMES:
CO1: The student will be able to understand the concept of Electro Magnetic Energy.
CO2: The student will be able to apply the concept of Satellite remote sensing.
CO3: The student will be able to process and analyse the different remote sensing data.
CO4: The student will be able to analyse raster and vector data models.
CO5: The student will be able to apply remote sensing and GIS techniques for various engineering related problems such as landuse; disaster management; information system etc.

PRINCIPLES AND CONCEPTS
Definition - Historical Importance of remote sensing - Principles - and methods of remote sensing - Electromagnetic spectrum Electromagnetic Radiation and radiation sources - Interference - Atmospheric effects on remote sensing - Energy interaction with energy surface features.   **(9)**

AERIAL PHOTOGRAPHY
Definition - Types of air photographs - Geometry of air photo - Parallax - pair of photos - Height determination - Flight planning - Stereoscopy - Monovision - Binocular vision - Aerial photo interpretation - Basic elements - Techniques of photo interpretation - Application of aerial photo interpretation - photographs versus maps.   **(9)**

IMAGERY
Landsat imagery - thermal infrared imagery - Radar imagery - Digital image processing - Comparison with aerial photographs.   **(9)**

INSTRUMENTATION FOR REMOTE SENSING
Imaging devices - Aerial camera - Panoramic camera – Multiband camera - Films for recording images - Black and white and colour serial films - Optical and electronic colour combiner - Photogrammatricequipments.   **(9)**

GIS AND ITS APPLICATIONS
GIS in water resources engineering, land use studies, soil sciences,geology, agriculture, forestry and oceanography. Survey, Mapping, Land use.   **(9)**

Total : 45

TEXT BOOKS:
1. Bhatia S.C, " Fundamentals of Remote sensing" New Delhi Atlantic Publishers, 2008.

REFERENCE BOOKS:
1. Burrough.P.A., "Principles of GIS for Land Resources Assesment, Oxford Publication, 1998.
2. Floyd F.Sabins, J.R., WH, "Remote Sensing Principles Interpretation", Freeman and Company and Francis Conpany, France, 1996.
3. Lillesand, Thomas.M and RaiphW.Kiefer, "Remote Sensing and Image Interpretation", John Wiley Sons, 2003.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1										x	x			x	
2			x		x					x					x
3	x		x			x				x			x		x
4	x			x				x					x		x
5			x		x		x		x			x			x

13CE86 GEOINFORMATICS LAB

L	T	P	C
0	0	3	2

ASSESSMENT: PRACTICAL
COURSE OBJECTIVES:
To provide practical and hands on training in the image processing & GIS Software such that students can able to generate required thematic maps from satellite data.

COURSE OUTCOMES:
CO1: The students will be able to carryout remote sensing and GIS applications of various industrial needs.
CO2: The students will be able to demonstrate the various environmental change detections.
CO3: The students will be able to be instrumental for decision support system.

1. Satellite Image georeferencing
2. Sub sect Image
3. Mosaic Image
4. Image enhancement
5. Image Classification
6. Classification Accuracy assessment
7. Spatial data generation
8. Raster and vector data modeling
9. Data conversion – Vector to Raster, Raster to Vector
10. Creating Thematic maps
11. Data output

TEXT BOOKS:
1. Floyd F.Sabins, J.R., WH, "Remote Sensing Principles Interpretation", Freeman and Company and Francis Conpany, France, 1996.
2. Lillesand, Thomas.M and RaiphW.Kiefer, "Remote Sensing and Image Interpretation", John Wiley Sons, 2002.

REFERENCE BOOKS:
1. Burrough.P.A., "Principles of GIS for Land Resources Assesment, Oxford Publication, 1998.
2. Thomas.M.Lillesand and Ralph.W.Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, Inc, 2003.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1		x	x		x		x		x	x			x		
2	x		x			x			x	x				x	
3		x			x		x		x	x				x	

13CE87 QUANTITY SURVEYING AND VALUATION

	L	T	P	C
	0	0	3	2

ASSESSMENT: PRACTICAL
COURSE OBJECTIVES:
        This practical covers the various aspects of estimating of quantities of items of works involved in buildings. This also covers the rate analysis, valuation of properties and preparation of reports for estimation of various items.

COURSE OUTCOMES:
CO1: The students will be able to understand the concepts of Detailed Estimate, Tender procedures – Model Tenders
CO2: The students will be able to explain the concepts of Valuation types – evaluation
CO3: The students will be able to estimate quantities of items of works involved in buildings.

Exercise   1   Preparation of specifications.

Exercise   2   Preparation of Detailed Estimate

Exercise   3   Data sheets – Requirements of labour and materials for different types of works.

Exercise   4   Methods of costing – Abstract Estimate

Exercise   5   Tender procedures – Model Tenders

Exercise   6   Preparation of billing

Exercise   7   Valuation types – evaluation

Exercise   8   Estimation of quantities and rate Abstracts for single storey building.

Exercise   9   Estimation of quantities and rate Abstracts for two storey building.

Exercise   10   Estimation of quantities and rate Abstracts for water tanks.

REFERENCE BOOKS:

1. Jagannathan, G., :Getting more at less cost – The value Engineering way", Tata McGraw Hill Publishing Company, New Delhi, 2000.
2. Senguptha, "Construction Engineering and Management", Tata McGraw Hill Publishing Company, New Delhi, 2001.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X			X	X		X			X	X				
2	X			X								X			x
3	X						X			X			x		

Mapping of CO's and PO's

13CEE01 PRESTRESSED CONCRETE STRUCTURES

L T P C
3 0 0 3

ASSESMENT: THEORY
COURSE OBJECTIVES:
To impart knowledge about the behaviour, analysis and design of prestressed concrete structures.

COURSE OUTCOMES:

CO1: The student will be able to explain basic concepts in prestressing.
CO2:The student will be able to understand various losses in prestressing.
CO3:The student will be able to design various structural elements using prestressing.

INTRODUCTION
Difference between reinforced and prestressed concrete. Principles of prestressing - Methods and systems of prestressing - Principles of Electrothermal prestressing& chemical prestressing - Classification of prestressed concrete structures - Materials – High strength concrete and High strength steel - Stress - Strain diagrams.

LOSSES IN PRESTRESS
Loss due to elastic shortening in pretensioned and post tensioned beams. Loss due to creep, shrinkage, relaxation, friction - Approximate percentage of various losses in pretensioned and post tensioned beams.
(10)

DESIGN OF BEAMS
Theory and behaviour of prestressed concrete beams in bending - Design of prismatic prestressed concrete members for bending for working loads by Magnel's graphical method - Check for ultimate load stage (Limit State Design) **(9)**

DEFLECTION AND END BLOCK DESIGN
Simple cable profiles - calculation of deflections - Design of beams for shear in working and ultimate loads - Design of Anchorage Zone by Guyon's method (simple problems) - Concept of Magnel's method, IS 1343 recommendations. **(10)**

TENSION AND COMPRESSION MEMBERS
Design of tension and compression members – Columns subjected to bending moment and axial compression.

COMPOSITE BEAMS
Composite prestressed concrete beams - Design procedure - Calculation of stresses at important stages both for propped and unpropped constructions - Design of shear connectors – Shrinkage stresses. **(8)**

STATICALLY INDETERMINATE STRUCTURES
Statically indeterminate structures - continuous beams – Concept of concordant cable and linear transformations - Sketching of pressure lines (simple problems). Partial and circular prestressing (Principles only) **(8)**

Total : 45

TEXT BOOKS:
1. Sinha, N.C. and Roy, S.K. ,"Fundamentals of Prestressed Concrete", S.Chand and Co., 1987.
2. Krishna Raju, N. "Prestressed Concrete", Tata McGraw Hill, New Delhi,2012.
3. IS 1343:1980 – Code of Practice for Prestressed Concrete, Bureaus of Indian Standards, New Delhi.

REFERENCE BOOKS:
1. Lin T.Y.&Burns,N., "Design of Prestressed Concrete Structures". John Wiley & Sons, 1992.
2. Dayaratham,N, "Prestressed Concrete Structures". Oxford & IBH Company, New Delhi, 2004.
3. Kachaturian,N. and Gurfinkel,G. - "Prestressed Concrete", McGraw Hill Book Co., Newyork, 1975.
4. Antoine, E.Naaman - "Prestressed Concrete Analysis and Design - Fundamentals", McGraw Hill Book Co., Newyork, 1982.
5. Rajagopalan- "Prestressed Concrete", Narosa Publishers, New Delhi, 2013.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X				X		X				X				
2	X				X		X				X				
3	X	x	X		X		X				X				

13CEE02 ADVANCED CONCRETE STRUCTURES

```
L  T  P  C
3  0  0  3
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ASSESSMENT: THEORY
COURSE OBJECTIVES:
The course aims to make the students to gain expertise in the design of special Civil Engineering structures, namely deep beams, flat slabs, prefabrication and tall structures.

COURSE OUTCOMES:

CO1: *The student will be able to explain the construction of precast structural members.*
CO2: *The student will be able to analyse and design various tall structures.*
CO3: *The student will be able to analyse and design various special structures such as chimneys and grid floors.*
.

CHECK FOR SERVICEABILITY
Check for deflection and cracking as per IS 456-2000 **(8)**

PREFABRICATION
Principles of precast construction - Merits and Demerits - Dimensioning and detailing of joints for different structural connections - Construction and expansion joints - Production - Transportation - Erection. **(8)**

TALL STRUCTURES
Analysis of R.C.Chimneys by Elastic theory - Design by LSD.Design of square bunker using Rankine's theory.Design of circular silo using Jansen's theory - and Airy's theory. (Derivation not required for both theories). **(10)**

DESIGN OF CHIMNEY
Types of chimney – Design of self supporting chimney and Guyed chimney – Design of chimney foundation. **(10)**

DESIGN OF FLOOR SLAB
Design of voided slab – Analysis and design of grid floor. **(9)**

Total : 45

TEXT BOOKS:
1. Ashok K.Jain., "Reinforced concrete - Limit State Design", Nem Chand Brothers, Roorkee, 2006.
2. Krishnaraju N., "Advanced Reinforced Concrete Design", C.B.S Publishers and Distributors, New Delhi, 2013.

REFERENCE BOOKS:
1. Jain and Jai Krishna., "'Plain and Reinforced Concrete", Nem Chand Brothers, Roorkee, 2007.
2. Mallick and Gupta., "Reinforced Concrete Design", Oxford and IBH, Publishers, Delhi, 1996.
3. Design Aids to I.S. 456 - 1980 (SP 16), Bureaus of Indian Standards, New Delhi.
4. Code of "Practice for Plain and Reinforced Concrete" IS456 - 2000, Bureaus of Indian Standards, New Delhi.
5. Glover.C.W.," Structural Precast Concrete" , Asia Publishing House, Bombay, 1967.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x		x		x		x				x				
2	x		x		x		x				x				
3	x		x		x		x				x				

(Table title: Mapping of CO's and PO's)

13CEE03 ADVANCED STEEL STRUCTURES

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To develop technical competence in the design of light gauge sections, industrial buildings, Bunkers, Silos and Plastic design.

COURSE OUTCOMES:
On completion of the course the student will be
CO1: The student will be able to analyze and design the light gauge structural members
CO2:The student will be able to analyze and design towers and industrial buildings
CO3:The student will be able to analyze Acquire knowledge on various types of connections
CO4:The student will be able to analyze and design bunkers and silos

LIGHT GUAGE STEEL MEMBERS

Light gauge sections - types of sections, material - local buckling of thin elements - stiffened and multiple stiffened compression members - Unstiffened elements - Laterally supported and unsupported flexural members - connections.   **(10)**

STEEL TOWERS

Transmission line towers - Micro Wave Towers - Loads on towers - Shape, Sag and Tension in Uniformly loaded conductors - Analysis of towers - Design of member in towers - Design of tower foundations.   **(10)**

CONNECTIONS:

Connections - flexible, semirigid and rigid or moment resisting connections. Multistoreyed framed structures - Analysis for Vertical and lateral loads for frames with moment resistant connections only - Design for composite construction.   **(9)**

INDUSTRIAL BUILDINGS:

Industrial Building frames - General, framing, bracing, Crane Girders and columns - Analysis of Trussed bents - Canopy design.   **(8)**

BUNKERS AND SILOS:

Pressure on side walls of bunkers and silos - Jansen's and Airy's theories - complete design of circular silos.   **(8)**

                                                                                       Total : 45

TEXT BOOKS:
1. Subramanian.N,"Design of Steel Structures",Oxford University Press,New Delhi,2008.
2. Bhavikatti.S.S. "Design of Steel Structures by Limit State Design", I.K International Pvt.Ltd.,2012.

REFERENCE BOOKS:
1. Ramchandra, "Design of Steel Structures" - Vol. I and II, Standard Publishers Distributers, New Delhi, 2002.
2. Bresler and Lin,"Design of Steel Structures", Wiley Eastern Pvt. Ltd., New Delhi. 1980.
3. Vazirani, V.N. and Ratwani,N.M., Honey Mehra "Design and Analysis of Steel Structures", Khanna Publishers, New Delhi, 2000.
4. IS: 800,Code of Practice for use of Structural Steel in General Building Construction, Bureau of Indian Standards , New Delhi, 2007.
5. IS 801:1975, Code of Practice for use of Cold Formed Light Gauge Steel Structural Members in General Construction, Bureaus of Indian Standards, New Delhi.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x		x		x		x				x				
2	x	x			x					x	x				
3	x		x		x						x				
4	x	x	x				x				x				

Mapping of CO's and PO's

13CEE04 EXPERIMENTAL STRESS ANALYSIS   L T P C
                                           3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
At the end of this course the student should be able to understand the measurement of strain for the experiments to be conducted in the laboratory and also understand modeling and distress on a structure.

COURSE OUTCOMES:
CO1: The students will be able to understand the working principles of different strain gauges and the force applied on the structure.
CO2: The students will be able to understand application of rosette for the determination and construction of stress circle.
CO3: The students will be able to understand the concept and practical application of force and vibration measurement.
CO4: The students will be able to explain the model analysis and photo elastic concepts & the distress measurements.

STRAIN GAUGES
Definition of gauge length, sensitivity and range – Characteristics of an ideal strain gauge - Different types of mechanical strain gauges (Huggenberger tensometer, Amslers' Extensometer, Amslers' mirror extensometer, Unwins compressometer) - Mechanical optical strain gauges (Tuckermans' gauge) – Optical strain gauge – Acoustic strain gauge – Pneumatic strain gauge – Merits and demerits.   **(9)**

ELECRICAL STRAIN GAUGES
Inductance, capacitance and piezo electric gauges –Electrical resistance gauges and their application in stress analysis – Fixing techniques and measurement of strains – Rosettes – Determination of principal stresses using rosettes – Construction of stress, strain circles – Analytical solution.   **(9)**

FORCE AND VIBRATION MEASUREMENTS
Hydraulic jacks and pressure gauges – Load cells – Proving rings – Transducer for velocity and acceleration measurements – Vibration meter – Vibration analyzer – Display and recording of signals – Digital data acquisition systems.   **(9)**

PHOTO ELASTICITY
Basics of optics and stress optic law – Plane and circularly polarised light and their use in photo elasticity – Polariscopes – Diffusion type polariscope – Isoclinics and Isochromatics - Calibration methods for finding material fringe values – Model fringe values – Examples of beam flexure and diametrically loaded circular plates.   **(9)**

MODEL ANALYSIS AND DISTRESS MEASUREMENT
Direct and indirect models – Laws of structural similitude – Choice of scales – Limitation of model studies – Model materials – Begg's deformeter and its use – Simple design of direct and indirect models – Crack observation and measurement – Corrosion of reinforcement in concrete – Half cell, construction and use.   **(9)**
                                                                              Total : 45

TEXT BOOKS:
1. Srinath, L. S, "Experimental Stress Analysis", Tata McGraw Hill Book Company, New Delhi.,2007.
2. Roy, T. K, "Experimental Analysis of Stress and Strain", S Chand & Co, New Delhi, 2006.

REFERENCE BOOKS:
1. Dally J.W. and Riley W.F., "Experimental Stress Analysis", McGraw Hill Book Co., 1985.
2. Dove and Adams, "Experimental Stress Analysis and Modern Measurement", Prenice Hall of India Ltd.1986.
3. Hetenyi M, "Hand Book of Experimental Stress Analysis", John Wiley and Sons, Inc. Newyork, 1980.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x		x				x				
2	x	x	x		x					x		x			x
3	x	x		x				x				x			
4	x	x	x		x		x				x			x	

13CEE05 HEALTH MONITORING OF STRUCTURES

L T P C
3 0 0 3

ASSEMENT: THEORY
COURSE OBJECTIVES:
To enable the students to learn the need for quality control in concreting, types of distresses in structures and their remedial measures, various materials and methods available for rehabilitation and also about the various non destructive techniques.

COURSE OUTCOMES:
CO1: *The students will be able to diagnose various distresses in structures and their causes.*
CO2: *The students will be able to explain various materials and techniques available for rehabilitation of structures.*
CO3: *The students will be able to understand various type of crack in concrete.*
CO4: *The students will be able to understand the different types of repair materials in concrete and diagnose the different repairing and demolition techniques of concrete.*

SERVICEABILITY AND DURABILITY OF CONCRETE
Quality assurance for concrete construction – concrete preparation – strength, permeability, thermal properties – effects due to climate, temperature, chemicals, corrosion – strength evaluation of existing structures by NDT (Rebound, UPV, Flow detector). **(9)**

MAINTENANCE AND REPAIR STRATEGIES
Maintenance, Repair and Rehabilitation, facets of maintenance, importance of maintenance – various aspects of inspection, Assessment procedure for evaluating a damaged structures, causes of deterioration. **(9)**

CRACKS
Cracks in concrete - intrinsic cracking and structural cracking - causes and remedies - plastic cracks and remedies – Thermal contraction cracks - Long term drying shrinkage cracks – Sulphate attack cracks – Alkali aggregate reaction cracks. (**9**)

MATERIALS FOR REPAIR
Material for Repair: Concrete chemicals, special elements for accelerated strength gain - Expansive cement - Polymer concrete - Sulphur infiltrated concrete - Ferrocement - Fibre reinforced concrete. **(9)**

REPAIR TECHNIQUES
Repair techniques: Rust eliminators and polymer coating for steel bars during repairs - formed concrete, mortar and dry pack – Vacuum concrete – Gunite, shotcrete and Grouting - Epoxy injection – Mortar repair for cracks - shoring and under pinning.

DEMOLITION TECHNIQUES
Engineered demolition techniques for dilapidated structures – Case studies. **(9)**

Total : 45

TEXT BOOK:
1. DensionCampell, Allen and Harold Roper., "Concrete Structures" , Materials, Maintenance and Repair", Longman Scientific and Technical, U.K. 1987.

REFERENCE BOOKS:
1. Allen R.T., and Sc Edwards., "Repair of Concrete Structures", Blakie and sons", U.K. 1987.
2. Neville A.M., "Properties of Concrete", The English Language Book Society and Pitman publishing, London, 2000.
3. Guha P.K.," Maintenance and Repairs of Building", New Central Book Agency (P) Ltd.,Calcutta,1998

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x		x	x			x				
2	x	x	x		x					x		x			x
3	x	x		x				x				x			
4	x	x	x		x		x				x			x	

13CEE06 PREFABRICATED AND INDUSTRIAL STRUCTURES

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To gain knowledge about the modern trends in building construction, role of prefabricated structures and the basic functional requirements of industrial structures.
COURSE OUTCOMES:

CO1: The students will be able to explain the various functional requirements of an industrial building.
CO2: The students will be able to explain the basic principles involved in prefabrication.
CO3: The students will be able to demonstrate the manufacturing techniques of precast elements.

GENERAL
Specific requirements for industries like Engineering, Textile, Chemical-site layout and external facilities- classification of industries minimum standards, internal circulation-materials-works. **(9)**

FUNCTIONAL REQUIREMENTS
i) Selection of site
ii) Lighting – Natural and Artificial-Protection from the sun and sky
iii) Services, layout, wiring fixtures, cable and pipe bridges-electrical installations-lighting substations-Effluent
iv) Ventilation and fire protection, air conditioning and air ventilation, Fire escapes and chutes, fire alarms, Extinguishers and hydrants. **(9)**

GENERAL PRINCIPLES OF PREFABRICATION
Types of prefabrication - Advantages of prefabrication - Site and plant prefabrication - Economy of prefabrication - Modular coordination – Standardisation - Disuniting of structures - Various prefabricated elements roof and floor panels-wall panels. **(9)**

PRECASTCONCRETE-MANUFACTURING TECHNIQUES
Cycle of precasting - Preparation and transportation of concrete, Reinforcement – Preparation of moulds-Production tolerances - Equipments for handling the precast elements - Standard practices and techniques of handling. **(9)**

JOINTS AND CONNECTIONS
Types of precast connections - Joints for different structural connections - Effective water proofing at the joints – Expansion joints in precast construction – Precast connections for seismic resistance – Provision for non structural fixtures and fastenings. **(9)**

Total : 45

TEXT BOOKS:
1) Glover.C.W, "Structural Precast Concrete" Asia Publishing House, Bombay. 1967.
2) Haas.A.M, "Precast Concrete- Design and Applications" Applied Science Publishers, London and NewYark, 1983.

REFERENCE BOOKS:
1) Dunham, "Planning of industrial Structures" Metropolitan Book Company, 1980.
2) SP32-1986, HandBook on Functional Requirements of Industrial Buildings (Lighting and Ventilation) Bureau of Indian Standards, New Delhi, 1990.
3) Structural Design Manual, Precast concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland BehorVerlag, 1978.
4) Proceedings of the Advanced Course on Design and Construction of Prefabricated Residential Buildings organized by SERC, Madras,1974.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X				X		X				X				
2	X		X		X		X				X				
3	X		X		X		X				X				

Mapping of CO's and PO's

13CEE07 ANALYSIS AND DESIGN OF DEEP FOUNDATIONS

L T P C
3 0 0 3

***COURSE* OBJECTIVES:**
The student will be exposed to the design of piles, pile groups and caissons with respect to vertical and lateral loads for various field conditions.

COURSE OUTCOMES:
CO1: The students will be able to understand the classifications of piles for various applications.
CO2: The students will be able to analyse axially loaded pile/ pile groups for different soil conditions.
CO3: The students will be able to analyse laterally loaded piles.
CO4: The students will be able to design piles and pile groups for given site specific conditions.
CO5: The students will be able to acquire knowledge of deep foundations for special situations.

PILE CLASSIFICATIONS
Function – classification of piles – Factors governing choice of pile foundation – Load transfer principles – piling equipments and methods – changes in soil condition during installation of piles – requirement of code of practice – responsibility of engineer and contractor.   **(9)**

AXIALLY LOADED PILES AND PILE GROUPS
Allowable load evaluation of piles and pile groups – Static method – cohesive – cohesionless soil – time effects – Dynamic method – pile driving formulae – Wave equation application – modeling – theoretical analysis – Interpretation of field test results and pile load test results – Settlement of Piles and Pile groups.   **(9)**

LATERAL AND UPLIFT LOAD EVALUATION
Piles subjected to Lateral loads – Broms method, elastic –p-y curve analyses – Batter piles – response to moment – pile subjected to uplift loads – load –deformation behaviour – Lateral and uplift load test data interpretation. Foundation on week compressible – collapsible soil – case studies. **(10)**

STRUCTURAL DESIGN OF PILE AND PILE GROUPS
Pile foundation – structural design – pile cap analysis, pile – raft system basic interactive analysis – pile and pile groups subjected to vibrations – fundamental solutions.   **(9)**

CAISSONS
Caissons types – Stability of caissons – principles of analysis and design, seismic influences - IRC Guidelines.   **(8)**

TOTAL: 45

REFERENCES:

1.   Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
2.   Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.
3.   Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.
4.   Cernica, J.N. Geotechnical Engineering Foundation Design, John Wiley and Sons, Inc. 1995.
5.   Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
6.   Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1					x		x							x	
2	x		x		x		x			x				x	
3	x	x			x		x			x				x	
4	x	x			x					x				x	
5	x	x					x			x				x	

13CEE08 SOIL STRUCTURE INTERACTION

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE **OBJECTIVES:**
To understand the mechanism of soils, their interactive behaviour, analysis, its influences in the design parameters through design charts and software packages.

COURSE OUTCOMES:
CO1: *The students will be able to understand and demonstrate soil structure interaction.*
CO2: *The students will be able to analyse analyse various foundations for given soil response conditions.*
CO3: *The students will be able to analyse various foundations for given soil response conditions.*

SOIL-FOUNDATION INTERACTION
Introduction to soil - Foundation interaction problems, Soil behaviour, Foundation behaviour, Interface, behaviour, Scope of soil-foundation interaction analysis, soil response models, Winkler, Elastic continuum, Two parameter elastic models, Elastic - plastic behaviour, Time dependent behaviour. **(8)**

BEAM ON ELASTIC FOUNDATION - SOIL MODELS
Infinite beam, Two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness – Analysis through application packages. **(9)**

PLATE ON ELASTIC MEDIUM
Infinite plate, Winkler, Two parameters, Isotropic elastic medium, Thin and thick plates, Analysis of finite plates, rectangular and circular plates, Numerical analysis of finite plates, simple solutions, Analysis of braced cuts - Application packages. **(9)**

ELASTIC ANALYSIS OF PILE
Elastic analysis of single pile, Theoretical solutions for settlement and load distribution, Analysis of pile group, Interaction analysis, Load distribution in groups with rigid cap - pile raft - Application packages. **(10)**

LATERALLY LOADED PILE
Load deflection prediction for laterally loaded piles, subgrade reaction and elastic analysis, Interaction analysis, and pile raft system, solutions through influence charts and Application packages. **(9)**

TOTAL: 45

REFERENCES:

1.   Saran, S, Analysis and desaign of substructures, Taylor & Francis Publishers, 2006
2.   Hemsley, J.A, Elastic Analysis of Raft Foundations, Thomas Telford, 1998.
3.   Poulos, H.G., and Davis, E.H., Pile Foundation Analysis and Design, John Wiley, 1980.
4.   Murthy, V.N.S., Advanced Foundation Engineering, CBS Publishers, New Delhi, 2007
5.   McCarthy, D.F. Essentials of Soil Mechanics and Foundations, Basic Geotechnics, Sixth Edition, Prentice Hall, 2002.
6.   Selvadurai, A.P.S., Elastic Analysis of Soil Foundation Interaction, Elsevier, 1979.
7.   Scott, R.F. Foundation Analysis, Prentice Hall, 1981.
8.   Structure Soil Interaction - State of Art Report, Institution of structural Engineers, 1978.

9.   ACI 336, Suggested Analysis and Design Procedures for Combined Footings and Mats, American Concrete Institute, Dehit, 1988.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x		x		x										
2	x		x		x		x				x				
3	x	x	x		x		x				x				x

13CEE09 ENVIRONMENTAL IMPACT ASSESMENT

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:

To impart the knowledge and skills to identify, assess and mitigate the environment and social impacts of development projects to give exposure to students about the assessment of environmental impacts due to major civil projects and their management.

COURSE OUTCOMES:

CO1: T*he students will be able to understand the necessity to study the impacts and risks that will be caused by projects or industries.*

CO2: *The students will be able to understand the methods of impacts identifications & methods to overcome the impacts.*

CO3: *The students will be able to understand about the legal requirements of environmental assessment for projects.*

IMPACT ASSESSMENT PERSPECTIVES

Impact assessment introduction –Historical perspective –Scope and goals of EIA and EMP – Organization responsible for EIA –International treaties and agreements on the environment and natural resources –Global warming –Climate change –Ozone depletion –Acid rain –National committee on environmental planning and co-ordination –Tiwari committee, Department of environment. **(9)**

COMPONENTS AND METHODS

Management of Environmental Assessment-Review and project appraisal- Environmental clearance-procedure for clearance- List of projects requiring clearance- Composition of expert committee- Public hearing- EIA amendments- Schedule- Forms- Checklist- NRBT criteria for EIA consultants-Environmental statements and standards. **(9)**

ASSESSMENT AND MONITORING

Contents of EIA and EMP- Baseline and inventory studies- Description of existing and proposed environment- Flora, Fauna, Social, and Cultural aspects- Environmental Impact Statement (EIS), Decision making tool- Adverse impacts- Project alternation- Mitigate measures- Assessment methodologies; ad hoc, Overlays, network, matrix, checklist- Environmental auditing and cost- Benefit analysis. **(9)**

CASE STUDIES

Case studies –Water related projects, Air related projects, soil and solid waste related projects – Environmental quality –Public and socio economic welfare –New ways towards environmental management –Changing concept of environmental management –Cleaner production –Environmental Management System. **(9)**

LEGISLATIVE PERSPECTIVES

Hazardous waste management and handling rules, 1989 and Manufacture, Storage, Important and export of Hazardous/Micro-organism/Genetically engineered organisms or cells rules 1989 – Biomedical waste (Management and Handling) rules -1998 –Coastal regulation zone notification 1991. **(9)**

Total: 45

REFERENCES

1. Rao, J.G., and Wotten, D.C., "Environmental Impact Analysis, Handbook", McGraw-Hill, 1980.

2. Van Nostr, and Reinhold, J.E. Heer, Hagerty,D . J.,"Environmental Assessment and Statement", 1977.

3. Canter, L.W., "Environmental Impact Assessment ", McGraw-Hill, New York, 1996.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x				x	x		x				x			
2	x				x	x		x							
3	x				x	x		x							

13CEE10 SOLID AND HAZARDOUS WASTE MANAGEMENT

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
The prime motive behind this course is to appropriately create, deep interest about the solid and hazardous wastes and their impact on the components of the environment. Also, to facilitate the students about the best available and strategic techno-economic management tools for noise pollution control.

COURSE OUTCOMES:
On completion of the course the students are expected to
CO1: The students will be able to understand the characteristics of different types of solid and hazardous wastes and factors affecting variation.
CO2: The students will be able to gain knowledge about the important concepts in the field of solid waste management and suggest suitable technical solutions for the treatment of municipal and hazardous waste.
CO3: The students will be able to apply the basic scientific principles for solving practical waste management.
CO4: The students will be able to explain the role of legislation and policy in waste management.

PERSPECTIVES OF SOLID WASTE
Definition, sources, and types of solid waste - Comparison of waste generation in India and other developed countries – Per capita generation rates - Sampling and characterization of solid waste - Composition of solid waste: physical (Individual contents, size, moisture content and density) and chemical (energy and chemical content) - Typical composition of Indian MSW – Functional elements of SWM system Legislation and responsibilities. **(9)**

COLLECTION AND TRANSPORT OF SOLID WASTE
Estimation of solid waste and factors affecting generation rates - On-site handling, storage, and processing - Collection services: municipal and commercial - Industrial services - Collection systems: Hauled-container system (HCS) and stationary container system (SCS) - Vehicle and labour assessment - Assessment of collection route - Transfer and transport – Transfer station location-Means and methods of transfer. **(9)**

PROCESSING AND DISPOSAL OF SOLID WASTE
Definition and necessity - Volume reduction: manual separation, mechanical, and thermal -Land filling method: site selection methods and operations, leachate and gas generations and movement and control of gas and leachate - Operations of landfills- Land farming, deep well injection, and ultimate disposal techniques - Composting: aerobic and anaerobic - Resource and energy recovery schemes - Vermi composting application - Integrated solid waste facilities. **(9)**

PERSPECTIVES OF HAZARDOUS WASTE
Definitions and Identifications of hazardous waste - Origin and characterization of hazardous solid waste - Typical hazardous wastes in MSW – Hazardous waste management: minimization, collection, storage, handling, transport, and compatibility – Typical industrial regulations – National and International legislation for hazardous waste management. **(9)**

TREATMENT AND DISPOSAL OF HAZARDOUS WASTE
Necessity and types of treatment – Objectives, principles, operations, relevant analytical equations without derivations (no design), of solidification, encapsulation, chemical oxidation, and incineration techniques – Planning, operation, and design of hazardous waste landfills – One or two case studies.
(9)
Total: 45

TEXT BOOKS:

1.Tchobanoglous, G. et al., "Integrated Solid Waste Management", McGraw-Hill Publication., N.Y., 1993.

REFERENCES

1. Peavy, SH, Rowe, RD and Tchobanoglous, G, "Environmental Engineering", McGraw-Hill Inter Edition. 1985.
2. Charles, A.W., "Hazardous Waste Management", McGraw-Hill Pub., 2002.

Mapping of Course Outcome with Program Outcome

<table>
<tr><th colspan="16">Mapping of CO's and PO's</th></tr>
<tr><th rowspan="2">CO's</th><th colspan="15">PO's</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>13</th><th>14</th><th>15</th></tr>
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13CEE11 BUILDING SERVICES AND
SYSTEMS ENGINEERING

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ASSESSMENT: THEORY
COURSE OBJECTIVES:
This subject covers the various aspects of building services involved in Civil Engineering practice. The basic concepts in building services are imparted.

COURSE OUTCOMES:
CO1: The students will be able to understand various system requirements in a building.
CO2: The students will be able to demonstrate various machineries, electrical systems and air conditioning systems in a building.
CO3: The students will be able to explain regulations involved in fire safety installations.

MACHINERIES
Hot Water Boilers – Lifts and Escalators – Special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity   **(9)**

ELECTRICAL SYSTEMS IN BUILDINGS
Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – Transformers and switch gears – Layout of substations   **(9)**

PRINCIPLES OF ILLUMINATION & DESIGN
Visual tasks – Factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – Additive and subtractive synthesis of colour – Luminous flux – Candela – Solid angle illumination – Utilisation factor – Depreciation factor – MSCP – MHCP – Lans of illumination – Classification of lighting – Artificial light sources – Spectral energy distribution – Luminous efficiency – Colour temperature – Colour rendering.
Design of modern lighting – Lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination required for physically handicapped and elderly in building types.   **(9)**

REFRIGERATION PRINCIPLES & APPLICATIONS
Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent heat of fusion, evaporation, sublimation – saturation temperature – Super heated vapour – Subcooled liquid – Pressure temperature relationship for liquids – Refrigerants – Vapour compression cycle – Compressors – Evaporators – Refrigerant control devices – Electric motors – Starters – Air handling units – Cooling towers – Window type and packaged air-conditioners – Chilled water plant – Fan coil systems – Water piping – Cooling load – Air conditioning systems for different types of buildings – Protection against fire to be caused by A.C. Systems   **(9)**

FIRE SAFETY INSTALLATION
Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non-combustible materials, construction, staircases and lift lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and wet risers – Automatic sprinklers   **(9)**

TEXT BOOKS:
1. E.R.Ambrose, "Heat Pumps and Electric Heating", John and Wiley and Sons, Inc., New York, 1968.
2. Handbook for Building Engineers in Metric systems, NBC, New Delhi, 1968.
3. Philips Lighting in Architectural Design, McGraw-Hill, New York, 1964.

REFERENCES
1.R.G.Hopkinson and J.D.Kay, "The Lighting of buildings", Faber and Faber, London, 1969.

2. William H.Severns and Julian R.Fellows, "Air-conditioning and Refrigeration", John Wiley and Sons, London, 1988.
3. A.F.C. Sherratt, "Air-conditioning and Energy Conservation", The Architectural Press, London, 1980.
4. National Building Code.

Mapping of Course Outcome with Program Outcome

<table>
<tr><td colspan="16">Mapping of CO's and PO's</td></tr>
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13CEE12 RENEWABLE ENERGY RESOURCES

L T P C

3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES :
This course aims at expertising the students of civil engineering about the various unconventional and renewable energy resources available in India.
COURSE OUTCOMES:

CO1: The students will be able to assimilate the basic knowledge pertaining to unconventional and renewable energy resources.
CO2: The students will be able to describe the challenges and problems associated with the use of various energy source with regard to future supply and the environment.
CO3: The students will be able to collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.

ENERGY PERSPECTIVES
Conventional and non conventional energies – Global energy perspectives – Energy and sustainable development – Current energy scenario in India – Energy consumption pattern in rural and urban regions
– Energy efficiency and economy – Energy losses and its control – Future of energy in India.   **(9)**

SOLAR ENERGY PERSPECTIVES
Concept of solar energy – Solar energy to light and to thermal conversions – Total energy and necessary infrastructure – Units and measurement of solar radiation – Temperature dependent collecting devices and their efficacies - Design aspects – Typical applications: heating, cooling, lighting, power generation and cooking.   **(9)**

WIND ENERGY PERSPECTIVES
Wind potential in India – Wind machines and their types – Merits and demerits – Wind power and appropriate coefficient – Efficiency and performance of wind machines –Energy conversion and storage - Synchronous invertors – Various storage aspects : battery, fly wheel, hydrogen and compressed air.   **(9)**

BIOMASS ENERGY PERSPECTIVES
Biomass potential in India – Gobar gas and producer gas – Characteristics of biomass – Operation and design of biogas plants – Objectives, principles and operational aspect of biogassifiers – Pyrolysis and incineration – Incineration of MSW and industrial Sludges – Application of biodiesel plants – Fuel cells.   **(9)**

TIDAL ENERGY PERSPECTIVES
Tidal aspects in coastal India – Tidal energy conversion system: mechanical to electrical and thermal to electrical – Tidal force calculation and power generation – conceptualization and potential of geothermal energy – Geothermal vents.   **(9)**

Total : 45

TEXT BOOK:
1. Sukathme, S.P , " Solar Energy" , Tata McGraw –Hill Book Co., New Delhi, 1993.

REFERENCE BOOKS
1. Rai, G.D., "Solar Energy Utilization", Khanna Publishers, New Delhi, 1993.
2. Angrist, S.W, "Direct Enery Conversion", Allied Publishers Ltd., Boston, 1971.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x				x	x		x			x				
2	x			x	x			x			x				
3		x		x							x		x		x

13CEE13 TOWN PLANNING AND ARCHITECTURE

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To introduce the fundamentals of architecture, development plans and development control rules for the overall development of a city in a scientific and systematic way.

COURSE OUTCOMES:
CO1: *The students will be able to understand the various elements of architecture and principles of orientation,*
CO2: *The students will be able to understand about developing of plans and planning regulations.*
CO3: *The students will be able to explain various development control rules in town planning.*

ELEMENTS OF ARCHITECTURE (9)
Introduction of architecture - definition - Evaluation of geometric forms - function and history - Sphere, Cube, Pyramid, Cylinder and Cone - aesthetic qualities of Architecture - Proportion, Scale, Balance, Symmetry, Rhythm and axis - Contrast in Form - Harmony.

PRINCIPLES OF ORIENTATION AND PLANNING OF BUILDINGS (9)
Factors affecting orientation - Sun-Wind-Rain - Orientation criteria for Indian conditions - Principles governing the theory of planning - Planning of residential buildings.

DEVELOPMENT PLAN (9)
Principles of city planning - levels of planning- scope and contents of regional plan, master plan, detailed development plan and structure plan - preparation and implementation - planning of new towns – slum clearance and urban renewal.

PLANNING LEGISLATION (9)
Planning legislation and administration - review of planning legislation relating to city planning and housing in India - Tamil Nadu Town and Country planning Act, Tamil Nadu Housing Board Act, Tamil Nadu slum clearance and Improvement Act.

DEVELOPMENT CONTROL RULES: (9)
Zoning regulations - sub division regulations – building regulations - Floor Space Index - minimum plot sizes and building frontage - open spaces - minimum standard dimensions of buildingelements - organisation and administration of Planning agencies at national, state, regional, local and metropolitan levels.

Total: 45

TEXT BOOKS:
1. Rangwala.S.C., "Town Planning", Charotar Publishing House, Anand, 2013.
2. Francis.D.K.,Ching, "Architecture Form, Space and Order" , Oxford University Press, 2005.

REFERENCE BOOKS:
1. Donald Helper and Wallach."Architectural Drafting and Design", McGraw Hill Book Company, New Delhi, 2004.
2. Arnold Whittick., "Encyclopedia of Urban Planning", McGraw Hill Book, Company, New Delhi, 2003.
3. Pickering.E., "Architectural Design", John Wiley & Sons, London, 2012.
4. Hiraskar, G.K, "Fundamentals of Town Planning", DhanpatRai and Sons, Delhi, 2005.
5. Arthur B.Gallion and Simon Eisner, "The Urban Pattern – City Planning and Design", CBS Publishers and Distributors, Delhi, 1980.
6. G.K.Hiraskar, "The Great Ages of World Architecture," DhanpatRai Publications (P) Ltd., New Delhi, 2010.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X				X			X						X	
2	X	X			X		X				X			X	
3	X	X			X		X				X			X	

13CEE14 CONSTRUCTION EQUIPMENTS AND TECHNIQUES

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L  T  P  C
3  0  0  3
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ASSESSMENT: THEORY
COURSE OBJECTIVES:
To introduce the various construction equipment used in the construction and various techniques of construction.

COURSE OUTCOMES:
CO1: The students will be able to acquire knowledge in using constructions equipments effectively in different construction aspects
CO2: The students will be capable to analyse the problems in construction processes and can find the remedy to solve with the modern equipments usage
CO3: The students will be able to develop solutions to well-defined project management problems within civil or construction engineering.

EARTHWORK AND MATERIAL HANDLING EQUIPMENTS
Fundamentals of earth work operations - Selection of equipment for earth work- Types of earth work equipment – Tractors, Motor graders, Scrapers , Front end waders, Earth movers. Material handling equipment – Forklifts and related equipment- Portable material bins – conveyors-hauling equipment.
(9)

EQUIPMENTS FOR AGGREGATE PRODUCTION AND CONCRETING
Crushers- Feeders- screening equipment – handling equipment- batching and mixing equipment-hauling, pouring and pumping equipment.RMC equipment. **(9)**

OTHER CONSTRUCTION EQUIPMENTS
Foundation and pile driving equipment – Equipment for compaction - Equipment for dewatering and grouting – Equipment for demolition. **(9)**

SUBSTRUCTURE CONSTRUCTION
Techniques for box jacking, pipe jacking, diaphragm wall construction – piling techniques – driving well and caisson – cofferdam – sheet piles – dewatering and stand by plant equipment for underground open excavation. **(9)**

SUPERSTRUCTURE CONSTRUCTION
Vaccum dewatering for concrete flooring- Techniques for continuous concreting operations – Concrete paving technology – Erection techniques of tall structures – pre stressing in high rise structures – aerial transporting. **(9)**
Total: 45

REFERENCES
1. Sharma S.C Construction equipment and Management, Khanna publishers, New Delhi 1988
2.Peurifoy,R.L.,Ledbetter, W.B and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore,2006
3. Arora S.P and Bindra S.P., Building construction, Planning and Techniques and Method of construction, Dhanpatrai and sons, 1997
4. Varghese, P.C Building construction, Prentice Hall of India Pvt. ltd, New Delhi
5.Deodhar, S.V. "Construction Equipment and Management" , Khanna publishers, New Delhi, 1988

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x			x	x		x				x
2	x	x	x						x		x	x		x	x
3	x	x	x			x			x	x	x	x	x		x

13CEE15 WATER POWER ENGINEERING

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To make the students understand the various sustainable sources of hydraulic energy available for generation of power and the system for power generation.
COURSE OUTCOMES:
The student will have knowledge about various types of hydel power generation facilities.
CO1: The students will be able to understand status of power and methods for power generation.
CO2: The students will be able to explain various processes involved in power generation.
CO3: The students will be able to understand the power house planning and distribution.

WATER POWER

Introduction - Sources of energy - Status of power in world - Hydro Power - Transmission voltages and Hydro power - Estimation of Water Power Potential.

ELECTRICAL LOAD ON HYDRO TURBINES

General - Load curve - Load factor – capacity factor – Utilisation factor - Diversity factor - Load duration curve - Firm power – Secondary power - Prediction of load - Illustrative examples.   **(9)**

HYDRO POWER PLANTS

Classification of hydel plants - Run-of-River Plants – General arrangements - Valley dam plants - Diversion canal plants - High head diversion plants - storage and pondages. Pumped storage plants - Types - Advantage - two unit arrangement, Three unit arrangement - Reversible pump turbines - Problems in operation - Efficiency of pumped storage plants.   **(9)**

WATER CONVEYANCE

Penstock - Types - Design criteria - Anchor Blocks - Valves, Bends and Manifolds - Intakes - Types - Losses - Aeration – Forebays - canals - Tunnels, - Water Hammer - Surge tanks.   **(9)**

TIDAL POWER

Tidal Phenomenon - Tidal power - Basic principle - Location - Difficulties - Components - Modes of generation - Constructional aspects - Estimation of energy and power - Regulation of power output - Corrosion control and quality of concrete.   **(9)**

POWER HOUSE PLANNING:

Surface power stations - Power House structure - Dimensions - Lighting and ventilations - Design variations - Under ground power stations - Location - Types - Advantages - Components - Layout types - Limitations - Environmental impact of Hydel power projects – Introduction to economic analysis of Hydro Power projects.   **(9)**

Total : 45

TEXT BOOK:

1. Dandekar.M.M and Sharma, K.N., "Water Power Engineering", DandekarVikas Publishing House Pvt Ltd., New Delhi, 1998.

REFERENCE BOOKS:

1. Creager.W.P and Justin .J.D, "Hydro Electric Hand Book", John Wiley Sons, London, 1981.
2. Desmukh.M.M "Water Power Engineering" ,DhanpatRai Publications, New Delhi, 1977.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X		X		X	X		X			X				
2	X		X		X	X		X			X				
3	X		X		X	X		X			X				

13CEE16   ENGINEERING HYDROLOGY

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE **OBJECTIVES:**

To impart an in-depth knowledge about
> ➢ *the rainfall and runoff processes that contributes to the surface and subsurface water for utilization for drinking and irrigation*
> ➢ *the behavior, availability and utilization of subsurface water and methods of acquiring the same*

COURSE **OUTCOMES:**

CO1: *The students will be able to analyze the rainfall-runoff data and predict the quantity of water that can be derived from nature*
CO2: *The students will be able to design wells for utilizing the ground water*
CO3: *The students will be able to demonstrate the construction of wells for utilizing the ground water.*

GENERAL *HYDROLOGY* AND PRECIPITATION

Hydrology – weather – general circulation – watershed hydrology – geomorphology – effect of land use in hydrology.
Precipitation -Types – forms – measurement – rainfall data analysis – abstraction and losses from precipitation such as evaporation – infiltration and transpiration – their estimation   **(9)**

RUN-OFF

Rainfall-Runoff process – runoff estimation through empirical formulae – hydrograph theory and its applications.   **(9)**

FLOOD AND STREAM FLOW MEASUREMENTS

Flood estimation – routing – flood control. Stream flow measurements - methods - Stage Discharge Relation – Stream gauging Network.   **(9)**

GROUND WATER AND WELLS

Ground water sources – aquifers – yield – storage coefficient – permeability – transmissibility – measurement. Wells -Construction and maintenance of open and tube wells – water divining   **(9)**

WELL HYDRAULICS

Darcy's law – yield of confined and unconfined aquifer under equilibrium and non-equilibrium condition – Dupuit's theory – Theis's theory – Theim's theory – Recuperation and Pumping Tests **(9)**

Total: 45

TEXT BOOK:
1. Raghunath, H.M. "Hydrology: Principles, Analysis and Design", New Age International (Pvt) Ltd., New Delhi, 2nd Revised Edition 2007
2. Raghunath, H.M. "Ground Water", New Age International (Pvt) Ltd., New Delhi, 2nd Edition, Reprint 2003

REFERENCE BOOKS:
1. Jayarami Reddy, P, "A Text Book of Hydrology" University Science Press, (Unit of Laxmi Publications) New Delhi, 3rd Edition, 2011
2. David Keith Todd and Larry W. Mays, "Ground Water Hydrology" John Wiley Publications, 3rd Edition, 2005
3. Subramanya K, "Engineering Hydrology", Tata McGraw Hill Publishing Company Ltd., 2000.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x			x			x			x				
2	x	x	x		x						x				
3	x	x			x			x			x				

13CEE17 FINITE ELEMENT METHOD

L T P C
3 0 0 3

ASSESSMENT : THEORY
COURSE OBJECTIVES :
To study the energy principles, finite element concept, stress-strain analysis and applications.

COURSE **OUTCOMES:**
CO1: *The students will be able to understand the computational concepts in terms of geometrical and material properties.*
CO2: *The students will be able to understand three dimensional stress analyses, Torsion problems, Thermal analysis and Free vibration analysis*
CO3: *The students will be able to analyze trusses, beams and frames*
CO4: *The students will be introduced to Finite element packages and their usage*

INTRODUCTION AND BASICS
General description – Basic element shapes – Discretization process – Node numbering – Mesh generation – Energy principles – Variational methods - Raleigh Ritz method – Galerkin Method – Least squares approach. **(9)**

ANALYSIS OF TRUSSES, BEAMS AND FRAMES
Stiffness matrix for an axial element – transformation of vectors – plane truss analysis – beam stiffness – solution for beam problems – Two Dimensional beam element – rigid plane frames – inclined or skewed supports – analysis of grids. **(9)**

PLANE STRESS AND PLANE STRAIN PROBLEMS
Basic concepts of plane stress and plane strain – derivation of stiffness matrix for constant – strain, linear strain triangular elements – rectangular elements – iso parametric elements – Lagrange and Serendipity elements – static condensation – axisymmetric elements. **(9)**

PLATE BENDING PROBLEMS
Basic concepts – derivation of element stiffness matrix – four noded, eight noded rectangular and isoparametric elements – shear deformation in plates – computer applications. **(9)**

OTHER APPLICATIONS
Three dimensional stress analysis – Torsion problems – Free vibration analysis – Buckling problems – Heat transfer – Fluid flow problems – Thermal analysis – Finite element packages. **(9)**
Total: 45

TEXT BOOKS
1. Daryl L.Logan, "Finite Element Method", Thomson Canada Ltd.,
India Edition, 2007.

REFERENCES
1. Singiresu.S.Rao, "The Finite Element Method in Engineering", Butterworth-Heinemann, India Edition, 2001.
2. Krishnamoorthy.C.S, "Finite Element Analysis", Tata Mc Graw Hill Publishing Co., New Delhi, 2008.
3. Rajasekaran.S, "Finite Element Analysis in Engineering Design", S.Chand and Company Ltd., 2003.
4. Larry.J.Segerlind, "Applied Finite Element Analysis", John Wiley and Sons, New York, 2010.
5. Robert.D.Cook, David.S.Malkus, "Concepts and Applications of Finite Element Analysis", John Wiley and Sons, India Edition, 2007.

Mapping of Course Outcome with Program Outcome

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1	x				x					x	x				x
2	x		x				x					x	x		
3	x	x			x			x		x	x				
4	x				x					x	x		x		x

13CEE18 THEORY OF PLATES

L T P C
3 0 0 3

ASSESSMENT : THEORY
COURSE OBJECTIVES :
To study the behaviour and analysis of thin plates and the behaviour of thick plates and its computer applications.

COURSE **OUTCOMES:**
CO1: *The students will be able to understand the theory of plates and its behavior*
CO2: *The students will be able to understand classical methods and approximate methods*
CO3: *The students will be able to understand the Engineering approach to design of Rectangular floor slabs and Computer Applications*

INTRODUCTION
Thin and thick plates - Plate behaviour - Material behaviour – Isotropic and orthotropic Materials. **(9)**

SMALL DEFLECTION THEORY AND CLASSICAL METHODS
Differential equation of plates in Cartesian co-ordinate system - boundary conditions - Rigorous solution - Navier's Method - Levy's Method.

SYMMETRICAL BENDING OF CIRCULAR PLATES
Differential equation for symmetrical bending of laterally loaded circular plates - Simply supported edges - Clamped edges - Circular plate with a circular hole at the centre - Circular plate concentrically loaded.   **(9)**

APPROXIMATE METHODS
Energy methods - Galerkin's Method - Ritz Method, Method of Images - Plate strip - Influence surfaces - Membrane and Various Analogies - Simultaneous Bending and Stretching.   **(9)**

NUMERICAL METHODS
Finite difference method - Improvements for solution, matrix displacement analysis of Grids - introduction to Finite Element Method.Computer Applications.   **(9)**

PLATES OF OTHER SHAPES
Triangular plates - Elliptic plates - Sector plates - Skew plates – Plates on elastic foundation - Continuous plates.Computer Applications
ADVANCED TOPICS
Large Deflection theory - Thermal stresses - Multilayered plates. - Mindlin's theory of plates - Flat slabs - Engineering approach to design of Rectangular floor slabs. Computer Applications.   **(9)**
Total: 45

TEXT BOOKS
1. Rudolph Szilard, "Theory and Analysis of Plates – Classical and Numerical Methods", Prentice Hall, 1995.
2. Timoshenko.S and Krieger.S.W, "Theory of Plates and Shells", Mc-Graw Hill Book Company, New York, 1990.

REFERENCES
1. Donnel.L.H, "Beams, Plates and Shells", McGraw Hill Inc., US, 1976.
2. Chandrashekhara, K., "Theory of plates" , University Press(India) limited, Hyderabad, 2001
3. Bairagi.N.K, "A Text Book of Plate Analysis", Khanna Publishers, New Delhi, 1996.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x			x	x					x	x				x
2	x		x		x		x			x			x		
3	x				x			x			x				x

13CEE19 OPTIMIZATION IN CIVIL ENGINEERING

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
The student should be able to understand different optimization techniques with reference to variable and also apply the concept of optimization for few civil engineering systems.

COURSE OUTCOMES:
CO1: The students will be able to understand the constraints, interpret the results and provide better engineering solution in terms of analysis and design.
CO2: The students will be able to diagnose the problems and find the optimal solution by using various optimization techniques.
CO3: The students will be able to solve using calculus and tabulation methods.
CO4: The students will be able to design pipes, steel beams and portal frames for the optimal function.

INTRODUCTION
Design vector, constraints, design surface – objective function – classification of optimization problems – Problem formulation. **(9)**

CLASSICAL OPTIMIZATION
Single variable – Multivariable problems – Equality constraints - Lagrangian Multipliers – Inequality constraints - Khun – Tucker conditions – Graphical method for two variable problem. **(9)**

LINEAR PROGRAMMING
Graphical solution – Simplex Algorithm – Primal – dual concept – Transportation problem – Assignment problem. **(9)**

NON – LINEAR PROGRAMMING
One dimensional minimization – search methods – Exhaustive search – Dichotomous search – Fibonacci method – Golden section method - Descent methods – Cauchy's method - Fletcher – Reeves method. Constrained optimization : Penalty Function method. **(9)**

DYNAMIC PROGRAMMING
Concept of sub optimization – Bellman's principle of optimality – calculus and tabulation methods.
APPLICATIONS
Application in design of pipes – plastic design of steel beams – simple portal frames. **(9)**
Total: 45

TEXT BOOK:
1. Rao.S.S., "Optimization Theory and Applications", New Age International Publishers, New Delhi, 1999.

REFERENCE BOOKS:
1. Stark, R.M and Nichols ., "Mathematical Foundation for Design of Civil Engineering Systems", Mc Graw Hill, Newyork, 1995.
2. Ossenbruggen, P.J., "Systems Approach to Civil Engineering Planning and Design", John Wiley & Sons, Canada , 1987.
3. Jewell, T.K., "Systems Approach to Civil Engineering Planning and Design", Harper & Row, Publishers, New York, 1991.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x	x		x		x	x			x				
2	x	x	x		x					x		x			x
3	x	x		x				x				x			
4	x	x	x		x		x				x			x	

13CEE20 SMART MATERIALS AND STRUCTURES

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:

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.
.
COURSE OUTCOMES:
CO1: The students will be able to explain the concepts of smart materials, function and response, Chemical and biochemical sensing in structural assessment
CO2: The students will be able to understand the concepts of Actuation of structural components
CO3: The students will be able to demonstrate the concepts of Role of actuators and Actuator Materials

INTRODUCTION

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

PROPERTIES OF MATERIALS

Piezoelectric Materials - Piezoelectric properties - Actuation of structural components - Shape Memory Alloys - Constitutive modeling of the shape memory effect - vibration control - Embedded actuators - Applications of shape memory alloys. **(9)**

ER AND MR FLUIDS

Electro rheological and magneto rheological fluids – Mechanisms and Properties - Applications of ER and MR fluids - Fiber Optics – Fiber characteristics - Fiber optic strain sensors - Applications of optical fibers. **(8)**

CONTROL OF STRUCTURES

Control modeling of structures - Control strategies and limitations - classification of control systems - Classical control - Modern control - Optimal control and Digital control - Active structures in practice. **(9)**

SENSORS

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.

ACTUATORS

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magnetostructure Material – Shape Memory Alloys – Electro rheological Fluids– Electromagnetic actuation – Role of actuators and Actuator Materials. **(10)**

SIGNAL PROCESSING AND CONTROL SYSTEMS

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

BIOMIMETICS

Characteristics of natural structures, Biomimetic structural design, Biomimetic sensing, Challenges and opportunities for Biomimetics, Chemical and biochemical sensing in structural assessment, Absorptive
chemical sensors, Spectroscopes. **(9)**

Total : 45

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Brian Culshaw, "Smart Structures and Materials" ,Artech House, Boston, 1996
2. Gandhi.M.V and Thompson.B.S,"Smart Materials and Structures", Chapman and Hall, NewYork, 1992
3. Mel. M Schwartz, Encyclopedia of Smart Materials, John Wiley and Sons Inc. 2002

Mapping of Course Outcome with Program Outcome

Mapping of CO's and PO's															
CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x			x		x			x	x				
2	x			x								x			x
3	x						x			x			x		

13CEE21 DISASTER MANAGEMENT
L T P C
3 0 0 3

ASSESSMENT: THEORY

COURSE OBJECTIVES:
The students are exposed to various disasters, which may strike periodically or once in a decade or century. Further, they will be taught disaster management skills, to tackle various types of disaster.

COURSE OUTCOMES:
CO1: The students will be able to explain the concepts of Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping
CO2: Students will be able to prepare disaster management plans.
CO3: The students will be able to demonstrate the management of disasters.

NATURAL DISASTERS: Cyclones, Floods, Drought and Desertification - Earthquake, Tsunami, Landslides and Avalanche. **(9)**

MAN MADE DISASTERS: Chemical industrial hazards, major power breakdowns, traffic accidents, Fire, War, Atom bombs, Nuclear disaster.- Forest Fire-Oil fire –accident in Mines. **(9)**

GEOSPATIAL TECHNOLOGY: Remote sensing, GIS and GPS applications in real time disaster monitoring, prevention and rehabilitation- disaster mapping. **(9)**

RISK ASSESSMENT AND MITIGATION: Hazards, Risks and Vulnerabilities. -Disasters in and India ,Assessment of Disaster Vulnerability of a location and vulnerable groups- Preparedness and Mitigation measures for various Disasters- Mitigation through capacity building -Preparation of Disaster Management Plans. **(9)**

DISASTER MANAGEMENT: Legislative responsibilities of disaster management- Disaster management act 2005- post disaster recovery & rehabilitation, Relief & Logistics Management; disaster related infrastructure development- Post Disaster, Emergency Support Functions and their coordination mechanism. **(9)**

TEXT BOOKS:

1. Khanna B K, "All You Wanted To Know About Disasters", New India Publishing Agency, New Delhi, 2005.

2. Ramana Murthy, "Disaster Management", Dominant, New Delhi, 2004.

3. RajdeepDasgupta, Disaster Management and Rehabilitation, Mittal Publishers, New Delhi, 2007.

REFERENCES:

1. Disaster Management in India- A Status Report- Published by the National Disaster Management Institute, Ministry of Home Affairs, Govt. of India.2004.

2. Murthy D B N, "Disaster Management: Text and Case Studies", Deep and Deep Publications (P) Ltd., New Delhi, 2007.

3. Sundar I and Sezhiyan T, "Disaster Management", Sarup and Sons, New Delhi, 2007.

Mapping of Course Outcome with Program Outcome

<table>
<tr><td colspan="16" align="center">Mapping of CO's and PO's</td></tr>
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13CEE22   **PAVEMENT DESIGN**

ASSESSMENT: THEORY

COURSE OBJECTIVES:
To impart knowledge in various IRC guidelines for designing rigid and flexible pavements. Further, to assess quality and serviceability conditions of roads.

COURSE OUTCOMES:
CO1 : *The students will be able to analyse the pavement strength by conducting various tests on pavement*
CO2 : *The students will be able to compute the rigid and flexible pavement design*
CO3 : *The students will be able to gain knowledge on various IRC guidelines for designing rigid and flexible pavements*
CO4 : *The students will be able to assess quality and serviceability conditions of roads*
CO5 : *The students will be able to apply the various design procedure of pavement design in real time.*

PRINCIPLES OF PAVEMENT DESIGN
Types of pavement-flexible and rigid- Components of pavement and their functions, Provisions of IRC Guidelines for each component, Comparison between highway and airport pavements, Factors influencing pavement stability: Vehicle and traffic factors-ESWL and Wheel Load Factor- Moisture and climate, soil-CBR, Hveem stabilometer method, Plate Bearing method for finding modulus of subgrade reaction and North Dakota Cone method- and stress distribution factor- Boussinesq and Burmister theories.   **(9)**

DESIGN OF FLEXIBLE PAVEMENT
Empirical method based on classification-Group Index method- Methods based on arbitrary strength-CBR method-Provisions of IRC 37- North Dakota Cone method, HveemStabilometer method, Plate Bearing method (US Navy method for airfields), Theoretical and semi-theoretical methods-Kansas and Texas triaxial methods, Burmister Design method.   **(9)**

STRESSES IN RIGID PAVEMENT
Advantages and Disadvantages of rigid pavement, Stresses in rigid pavement due to wheel load-Westergaard, Older, Bradbury and Kelly theories- Stresses due to change in temperaure-warping stress-theory by Bradbury- Stress due to subgrade restraint, Critical combination of stresses.   **(8)**

DESIGN OF RIGID PAVEMENT
Modulus of Rupture of concrete, Design of airport pavement-Portland Cement Association (PCA) method and Corps of Engineers method- Design of rigid highway pavement- IRC 58 method and PCA method.
JOINTS IN RIGID PAVEMENT
Types of joints, Types of rigid pavement based on reinforcement, Design of reinforcement in longitudinal and transverse direction, tie bars and dowel bars.   **(10)**

PAVEMENT DISTRESS, EVALUATION AND REHABILITATION
Flexible pavement distress - rigid pavement distress - condition surveys - Types of roughness - present serviceability index - skid resistance - structural evaluation - Bituminous and flexible overlays on rigid pavements - Rigid overlays on rigid pavements - Bounded concrete overlay on rigid pavements - Rigid overlays over existing flexible pavements.
STABILISATION OF PAVEMENTS
Stabilisation with special reference to highway pavements, Choice of stabilisers, Testing and Field control, Use of Geosynthetics (geotextiles and geogrids) in roads.   **(9)**

Total: 45

TEXT BOOKS:
1. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna Tech Publications, New Delhi, 1989.
2. Sharma S K," Principles, Practice and Design of Highway Engineering", S Chand and Company Ltd., New Delhi, 1985.
3. Yoder E J and Witezak M W," Principles of Pavement Design", John Wiley and Sons Inc., New York, 1975.

REFERENCES:
1.   IRC: 37-2001, Guidelines for the Design of Flexible pavements, Indian Road Congress, New Delhi, 2001.
2.   IRC: 58-2002, Guidelines for the Design of Rigid Pavements for Highways , Indian Road Congress, New Delhi, 2002.

Mapping of Course Outcome with Program Outcome

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13CEE23   DESIGN OF BRIDGES

L T P C
3 0 0 3

ASSESSMENT: THEORY

COURSE **OBJECTIVES**
To impart knowledge on various types of bridges, their behaviour and designs as per IRC guidelines.

COURSE OUTCOMES:
CO1 : *The students will be able to analyse various types of bridges and bridge components*
CO2 : *The students will be able to compute the necessary type of bridge based on its loading conditions*
CO3 : *The students will be able to gain knowledge on various IRC guidelines for designing bridge decks*
CO4 : *The students will be able to assess quality and serviceability of the bridges*
CO5 : *The students will be able to choose appropriate bridge structure and design it for given site conditions*

INTRODUCTION
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 **(9)**

STEEL BRIDGES
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.   **(9)**

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

REINFORCED CONCRETE GIRDER BRIDGES
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.   **(9)**

PRESTRESSED CONCRETE BRIDGES
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.   **(9)**
Total: 45

TEXT BOOKS
1. Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 1990.
2. Ponnuswamy S., "Bridge Engineering", Tata McGraw-Hill, New Delhi, 1996.

REFERENCES
1. Phatak D.R., "Bridge Engineering", SatyaPrakashan, New Delhi, 1990

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X	X			X					X	X	X	X		
2	X	X			X							X	X		
3	X	X			X						X	X	X		
4	X	X			X							X	X		
5	X	X	X		X			X			X	X	X	X	

13CEE24 INDUSTRIAL WASTE WATER TREATMENT AND DISPOSAL

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
This course facilitates the students of civil engineering about the various aspects of treatment and disposal of industrial wastewater.

COURSE OUTCOMES:
CO1: The students will be able to assimilate the basic knowledge pertaining to industrial waste water treatment
CO2: The students will be able to characterise the wastewater for various treatment schemes in industries
CO3: The students will impart the knowledge about disposal of effluents and the standards for disposal

INDUSTRIAL WASTEWATER PERSPECTIVES
Manufacturing and process-based industries – General characteristics of industrial wastewater - Objectives and management of industrial wastewater – Effluent and stream standards for disposal of wastewater – Sewer ordinance – Effects of untreated and/or partially treated wastewater on disposal into land and rivers - DO sag curve and Streeter - Phelp's equation – Joint treatment of municipal sewage and Industrial wastewater – Individual treatments and CETPs.   **(9)**

WASTEWATER MINIMIZATION AND CLEANER PRODUCTION
Necessity of wastewater minimization and basic concepts of cleaner production- Volume and strength of reductions – Housekeeping aspects - 3R concepts – By-product recovery aspects - Material balance and waste auditing – Raw Material selections.   **(9)**

WASTEWATER TREATMENT TECHNIQUES
Objectives, principles and process description of equalization, neutralization, chemical oxidation, chemical precipitation, adsorption and \ sedimentation facilities –Biological treatment process: aerated lagoon, stabilization ponds, oxidation ditch, RBCs and UASBPs – Principles of RO, ultra and nano filtrations in TDS removal.   **(9)**

INDUSTRIAL SLUDGE TREATMENT
Types of industrial sludges –Characteristics and treatment schemes- Toxicity and hazardousness – High-rate digestors and methane recovery – Land application of sludge and acceptable limits – Bioaccumulation potential – Pyrolysis and incineration techniques- Energy conversion and air pollution problems.   **(9)**

WASTEWATER CHARACTERISTICS AND TREATMENT SCHEMES IN INDUSTRIES
Typical manufacturing industries: cement, iron and steel, thermal power plants, sugar, paper and pulp and mining- Typical process industries: tannery, food processing, distilleries, and diary, textile-Dyeing and petrochemical industries.   **(9)**

Total: 45

TEXT BOOK:
1. Rao, M.N and Datta, A.K. "Waste Water Treatment", Oxford and IBH Publishers Co; New Delhi, 1995.

REFERENCE BOOKS:
1. Eckenfelder, W.W.(jr)", Industrial Water Pollution Control", McGraw- Hill Book Co, NewYork ,2000.
2. Metcalf and Eddy", Wastewater Engineering Treatment, Disposal and Resuse", McGraw-Hill Publishing Co, Indian Edition, New Delhi,2005.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x	x			x	x	x			x	x			x	
2	x	x			x	x	x			x	x			x	
3	x	x			x	x	x			x	x			x	

13CEE25   POLLUTION AND CONTROL ENGINEERING

	L	T	P	C
	3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
The prime motive behind this course is to appropriately create deep interest about the air pollution, noise pollution and various deleterious effects on the components of environment. Also, to facilitate the students about the best available and strategic techno-economic management tools for pollution control.
COURSE OUTCOMES:

CO1: The students will be able to explain the principles of pollution prevention.
CO2: The students will be able to understand the suitable technologies for prevention of air pollution.
CO3: The students will be able to design the devices for control of particular matter.
CO4: The students will be able to understand the concepts of noise pollution and their control.

AIR QUALITY AND EFFECTS OF AIR POLLUTANTS
Definitions – Sources and classification of pollutants – Natural and anthropogenic – Units and measurements – Air quality standards – Meteorology and air pollution – Atmospheric stability and inversions – Mixing height and plume behavior – Effects of air pollution on human beings, vegetation, animals, materials and climate.   **(9)**

SAMPLING AND MODELLING OF AIR POLLUTION

Concept and objectives of sampling – Averaging principle – Standard methods for major air pollutants in ambient air – Isokinetic sampling – objectives of modeling – Types and uses of models – Design of stack height – Principles and application of Fixed-box, Gaussian dispersionand multiple-cell models (no derivations).   **(9)**

CONTROL OF PARTICULATE MATTER
Basic devices of control – Objectives, applications, principles, process descriptions, relevant analytical equations without derivations (no design), essential considerations, performances, limitations and modifications of gravity settler, cyclone separator, ESP, fabric filter, and co-flow venture scrubber. **(9)**

BASIC CONCEPTS OF SOUND AND NOISE
Definitions of sound and noise- Sources of sound - Propagation of sound in air and hearing mechanism by ear- Relationship between sound pressure, power, and intensity- Types of noise: structure-borne, air-borne, and impact – Near and far fields- Periodic and aperiodic sounds- Effects of noise on human being.   **(9)**

NOISE CONTROL STRATEGIES
Source, transmission path, and destination strategies- Outdoor noise propagation- Attenuating factors- Noise control criteria- vibration control methods.   **(9)**

                                                                                              Total: 45
TEXT BOOKS
1. Nevers, N.D., "Air Pollution Control Engineering", 2ⁿᵈEdn., McGraw-Hill International Editions, N.Y., 2000.
2.White, R.G. and Walker, J.G., "Noise and Vibration", Ellis Horwood Publishers, N.Y. 1982.

REFERENCES
1. Sincero, A.P., and Sincero, G.A., "Environmental Engineering-A Design Approach", PHI Pub., New Delhi, 1996.

2. Anjaneyulu, D., "Air Pollution Control Technologies", Allied Publishers, Mumbai, 2002.
3. Rao, M.N., and Rao, H.V.N., "Air Pollution Control", Tata McGraw-Hill Book Co., New Delhi, 1996.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X				X			X							
2	X	X			X					X	X				
3	X		X		X						X				
4	X							X							

13CEE26   PRINCIPLES OF SUSTAINABLE DEVELOPMENT

                                                    L T P C
                                                    3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To provide the concept of sustainable development, their global impact and assessment.

COURSE OUTCOMES:
CO1: The students will be able to understand the responsibility of individual in maintaining sustainability.
CO2: The students will be able to understand the sustainable strategies for social improvement and economical growth.
CO3: The students will be able to understand the integrated approaches for resource management and their protection.
CO4: The students will be able to understand the rate of legislation and policy in maintaining sustainable development.

GLOBAL RESPONSE TO SUSTAINABLE DEVELOPEMENT

Historical emergence and various definitions –Environmental issues and crisis –Industrial growth and resource depletion –Components and factors affecting the sustainable development –Complexly of growth and equity –International summits, conventions, and agreements –Tran boundary issues –Action plan for implementing sustainable growth.   **(9)**

SUSTAINABLE DEVELOPEMENT OF SOCIO-ECONOMIC SYSTEMS

Socio-economic policies for sustainable development –Strategies for implementing eco development programmes –Sustainable development through trade –Economic growth –Carrying capacity –Ecological footprint –Public participation.   **(9)**

NATIONAL POLICY AND GLOBAL SUSTAINABLE DEVELOPEMENT

Judicial systems –Relationship between developing and developed countries in sustainable development –Demographic dynamics and sustainability –Integrated approach to resource protection and management.   **(9)**

CLEANER PRODUCTION ASSESSMENT

Necessity and overview of CP assessment –Necessary procedure –Steps and skills, flow and material balance, and process and treatment flow sheets –Feasible CP options –Typical case studies.   **(9)**

LIFE CYCLE ASSESSMENT

Definition and necessity –Elements of LCA –Life cycle cost –Green chemistry –Eco labeling –Design for the environment –International environmental standards –ISO 14001 series –Environmental audit.
                                                    (9)

                                                    Total: 45

REFERENCES

1. Bishop, P., "Pollution Prevention: Fundamentals and Practice", McGraw-Hill International Edn., New York, 2000.

2. World Bank Group, "Pollution Prevention and Abatement Hand Books towards Cleaner Production", World Bank and UNEP, Washington, D.C., 1998.

3. Kirkby, J.O., Keefe, P., and Timberlake, "Sustainable Development", Earthsean Pub., London, 2001.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	X				X			X							
2	X				X		X							X	
3	X				X									X	
4	X				X		X							X	

13CEE27 SAFETY ENGINEERING

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
To provide on concept of safety in industry, principle of accident prevention, major hazards, consequences and concept of reliability.

COURSE OUTCOMES:
CO1: *The students will be able to explain basic concepts in industrial safety engineering.*

CO2: *The students will be able to demonstrate fire explosion control in various industries.*

CO3: *The students will be able to understand safety standards in construction industry.*

INTRODUCTION TO CONCEPTS
Concept of safety - Evolution of modern safety concept- Safety policy - Safety Organization - line and staff - functions for safety- Safety Committee- budgeting for safety. Techniques- Incident Recall Technique (IRT), disaster control, Job Safety Analysis (JSA), safety survey, safety inspection, safety sampling, Safety Audit. **(9)**

OCCUPATIONAL HEALTH AND HYGIENE
Physical hazards - Noise, noise exposure regulation, occupational damage, risk factors, and permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, control measures. Chemical hazards - Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. dose, Methods of Control. Concept and spectrum of health - functional units and activities of occupational health services, pre employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases.
(9)

FIRE ENGINEERING AND EXPLOSION CONTROL
Fire chemistry – Dynamics of fire behavior – Fire properties of solid, liquid and gas – Fire spread – Toxicity of products of combustion. Building evaluation for fire safety – Fire load –Fire resistance materials and fire testing –Structural Fire protection – Exits and egress. Statutory Rules and Techniques of fire fighting - Indian Explosive acts and rules –Techniques of fire fighting and demonstration. **(9)**

SAFETY IN CONSTRUCTION
General safety consideration – analyzing construction jobs for safety – Contract document –Safety certificate for statutory authorities for old building and construction. Safety in Erection and closing operation - Construction materials –Specifications – suitability – Limitations. Safety in typical civil structures – Dams-bridges-water Tanks-Retaining walls-Critical factors for failure-Regular Inspection and monitoring. **(9)**

SAFETY IN MATERIAL HANDLING
General safety consideration in material handling - Ropes, Chains, Sling, Hoops, Clamps, Arresting gears. Selection, operation and maintenance of Industrial Trucks – Mobile Cranes – Tower crane – Checklist - Competent persons. **(9)**

TEXT BOOKS:
1. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997
2. Accident Prevention Manual for Industrial Operations", N.S.C.Chicago, 1982

REFERENCES:
1. Handbook of Occupational Health and Safety, NSC Chicago, 1982
2. James, D., Fire Prevention Handbook, Butterworths, London, 1986.
3. Gupta R.S., Handbook of Fire Technology, Orient Longman, Bombay, 1997.
4. Fulman, J.B., Construction Safety, Security, and Loss Prevention, John Wiley and Sons,1979.
5. Alexandrov, M.P., Material Handling Equipment, Mir Publishers, Moscow, 1981.

6. Rudenko N., Material Handling Equipments, Mir Publishers, Moscow, 1981.

Mapping of Course Outcome with Program Outcome

CO's	\multicolumn{15}{c}{Mapping of CO's and PO's}

	\multicolumn{15}{c}{PO's}
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1	X				X	X		X			X				
2	X				X	X		X			X				
3	X				X	X		X			X				

13CEE28   PRINCIPLES OF ECONOMICS

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
The objective of this course is to familiarize the prospective engineers with elementary principles of economics. It also deals with acquainting the students with standard concepts and tools that they are likely to find useful in their profession when employed in the firm/industry/corporation in public or private sector. It also seeks to create and awareness about the status of the current economic parameters /indicators/ policy debates. All of this is a part of the quest to help the students imbibe soft skills that will enhance their employability.

COURSE OUTCOMES:
CO1: *The students will be able to demonstrate basic concepts of economics*

CO2: *The students will be able to improve project planning, construction and management skills.*

CO3: *The students will be able to understand the knowledge of Cause and effect of Economic factors which reflect in the society.*

CO4: *The students will be able to use technical, financial and managerial skills in industry, management and business.*

BASICS OF ECONOMICS

Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies.   **(9)**

PRINCIPLES AND METHODOLOGY

Demand/Supply – elasticity –Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes - Cost & Cost Control –Techniques, Types of Costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming.   **(9)**

PUBLIC SECTOR ECONOMICS

Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy.– Inflation and Phillips Curve.   **(9)**

BUSINESS/MANAGERIAL ECONOMICS

Elements of Business/Managerial Economics and forms of organizations. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money. Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.   **(9)**

INDIAN ECONOMY

Brief overview of post independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.   **(9)**

Total: 45

Text/Reference Books:

1. Mankiw Gregory N.(2002), *Principles of Economics,* Thompson Asia

2. V. Mote, S. Paul, G. Gupta(2004), *Managerial Economics,* Tata McGraw Hill

3. Misra, S.K. and Puri (2009), *Indian Economy,* Himalaya

4. PareekSaroj (2003), *Textbook of Business Economics,* Sunrise Publishers

Mapping of Course Outcome with Program Outcome

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13CEE29   PUBLIC ADMINISTRATION

L T P C

3 0 0 3

ASSESSMENT: THEORY
COURSE **OBJECTIVES:**
The objective of the course is to expose the students to administration in India.

COURSE OUTCOMES:
CO1: *The students will be able to explain impact of liberalization and privatization in India.*
CO2: *The students will be able to understand the union government and administration policies.*
CO3: *The students will be able to understand district administration and rural development.*

Public Sector Undertakings
Public sector in modern India; Forms of Public Sector Undertakings; Problems of autonomy, accountability and control; Impact of liberalization and privatization.   **(9)**

Union Government and Administration
Executive, Parliament, Judiciary - structure, functions, work processes; Recent trends; Intragovernmental relations; Cabinet Secretariat; Prime Minister's Office; Central Secretariat; Ministries and Departments; Boards; Commissions; Attached offices; Field organizations.

(9)

State Government and Administration
Union-State administrative, legislative and financial relations; Role of the Finance Commission; Governor; Chief Minister; Council of Ministers; Chief Secretary; State Secretariat; Directorates. **(8)**

District Administration since Independence
Changing role of the Collector; Union state- local relations; Imperatives of development management and law and order administration; District administration and democratic decentralization.   **(9)**

Law and Order Administration
British legacy; National Police Commission; Investigative agencies; Role of central and state agencies including paramilitary forces in maintenance of law and order and countering insurgency and terrorism; Criminalisation of politics and administration; Police- public relations; Reforms in Police

Rural Development
Institutions and agencies since independence; Rural development programmes: foci and strategies; Decentralization and Panchayati Raj; 73rd Constitutional amendment.   **(10)**

Total: 45

TEXT BOOKS
1) Sharma, M.P.: Public Administration-Theory and Practice
2) White: Introduction to Public Administration
3) Bhambari, C.P.: Public Administration
4) Awasthi & Mahaeshwari: Public Administration (Hindi& English)
5) Prasad, D.R. & Others: Administrative Thinkers

REFERENCES
1) Frank Marini (en.): Towards New Public Administration
2) Sharma, R.D.: Advanced Public Administration
3) RumkiBasu: Public Administration-Concept and Theories
4) Albert Lepawski: Administration
5) Mohit Bhattacharya: Public Administration : Structure, Process and Behaviour

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1				x	x	x		x					x		
2				x	x	x		x					x		
3				x	x	x		x					x		

13CEE30   INDIAN ECONOMY

L	T	P	C
3	0	0	3

ASSESSMENT: THEORY

COURSE OBJECTIVES:
The objective of the course is to expose the students to Indian economic scenario, to understand the basics of Indian economy.

COURSE OUTCOMES:
CO1: The students will be able to explain the structure of Indian economy.
CO2: The students will be able to understand about socio-economic developments.
CO3: The students will be able to understand the economic conditions in agriculture, industries and tertiary sectors.

STRUCTURE OF THE INDIAN ECONOMY

Features of Indian Economy - factors responsible for development - a comparison between Indian and other developed economies - India's Share in World GDP - Demographic dynamics and sustainability - Changes in the demographic features.

(9)

PLANNING AND ECONOMIC DEVELOPMENT

Planning in India - A brief review of the achievements of various Five Year Plans - Meaning of development and growth - Determinants of socio-economic development - India as a developing economy - Causes of inflation.   **(9)**

AGRICULTURE IN THE NATIONAL ECONOMY

The place of agriculture in Indian economy-Causes and effects of low Agricultural productivity-Measures to increase productivity – Causes and consequences of small Agricultural holdings - Land Reforms - Estimates of irrigated area - Green revolution– Agricultural Marketing , Defects in Agricultural Marketing in India –Remedial Measures – Role of NABARD.

(9)

INDIAN INDUSTRIES

The role of industrialisation – Small Scale Industry - Large Scale Industries - Trends in industrial production and productivity - Industrial Sickness - causes and measures; Industrial Policy Resolutions (of 1956, 1985 & 1991) - WTO and Industry.   **(9)**

THE TERTIARY SECTOR IN THE INDIAN ECONOMY

Importance of Tertiary sector in economic development - Increasing role of transport, banking and insurance- Role of infrastructure in economic development - Special Economic Zones.   **(9)**

Total:45

TEXT BOOKS:

1.RudarDutt& K.P.M Sundaram, Indian Economy, S. Chand & Co.,

REFERENCES
1. M.L. Jhigan, Economics of Development & Planning, Konark Publishers, New Delhi.

2. Dr. S. Sankaran, Indian Economy, Margham Publications, Chennai.
3. Velayutham, Foreign Trade, Theory & Practice, S. Chand & Co.,

Mapping of Course Outcome with Program Outcome

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13CEE31 PRINCIPLES OF MANAGEMENT

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE OBJECTIVES:
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.

COURSE OUTCOMES:
CO1: The students will be able to demonstrate the Fundamental management concepts.

CO2: The students will be competent in planning, controlling and executing different types of Engineering projects.

CO3: The students will be able to demonstrate Organisation culture and their functional aspects.

CO4: The students will be able to understand the leadership qualities, attitudes and acquire skills to be an effective leader in their chosen field.

HISTORICAL DEVELOPMENT

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. **(9)**

PLANNING

Nature & Purpose – Steps involved in Planning – Objectives – Setting Objectives – Process of Managing by Objectives – Strategies, Policies & Planning Premises- Forecasting – Decision-making. **(9)**

ORGANISING

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. **(9)**

DIRECTING

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. **(9)**

CONTROLLING

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. **(9)**

Total: 45

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.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's														
	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1			x	x	x			x	x			x		x	
2				x	x			x							
3			x	x					x			x			
4			x	x				x						x	

13CEE32   ENGINEERING RISK & BENEFIT ANALYSIS   L T P C

                                                                        3 0 0 3

ASSESSMENT: THEORY

COURSE **OBJECTIVES:**
The objective of the course is to impart skills in risk and benefit analysis.

COURSE **OUTCOMES:**
CO1: *The students will be better prepared to analyse projects in terms of risk and management due to uncertainty.*
CO2: *The students will be able to identify, formulate and solve engineering problems.*

CO3: *The students will be able to use decision analysis to solve complex problems and to improve the quality of the resulting decision.*

CO4: *The students will be able to understand the relationship between benefit and risk analysis.*

INTRODUCTION

Knowledge and Ignorance, Information Uncertainty in Engineering Systems, Introduction and overview of class; definition of Engineering risk; overview of Engineering risk analysis. Risk Methods: Risk Terminology, Risk Assessment, Risk Management and Control, Risk Acceptance, Risk Communication, Identifying and structuring the Engineering risk problem; developing a deterministic or parametric model.

(9)

SYSTEM DEFINITION AND STRUCTURE

System Definition Models, Hierarchical Definitions of Systems, System Complexity. Reliability Assessment: Analytical Reliability Assessment, Empirical Reliability Analysis Using Life Data, Reliability Analysis of Systems.

(9)

CONSEQUENCE ASSESSMENT

Types, Cause-Consequence Diagrams, Microeconomic Modelling, Value of Human Life, Flood Damages, Consequence Propagation. Engineering Economics: Time Value of Money, Interest Models, Equivalence.

(9)

DECISION ANALYSIS

Risk Aversion, Risk Homeostasis, Influence Diagrams and Decision Trees, Discounting Procedures, Decision Criteria, Tradeoff Analysis, Repair and Maintenance Issues, Maintainability Analysis, Repair Analysis, Warranty Analysis, Insurance Models.   **(9)**

FORENSIC ENGINEERING

Forensic – linguistics, materials engineering, polymer engineering and vehicular accident reconstruction.

(9)

                                                    Total: 45

TEXT BOOKS:
1. Risk Analysis in Engineering and Economics, B. M. Ayyub, Chapman-Hall/CRC Press, 2003.

REFERENCE BOOKS:
1. Probability, Statistics, and Reliability for Engineers and Scientists, Ayyub&McCuen, 2003.

2. Probabilistic Risk Assessment and Management for Engineers and Scientists, by H. Kumamoto and E. J.Henley, Second Edition, IEEE Press, NY, 1996.

3. Bedford, T. and Cooke, R. Probabilistic Risk Analysis: Foundations and Methods. New York: Cambridge University Press, 2001.

4. Normal Accidents, Living with High-Risk Technologies, C. Perrow, Princeton University Press, 1999.

5. Accident Precursor Analysis and Management - Reducing Technological Risk Through Diligence, National Academy of Engineering, the National Academies Press, Washington, DC, 2004.

Mapping of Course Outcome with Program Outcome

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1					x	x		x		x					
2	x			x	x										
3					x	x	x								
4				x	x										

13CEE33   ACCOUNTING FOR ENGINEERS

L T P C
3 0 0 3

ASSESSMENT: THEORY
COURSE **OBJECTIVES:**
The objective of the course is to expose the students to basic concepts in accounting.

COURSE OUTCOMES:
CO1: *The students will be able to understand financial management, fund and cash flow statements, sources of finances and investment decisions.*
CO2: *The students will be able to explain about cash flow and sources of finance.*
CO3: *The students will be able to explain basic concepts in managing current assets.*

MANAGEMENT ACCOUNTING
Meaning – Nature and Scope – Functions – Limitations – Need – Financial Accounting vs. Management Accounting.
FINANCIAL STATEMENTS
Characteristics – Limitations – Financial Statement Analysis – Ratio Analysis.
FUND FLOW STATEMENT
Meaning and Concept of Flow of Funds – Meaning of a Fund Flow Statement – Differences between Fund Flow Statement and Income Statement – Preparation and Interpretation of Fund Flow Statement.   **(9)**
CASH FLOW STATEMENT
Meaning of a Cash Flow Statement – Classification of Cash Flows – Preparation and Interpretation of Cash Flow Statement.
FINANCIAL MANAGEMENT
An Overview – Nature and Scope – Finance Functions – Goals of Financial Management – Financial Manager's Role – Agency Problems, Agency Cost – Economic Value Added.   **(10)**
SOURCES OF FINANCE
Long Term Finance – Ordinary Shares – Right Issue of Equity Shares – Preference Shares – Debentures – Term Loan – Asset Based Financing – Hire Purchase – Leasing – Venture Capital Financing – Short Term Finance – Trade Credit - Bank Credit – Bill Discounting – Commercial Paper.
TIME VALUE OF MONEY
Concept – Future Value – Present Value – Single Cash Flows – Annuity – Uneven Cash Flows – Multi Period and Continuous – Yield Calculation.   **(9)**
INVESTMENT DECISION
Capital Budgeting Decisions – Evaluation of Capital Budgeting – Discounted and Non Discounted – Cash Flows Methods – Simple Problems.   **(8)**
FINANCING AND DIVIDEND DECISION
Capital Structure – Financial Leverage – Operating Leverage – Only Concepts – Capital Structure Theories – Dividend Theories.
WORKING CAPITAL
Policies for Financing Current Assets.
RECEIVABLES MANAGEMENT, INVENTORY MANAGEMENT AND CASH MANAGEMENT
Basic Concepts Only.   **(9)**

Total: 45

TEXT BOOK:
1. DamodaranAswath, "Corporate Finance-theory and Practice", Tata McGraw-Hill, New Delhi, 2005.
REFERENCES:
1. Ross S A, Westerfield R W and Jordan B D, "Fundamentals of Corporate Finance", Tata McGraw-Hill, New Delhi, 2006.
2. Myers Brealey, "Principles of Corporate Finance", Vikas Publishing House P Ltd, 2005.

3. Pandey IM, "Financial Management", Ninth Edition, Vikas Publishing House P Ltd, 2005.
4. Prasanna Chandra, "Financial Management", Tata McGraw-Hill, New Delhi, 2004.

Mapping of Course Outcome with Program Outcome

CO's	Mapping of CO's and PO's

CO's	PO's														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	x			x	x			x				x			
2	x	x	x	x	x									x	
3	x	x	x	x	x									x	

13CEE34 INFRASTRUCTURE PLANNING AND MANAGEMENT

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                                                    L   T   P   C
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ASSESSMENT: THEORY
COURSE OBJECTIVES:
The objective of the course is to expose the students to various strategies of infrastructure planning and management.

COURSE OUTCOMES:
CO1: The students will be able to demonstrate basic concepts related to infrastructure
CO2: The students will be able to understand the benefits of infrastructure privatization
CO3: The students will be able to understand the challenges involved in successful infrastructure planning and management.
CO4: The students will be able to demonstrate the strategies for successful infrastructure planning and implementation.

AN OVERVIEW OF BASIC CONCEPTS RELATED TO INFRASTRUCTURE
Introduction to Infrastructure - An Overview of the Power Sector in India - An Overview of the Water Supply and Sanitation Sector in India - An overview of the Road, Rail, Air and Port Transportation Sectors in India - An overview of the Telecommunications Sector in India - An overview of the Urban Infrastructure in India - An overview of the Rural Infrastructure in India - An Introduction to Special Economic Zones - Organizations and Players in the field of Infrastructure - The Stages of an Infrastructure Project Lifecycle -   An Overview of Infrastructure Project Finance   **(9)**

PRIVATE INVOLVEMENT IN INFRASTRUCTURE
A Historical Overview of Infrastructure Privatization - The Benifits of Infrastructure Privatization - Problems with Infrastructure Privatization - Challenges in Privatization of Water Supply (with a case study) - Privatization of Infrastructure in India - Privatization of Road Transportation Infrastructure in India.   **(9)**

CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION
Mapping and Facing the Landscape of Risks in Infrastructure Projects - Economic and Demand Risks - Political Risks - Socio-Environmental Risks - Cultural Risks in International Infrastructure Projects - Legal and Contractual Issues in Infrastructure - Challenges in Construction and Maintenance of Infrastructure.   **(9)**

STRATERGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION
Risk Management Framework for Infrastructure Projects - Shaping the Planning Phase of Infrastructure Projects to mitigate risks - Designing Sustainable Contracts - Introduction to Fair Process and Negotiation - Negotiating with multiple Stakeholders on Infrastructure Projects - Sustainable Development of Infrastructure - Information Technology and Systems for Successful Infrastructure Management   **(9)**

INFRASTRUCTURE MANAGEMENT
Innovative Design and Maintenance of Infrastructure Facilities - Infrastructure Modelling and Life Cycle Analysis Techniques - Capacity Building and Improving the Governments Role in Infrastructure Implementation - An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.   **(9)**

                                                                    Total: 45

TEXT BOOKS:
1. Joshi P, "Law Relating to Infrastructure Projects", Taxmann Publishers, 2001.
2. Murty G R K, "Infrastructure Projects : Current Financing Trends", Icfai University Press, 2006.
3. Alagiri D, "Infrastructure Growth In India and China : A Comparative Study", Icfai University Press, 2006.
4. 3i Network, "India Infrastructure Report 2007 : Rural Infrastructure", Oxford University Press, 2007.

REFERENCES:
1. 3i Network, "India Infrastructure Report 2006 : Urban Infrastructure", Oxford University Press, 2006.

2. Raghuram G, "Infrastructure Development and Financing : Towards a Public Private Partnership", Macmillan , 2001.
3. NarindarJethi K, "Infrastructure Development In India", New Century Publications, 2007.
4. AlagiriD,"Infrastructure Development", ICFAI University Press, 2007.
5. Krishnamurthy G G, "Infrastructure Financing", ICFAI University Press, 2007.

Mapping of Course Outcome with Program Outcome

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	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1			X				X	X							X
2			X				X	X							X
3			X				X	X							X
4			X				X	X							X