VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA
ODISHA

SCHEME OF INSTRUCTION AND SYLLABI

FOR

B.TECH PROGRAM IN CIVIL ENGINEERING

Effective from 2015-16

DEPARTMENT OF CIVIL ENGINEERING

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA
DEPARTMENT OF CIVIL ENGINEERING

VISION

To emerge as an internationally acclaimed Civil Engineering Department for imparting futuristic technical education and creation of vibrant research enterprise to create quality civil engineering and researchers, truly world class leader and unleashes technological innovations to serve the global society and improve the quality of life.

MISSION

The Department of civil Engineering, VSSUT, Burla strives to create values and ethics in its product by inculcating depth and intensity in its education standards and need based research throughout

- Participative learning in a cross-cultural environment that promotes the learning beyond the class room.
- Collaborative partnership with industries and academia within and outside the country in learning and research.
- Encouraging innovative research and consultancy through the active participation and involvem ent of all faculty members.
- Facilitating technology transfer, innovation and economic development to flow as natural results of research where ever appropriate.
- Expanding curricula to cater broader perspectives.
- Creation of service opportunities for upliftment of the society at large.

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA

DEPARTMENT OF CIVIL ENGINEERING

B.TECH IN CIVIL ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1:

To lead a successful career in industries or pursue higher studies or entrepreneurial endeavours.

PEO2:

To offer techno-commercially feasible and socially acceptable solutions to real life engineering problems.

PEO3:

To demonstrate effective communication skill, professional attitude and a desire to learn.

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GRADUATE ATTRIBUTES

The Graduate Attributes are the knowledge skills and attitudes which the students have at the time of graduation. These attributes are generic and are common to all engineering programs.

These Graduate Attributes are identified by National Board of Accreditation.

a. Engineering Knowledge
b. Problem Analysis
c. Design & Development of Solutions
d. Investigation of Complex Problem
e. Modern Tools Usage
f. Engineer and Society
g. Environment & Sustainability
h. Ethics
i. Individual & Team work
j. Communication
k. Lifelong Learning
l. Project management & Finance

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B.TECH IN CIVIL ENGINEERING

PROGRAMME OUTCOMES (POs)

a. Ability to apply knowledge of mathematics, science and engineering to solve complex problems in civil engineering

b. Ability to identify, formulate, and solve complex civil engineering problems using first principle of mathematics, basic science & engineering

c. Ability to design, implement & evaluate civil engineering projects to meet societal and environmental needs.

d. Ability to design and conduct complex civil engineering experiments as well as to analyze and interpret the experimental data.

e. Ability to use the techniques, skills, and modern engineering tools necessary for relevant engineering practices

f. Ability to assess impact of contemporary social issues on professional practice.

g. Ability to recognize the sustainability and environmental impact of the engineering solutions

h. Ability to follow prescribed norms, responsibilities and ethics in engineering practices.

i. Ability to work effectively as an individual and in a team.

j. Ability to communicate effectively through oral, written and pictorial means with engineering community and the society at large.

k. Ability to recognize the need for and to engage in life-long learning

l. Ability to understand and apply engineering and management principles in executing project

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POs aligned to the Graduate Attributes prescribed by the NBA

GA (NBA) /PO	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
a	√											
b		√										
c			√									
d				√								
e					√							
f						√						
g							√					
h								√				
i									√			
j										√		
k											√	
l												√

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA

DEPARTMENT OF CIVIL ENGINEERING

B.TECH IN CIVIL ENGINEERING

Course Component distribution of credits and PEOs of the Department

Course Component	PEOs	Curriculum Content (%of total number of credits of the program)
Mathematics and Basic Sciences	PEO I & PEO II	13
Basic Engineering Courses	PEO I & PEO II	16
HSS	PEO III	6
Professional Core	PEO I, PEO II &PEO III	58
Engineering Electives	PEO I & PEO II	6

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DEPARTMENT OF CIVIL ENGINEERING
B.TECH IN CIVIL ENGINEERING

COURSE STRUCTURE

FIRST YEAR
(COMMON TO ALL BRANCHES)

FIRST SEMESTER				SECOND SEMESTER			
Theory		**Contact Hrs.**	**CR**	**Theory**		**Contact Hrs.**	**CR**
Course Code	Subject	L .T .P		Course Code	Subject	L. T. P	
	Mathematics - I	3 - 1 - 0	4		Mathematics - II	3 - 1 - 0	4
	Physics/Chemistry	3 - 1 - 0	4		Chemistry/ Physics	3 - 1 - 0	4
	Engineering Mechanics/ Computer Programming	3 - 1 - 0	4		Computer Programming/ Engineering Mechanics	3 - 1 - 0	4
	Basic Electrical Engineering/ Basic Electronics	3 - 1 - 0	4		Basic Electronics/ Basic Electrical Engineering	3 - 1 - 0	4
	English/ Environmental Science	3 - 1 - 0	4		Environmental Science/ English	3 - 1 - 0	4
Sessionals				**Sessionals**			
	Applied Physics Laboratory/Chemistry Lab	0 - 0 - 3	2		Chemistry Lab/Applied Physics Laboratory	0 - 0 - 3	2
	Workshop-I/ Engineering Drawing	0 - 0 - 3	2		Engineering Drawing/ Workshop-I	0 - 0 - 3	2
	Basic Electrical Engg. Lab/ Basic Electronics Lab	0 - 0 - 3	2		Basic Electronics Lab/ Basic Electrical Engg. Lab	0 - 0 - 3	2
	Business Communication and Presentation Skill/ Programming Lab	0 - 0 - 3	2		Programming Lab/ Business Communication and Presentation Skill	0 - 0 - 3	2
	Total	**15-5-15**	**28**		**Total**	**15-5-15**	**28**

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COURSE STRUCTURE
THIRD SEMESTER

Sl No.	Course Code	Subject	Contact Hrs. L-T-P	CR
1		Mathematics-III	3-1-0	4
2		Object Oriented Programming	3-1-0	4
3	CE 15003	Mechanics of Materials	3-1-0	4
4	CE 15004	Civil Engineering Materials and Construction	3-1-0	4
5		Engineering Economics	3-1-0	4
		SESSIONAL		
1	CE 15005	Building Drawing	0-0-3	2
2	CE 15006	Concrete Lab	0-0-3	2
3		Material testing lab	0-0-3	2
4		OOP Lab	0-0-3	2
Total			**15-5-12**	**28**

FOURTH SEMESTER
THEORY

1		Mathematics-IV	3-1-0	4
2	CE 15007	Engineering Surveying	3-1-0	4
3	CE 15008	Fluid Mechanics	3-1-0	4
4	CE 15009	Structural analysis-I	3-1-0	4
5		Organizational Behaviour		
			3-1-0	4
		SESSIONAL		
1	CE 15010	Hydraulics Lab	0-0-3	2
2	CE 15011	Survey Practice-I	0-0-3	2
3	CE 15012	Computer application in Civil Engineering	0-0-3	2
4	CE 15013	Environmental Engineering Lab.	0-0-3	2
Total			**15-5-12**	**28**

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FIFTH SEMESTER
THEORY

Sl No.	Course Code	Subject	Contact Hrs. L-T-P	CR
1	CE 15014	Structural Design	3-1-0	4
2	CE 15015	Water Resources Engineering	3-1-0	4
3	CE 15016	Geotechnical Engineering-I	3-1-0	4
4	CE 15017	Environmental Engineering	3-1-0	4
5	CE 15018	Structural Analysis -II	3-1-0	4
SESSIONAL				
1	CE 15019	Fluid Flow Lab	0-0-3	2
2	CE 15020	Geotechnical Engineering Lab	0-0-3	2
3	CE 15021	Environmental Engineering Design	0-0-3	2
4	CE 15022	Design of Concrete Structure	0-0-3	2
Total			**15-5-12**	**28**
SIXTH SEMESTER THEORY				
1	CE 15023	Fluid Dynamics	3-1-0	4
2	CE 15024	Transportation Engineering-I	3-1-0	4
3	CE 15025	Geotechnical Engineering-II	3-1-0	4
4	CE 15026	Steel Structures	3-1-0	4
5		Core Elective-I	3-1-0	4
SESSIONAL				
1	CE 15027	Design of Steel Structures	0-0-3	2
2	CE 15028	Transportation & Geotechnical Engineering Design	0-0-3	2
3	CE 15029	Transportation Engineering Lab	0-0-3	2
4	CE 15030	Survey Practice-II	0-0-3	2
Total			**15-5-12**	**28**

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SEVENTH SEMESTER
THEORY

Sl No.	Course Code	Subject	Contact Hrs. L-T-P	CR
1	CE 15031	Advanced Concrete Structures	3-1-0	4
2	CE 15032	Hydraulic Structures	3-1-0	4
3	CE 15033	Transportation Engineering-II	3-1-0	4
4		Core Elective-II	3-1-0	4
5		Open Elective-I	3-1-0	4
SESSIONAL				
1	CE 15034	Structural Engineering lab	0-0-3	2
2	CE 15035	Minor Project	0-0-3	2
Total			**15-5-6**	**24**
EIGHTH SEMESTER THEORY				
1	CE 15036	Construction Management	3-1-0	4
2	CE 15037	Estimation and Professional Practices	3-1-0	4
3		Open Elective-II	3-1-0	4
SESSIONAL				
1	CE 15038	Comprehensive VivaVoce	0-0-0	2
2	CE 15039	Seminar	0-0-3	2
3	CE 15040	Major Project	0-0-6	8
Total			**9-3-6**	**24**

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B.TECH IN CIVIL ENGINEERING

Electives

Open Elective-I & Open Elective-II			
CE 15066	Numerical Methods in engineering	CE 15051	Mechanics of Composite Materials
CE 15067	Traffic Engg & Management	CE 15052	Remote Sensing and GIS
CE 15068	Theory of Elasticity & Plasticity	CE 15053	Water Power Engg
CE 15069	Finite Element Method	CE 15054	Green Building
CE 15070	Project Management	CE 15055	Waste Management
CE 15071	Environmental Management	CE 15072	Structural Dynamics

Core Elective-I & Core Elective-II			
CE 15041	Advance Surveying	CE 15056	Pavement Design
CE 15042	Town Planning & Architecture	CE 15057	Rock mech and Tunnel Engg
CE 15043	Economic evaluation and analysis of transport project	CE 15058	Machine foundation
CE 15044	Pavement management system	CE 15059	Soil Dynamics & Earthquake Engineering
CE 15045	Environmental Geotechnique	CE 15060	Advanced Structural Analysis
CE 15046	Ground Improvement Technique	CE 15061	River Engineering
CE 15047	Concrete technology	CE 15062	Computational Hydraulics
CE 15048	Pre-stressed Concrete	CE 15063	Water Resources Planning & Management
CE 15049	Bridge Engineering	CE 15064	Open Channel Flow
CE 15050	Ground Water Engineering	CE 15065	Watershed Management
CE 15051	Mechanics of Composite Materials	CE 15066	Numerical Methods in engineering
CE 15052	Remote Sensing and GIS	CE 15067	Project Management
CE 15053	Water Power Engg	CE 15068	Finite Element Method
CE 15054	Green Building	CE 15069	Theory of Elasticity & Plasticity
CE 15055	Waste Management	CE 15070	Traffic Engg & Management
		CE 15071	Environmental Management

CE 15001: ENVIRONMENTAL SCIENCE & ENGINEERING (3-1-0) CR-04

Course Objectives:

This course introduces the students to the environmental consequences of industries, development actions etc. and the methods of minimizing their impacts through technology and legal systems.

Course Content:

Module – I **(6 Hours)**

Components of Earth System: Lithosphere, Cryosphere, Atmosphere, Hydrosphere, Biosphere and Outer space.

Ecological concepts and natural Resources: Ecological perspective and value of environment, Environmental auditing, Biotic components, Levels of organizations in environment Ecosystem Process: Energy, Food chain, Environmental gradients, Tolerance levels of environmental factor.

Natural Resources covering Renewable and Non-renewable Resources, Forests, water, minerals, Food and land (with example of one case study); Energy, Growing energy needs, energy sources (conventional and alternative).

Hydrological cycle, water balance, energy budget, precipitation, infiltration, evaporation and evapotranspiration.

Module – II **(15 Hours)**

Environmental Pollution: Definition, Causes, effects and control measures of: Water pollution, Air pollution, Noise pollution, Soil pollution, Marine pollution, Thermal pollution, Nuclear hazards

Environmental Issues: Climate change, Global warming, Acid rain, Ozone layer depletion, Sustainable development, Bio gas, Natural gas, Biodiversity, Urban problems related to energy, water scarcity, Water conservation, rain water harvesting, artificial recharge, watershed management, carbon trading, carbon foot print

National Ambient Air quality Standards, Noise standards, Vehicle emission standards

Module – III **(12 Hours)**

Drinking water standard (IS 10500), Water Quality Criteria and wastewater effluent standards

Water treatment: Water sources and their quality, Lay out of a water treatment plant and working of each unit/ principles of each process i.e. Screening, Aeration, Sedimentation, coagulation, flocculation, Filtration, Disinfection. Miscellaneous treatment: Removal of color, tastes and odour control, removal of iron and manganese, fluoridation and defloridation. Advanced water treatment: Ion exchange, electro-dialysis, RO, desalination

Working principles of ready-made water filter/purification system commercially available

Lay out of a wastewater treatment plant and working of each unit.

Module – IV **(7 Hours)**

Solid waste management: Source, classification and composition of Municipal Solid Waste (MSW), Storage and transport of MSW, MSW management, Waste minimization of MSW, Reuse and recycling, Biological & thermal treatment (principles only), land fill

Biomedical Waste management – sources, treatment (principles only) and disposal

Hazardous Waste Management- Introduction, Sources, Classification, treatment (principles only)

Introduction to e-waste management.

Environmental impact Assessment: Project screening for EIA, Scoping studies

Environmental policies and acts (Air, Noise, Water, Forest, E-waste, Hazardous waste acts).

Text Book:

1 Environmental Engineering, G. Kiely, TMH, 2007

Reference Books:

1 Environmental Engineering, H.S. Peavy, D.R.Rowe and G. Tchobanoglous, McGraw Hill, 1985.

2 Introduction to Environmental Engineering, M. L. Davis and D. A Cornwell, McGraw Hill International, 2005.

Course Outcomes:

Understand the importance of environment

Identify the environmental problems and issues on local, regional and global scale

Identify problems due to human interactions with the environment

Get encouragement to contribute solutions for the existing environmental issues

Understand the enforcement of environmental acts in our constitution

CE 15002: ENGINEERING DRAWING (0-0-3) CR-02

(Minimum 8 sheets and 2 Auto Cad classes)

Course Objectives

1. To enable students to acquire and use engineering drawing skills as a means of accurately and clearly communicating ideas, information and instructions.
2. To enable students to acquire requisite knowledge, techniques and attitude required for advanced study of engineering drawing
3. To know about different types of lines & use of different types of pencils in an engg. Drawing
4. To know how to represents letters & numbers in drawing sheet, basics of dimensioning ,Lettering& representation of lines
5. To know projection of points ,straightlines,planes, solids (pyramid,frustrum) etc.
6. To know development of different types of surfaces and intersection of soilds.
7. To know about isometric projection.

Course Contents

Introduction to Engineering Drawing: Drawing instruments, lines, lettering and dimensioning.

Scales: Plain, Diagonal and Vernier Scales.

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Orthographic Projections: Concepts, Orthographic projections of points, Lines, Planes and Solids.

Sections of solids; Development of surfaces

Isometric Projections: Principles, Isometric Scale, Isometric Views, Isometric Views of lines, Planes, Simple and compound Solids,

Introduction to Auto-Cad:

Curves: Parabola, Ellipse, Hyperbola, Cycloid, Epicycloid, Hypocycloid and Involute.

Text Book:

1 Engineering drawing by N.D. Bhatt and V.M Panchal, Charotar Publishing House, Anand.

Reference Books:

1. Engineering Drawing by Venugopal, New Age publisher.

Course outcomes

On completion of the course, the students will be able to**:**

Orthographic projections of Lines, Planes, and Solids.

Construction of Isometric Scale, Isometric Projections and Views.

Sectioning of various Solids and their representation.

Conversion of Pictorial views to Orthographic Projections

THIRD SEMESTER

CE 15003: MECHANICS OF MATERIALS (3-1-0) CR-04

Course Objectives:

1. To develop an understanding of the relationship between external loads applied to a deformable body and the internal stress, strain and deformation induced in the body subjected to different loads (e.g. normal, shear, torsion, bending and combined loads).
2. To provide basic knowledge in mechanics of materials so that the students can able to solve real engineering problems and design engineering systems
3. To develop analytical and graphical problem solving skills

Module – I **(10 Hours)**

Direct Stress: Load, Stress, Principle of St. Venant, Strain, Hooke's Law, Modulus of Elasticity, Composite bars in tension and compression, temperature stresses in composite rods, statically indeterminate problems

Shear Stress: Shear stress, Complementary shear stress, shear strain, modulus of rigidity

Module – II **(10 Hours)**

Two dimensional stress and strain systems: Principal stresses, Maximum shear stresses, Analysis of stresses, Mohr's stress circle.

Principal strains and principal axes of strain measurement, calculation of principal stresses from principal strains, Analysis of strains, Mohr's strain circle.

Module – III **(12 Hours)**

Shear force and Bending moment: Types of supports, shear force and bending moment diagrams for concentrated load and uniformly distributed load on simple supported and cantilever beam.

Simple bending of beams: Theory of pure bending of initially straight beams, Distribution of normal and shear stresses, Composite beams.

Torsion in solid and hollow circular shafts, Twisting moment, strength of solid and hollow circular shafts, strength of shafts in combined bending and twisting, closed coil helical spring.

Introduction to theories of failure: Maximum normal stress theory, maximum normal strain theory, maximum shearing strain theory, maximum strain energy theory, maximum distortion energy theory, maximum octahedral shearing stress theory

Module – IV **(8 Hours)**

Thin cylinders and spheres: Stresses in thin cylinders and spherical shells under internal pressure, wire winding of thin cylinders.

Buckling of Columns: Short and long columns, eccentric loading of columns, core of the section, Euler's theory of initially straight columns with various end conditions, Columns with initial curvature.

Combined bending and direct stress

Text Book:

1. Strength of Materials by S. P. Timoshenko and D. H. Young, East West Press

Reference Books:

1. Strength of Materials by G.H. Ryder, Macmillan India Ltd.

2. Mechanics of Materials by E. Popov

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Calculate and understand the concepts of stress and strain relationships for homogenous, isotropic materials.
2. Calculate, describe, and estimate external loadings, including axial load, shear force, bending, and torsion, and the resulting deformations and internal stresses associated with these external loadings
3. Calculate and describe the internal stresses and deformations that result in combined loading conditions
4. Determine and illustrate principal stresses, maximum shearing stress, and the stresses acting on a structural member.
5. Calculate the stresses and strains associated with thin-wall spherical and cylindrical pressure vessels.
6. Design simple bars, beams, and circular shafts for allowable stresses and loads

CE 15004: CIVIL ENGG. MATERIALS & CONSTRUCTION (3-1-0) CR-04

Course Objectives:

To understand brick material, cement and concrete

To understand Stairs, Doors & Windows, Masonry arches and Cavity walls

To understand Fire resistive construction, Plastering, Painting and Damp prevention

To understand Stone, Glass, Timber, Foundation, Repair of building and its maintenance,

Course Content:

Module I **(11 Hours)**

Bricks: Methods of bricks manufacture, testing of bricks

Cement: Classification, chemical composition, hydration, tests for cement.

Concrete: Composition, water- cement ratio, workability.

Module – II **(9 Hours)**

Stairs: Terms used, types of stairs, essential requirements, wooden stairs, concrete stairs, and metal stairs.

Doors and Windows: Types, materials used.

Masonry arches: Terms used types of arches, stability, line of thrust, depth of arch at the crown.

Cavity walls: Purpose, method of construction.

Module – III **(10 Hours)**

Fire resistive construction: Fire resistive construction, fire resistance of common building materials, protection for girders and columns, firefighting appliances.

Plastering: Materials for plastering, methods of plastering, defects in plastering and remedy.

Painting and decoration: Oil painting and Varnishing, enamel painting, Washes and distemper, defects in painting.

Damp prevention: causes, effects, different methods of prevention of dampness.

Module – IV **(10 Hours)**

Stone: Indian building stones, their properties and uses, methods of querying

Glass: Varieties of glass, decorative glass, door and window glazing.

Timber: Preservation and seasoning of timber

Foundation: Brief idea on various types of foundation.

Repair of building: Annual and special repair of buildings, Maintenance of buildings, Types of cracks in Building, Types of building Joint.

Text Book

1. A Text book of Building Construction, A.P. Arora & S.P. Bindra, Dhanpat Rai & Sons.

Reference Books

1. A Text Book of Building Materials, C.J. Kulkarrni
2. Building Materials, Varghese, PHI, Pvt. Ltd.
3. Building Construction, Varghese, PHI, Pvt. Ltd.

Course Outcomes:

Learning about all properties of stones, bricks, cement,concrete,timber.

Learning about different types of Foundations and Masonries.

CE 15005: BUILIDING DRAWING (0-0-3) CR-02

Objective:

To understand the principles of planning and bylaws

To draw plan, elevation and section of load bearing and framed structures

To draw plan, elevation and section of public and industrial structures

To prepare detailed working drawing for doors, windows, etc.

1. Plan, elevation, side view of residential/office building
2. Detailing of doors/windows
3. Drawing of several types of footing, brick work, floor staircase, masonry, arches and lintels.
4. Types of steel roof trusses

5. Drawing of 2 bedroom/3 bedroom houses (single and two storied), ground and first floor plans, elevation and section for load bearing and framed structures
6. Project on establishment like Bank building/Post.
7. Office/Hostel/Library/Auditorium/Factory building etc.
8. Introduction to Auto-CAD: Use of Auto-CAD in building drawing.

Text Book:

1. Civil Engineering Drawing by: M. Chakraborti,

Reference Book:

1 Building Planning and Drawing by N. Kumara Swamy and A. Kameswara Rao, Charotar Publisher.

Course outcomes:

On completion of the course, the students will be able to:

Apply the principles of planning and bylaws used for building planning

Draw plan, elevation and section for various structures

CE 15006: CONCRETE LAB. (0-0-3) CR-02

Course Objectives:

- To understand the characterization of cement, aggregates and concrete.

Course Content:

1. Fineness of Cement by Sieve analysis and by air permeability method.
2. Standard consistency & Setting times of cement
3. Specific gravity & Soundness of cement
4. Compressive strength of cement
5. Shape size test, Water absorption & Compressive strength of Brick
6. Grain size distribution, Specific gravity and water absorption of fine and coarse aggregates.
7. Unit mass and Voids of concrete aggregates and Bulking of fine aggregates
8. Slump test & Compaction factor test of wet concrete.
9. Stress-strain curve, modulus of elasticity, and poisson's ratio of concrete.
10. Modulus of Rupture of concrete
11. Flexural strength and split tensile strength tests of concrete.

Course Outcomes:

Ability to characterize cement, aggregates and concrete

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FOURTH SEMESTER

CE 15008: FLUID MECHANICS (3-1-0) CR-04

Course Objectives:

Apply conservation laws to derive governing equations of fluid flows
Compute hydrostatic and hydrodynamic forces
Analyze and design simple pipe systems
Apply principles of dimensional analysis to design experiments

Course content:

Module-I (12Hours)

Introduction: Physical properties of fluids; Density; specific weight; Specific volume; Specific gravity; Compressibility; Elasticity; Surface tension; Capillarity; Vapour pressure; Viscosity; Ideal and real fluids; Concept of shear stress; Newtonian and non-Newtonian fluids.

Fluid statics: Pressure-density-height relationship; Manometers; Pressure on plane and curved surface;; Centre of pressure; Buoyancy; Stability of immersed and floating bodies; Fluid masses subjected to uniform accelerations.

Module – II (8 Hours)

Fluid kinematics: Steady and unsteady, uniform and non-uniform, laminar and turbulent flows and enclosed flows; Definition of one-, two- and three-dimensional flows, Stream-lines, streak-lines, and path-lines; Stream-tubes; elementary explanation of stream-function and velocity potential; Basic idea of flow nets.

Module – III (12 Hours)

Fluid dynamics: Basic equations: Equation of continuity; One-dimensional Euler's equation of motion and its integration to obtain Bernoulli's equation and momentum equation.

Flow through pipes: Laminar and turbulent flow in pipes; Hydraulic mean radius; Concept of losses; Darcy-Weisbach equation; Moody's (Stanton) diagram; Flow in sudden expansion and contraction; Minor losses in fittings; Branched pipes in parallel and series, Transmission of power; Water hammer in pipes (Sudden closure condition).

Module-IV (8 Hours)

Open channel flow
Definition; Uniform flow; Chezy's, Kutter's and Manning's equations; Channels of efficient cross section.
Flow in Open Channels: Specific energy, Critical flow, Discharge curve, Application of specific energy, Specific force, Classification of Surface profiles, Back water & draw down curves, Flow transition in open channels.

Measurements: Hook gauge; Point gauge; Pitot tube; Current meter; Venturi meter; Orifice meter; Orifices and mouthpieces; Notches and weirs.

Text Books:

1. Fluid mechanics by A.K. Jain, Khanna Publishers.

Reference Books:

1. Hydraulics and Fluid Mechanics including Hydraulic Machines by P.N.Modi and S.M. Seth, Standard Book House.
2. Engineering Fluid Mechanics by K.L. Kumar, S. Chand & Co.

3. Fluid Mechanics by V.L. Streeter, MGH

Course outcomes:

Ability to know the fundamental concepts of fluid mechanics
Ability to apply the basic equations of fluid statics to determine forces
on planar and curved surfaces submerged in a static fluid; to manometers:to the determination of buo yancy and stability
Ability to know the concept of fluid kinematics, stream functions,
Ability to Use Euler's and Bernoulli's equations and the conservation
of mass to determine velocities, pressures and accelerations for fluids

CE 15009: STRUCTURAL ANALYSIS-I (3-1-0) CR-04

Course objectives:

To understand the concept of analysis of indeterminate structures by various classical methods

To learn the concepts of moving loads and its effect on structures

To study the use of ILD for determinate structure

To understand the concept of equivalent UDL

Course Content:

Module – I **(10 Hours)**

Introduction to statically determinate/ indeterminate structure with reference to 2D and 3D structures, free body diagram of structure, introduction to kinematically determinate/indeterminate structures with reference to 2D and 3D structures, degree of freedom.

B.M. and S.F. diagrams for different loading on simply supported beam, cantilever and overhanging beams.

B.M. shear and normal thrust of three hinged arches.

Suspension Cables: Three hinged stiffening girders

Module – II **(12 Hours)**

Deflection of statically determinate beams: Integration method, Moment area method, Conjugate beam method.

Deflection of statically determinate beams by energy methods- strain energy method, castiglianos theorems, reciprocal theorem, unit load method, Deflection of pin-jointed trusses, Williot-Mohr diagram.

Module – III **(06 Hours)**

B.M. and S.F. diagrams for statically indeterminate beams – propped cantilever and fixed beams.

Application of three moment theorem to continuous and other indeterminate beams.

Module – IV **(12 Hours)**

ILD for determinate structures for reactions at supports, S.F. at given section, B.M. at a given section, Maximum shear and maximum bending moment at given section, Problems relating to beams, three hinged arch, suspension cables and roof truss

Text Books

1. Structural Analysis – Norris & Wilber
2. Indeterminate Structures – J.S. Kenney

Reference Book:

Structural Analysis – C.S. Reddy, TMH Publication

Course outcomes:

Ability to determine various internal forces in beams and frame from bending moment and shear force diagram

Ability to select appropriate method to determine slope and deflection of determinate beams and frames

Ability to determine internal forces in the members of plane & space truss, three hinged arch and cables.

Ability to determine absolute maximum internal forces due to rolling or moving loads from Influenced line Diagrams

CE 15007: ENGINEERING SURVEYING (3-1-0) CR-04

Course Objectives:

- To understand the importance of surveying in the field of civil engineering
- To study the basics of linear/angular measurement methods like chain surveying, compass surveying
- To study the significance of plane table surveying in plan making
- To know the basics of levelling and theodolite survey in elevation and angular measurements

Course Content:

Module I **(9 Hours)**

Concept of surveying: Definition of surveying, classification, principle, accuracy

Linear measurement: Different methods of direct measurement instrument for chaining, ranging, chaining on uneven sloping ground, errors in chaining, corrections.

Chain surveying: Chain triangulation, survey station, lines, locating ground features, field work, instruments for setting out basic problems in chaining, obstacles in chaining

Module II **(11 Hours)**

Compass surveying: Principles use of prismatic compass, measurement of bearings, conversion of bearings, local attraction, correction of compass traverse

Plane table survey: Principles, advantages and disadvantages, equipment, accessories and their uses, Methods of plane table survey, two point and three point problems

Levelling: Types of levelling and their uses, permanent adjustment, curvature and refraction effects

Module III **(10 Hours)**

Contouring: Characteristics and uses of contours, methods of contouring

Theodolite survey: application in height and distance measurements, permanent adjustment of transit theodolite, methods of repetitions and reiterations

Module IV **(10 Hours)**

Curve setting: Simple circular curve setting by chain, tape & theodolite

Introduction to total station

Minor survey instruments: box-sextant, planimeter, pantagraph, their working principles and uses

Text Book:

1 Surveying & Levelling – Kanetkar & Kulkarni, Vol.-I, Pune Vidyarthi Griha Prakashan.

Reference Books:

1 Surveying – Punmia, Vol. – I, Laxmi Publication.

2 Surveying – S.K. Duggal, Tata McGraw Hill
2 Surveying – S.K. Duggal, Tata McGraw Hill

Course Outcome:

CO1: Ability to apply the basic principles of surveying and can carry outthe survey in the field for various purposes using chain, compass, plane table and Theodolite.

CO2: Ability to perform levelling and contouring of given ground

CO3: Ability to set different types of curves

SESSIONAL

CE 15010: HYDRAULICS LAB -I (0-30-0) CR-02

Course objectives:

To understand the flow measurement in a pipe flow

To determine the energy loss in pipe flow

To study the characteristics of turbines

To study the characteristics of pumps

To measure the discharge in a open channel flow

Course Content:

1. Study of flow measuring equipment
2. Determination of head loss in pipes
3. Determination of C_c, C_v and C_d of an circular orifice
4. Determination of discharge coefficient (C_d) of Venturimeter
5. Determination of discharge coefficient (C_d) of orifice meters
6. Flow classification using Raynolds Apparatus

7. Determination of Metacentric height of a pantoon
8. Determination of Manning's and Chezy's coefficients of an open channel
9. Calibration of V-notch
10. Calibration of rectangular weir
11. Measurement of flow using V-notch and rectangular weir
12. Verification of Bernoulli's equation

Course outcomes:

On completion of the course, the students will be able to:

Measure discharge in pipes

Determine the energy loss in conduits

Demonstrate the characteristics curves of pumps

Demonstrate the characteristics curves of turbines carry out discharge measurements in open channel

CE 15010: SURVEY PRACTICE-I (0-0-3) CR-02

Course objective: The Lab sessions would include experiments on

Chain Surveying

Chain Traverse

Compass Surveying

Compass surveying Traversion

Plane Table Surveying – Radiation, intersection, Traverse, Resection Leveling

Course Content

1. Study of Chain, Standardization of Chain & Measurement of a line
2. Chain traversing
3. Compass traversing
4. Plane Table : 3 Point problem
5. Study of Dumpy level, its temporary adjustment, Differential Leveling and Fly leveling.
6. Contouring
7. Study of Theodolite, Temporary adjustment of Theodolite & measurement of horizontal and vertical angle.
8. Theodolite Traversing
9. Study on total station

Course outcomes: On completion of the course, the students will be able to:

Use conventional surveying tools such as chain/tape, compass, plane table, level in the field of civil engineering applications such as structural plotting and highway profiling.

Apply the procedures involved in field work and to work as a surveying team

Plan a survey appropriately with the skill to understand the surroundings

Take accurate measurements, field booking, plotting and adjustment of errors can be understood

Plot traverses / sides of building and determine the location of points present on field on a piece of paper

CE 15013: ENVIRONMENTAL ENGINEERING LABORATORY (0-0-3) CR-02

Course Objectives

1. To quantify the water and wastewater pollutant
2. To measure the concentration of air pollutants
3. To analyze the characteristics of water, wastewater and ambient air

Course Content:

1. Determination of Taste, Odour and Color of water/wastewater sample
2. Determination of pH, Temperature, E. Conductivity and D.O. of water/wastewater sample
3. Determination of TS, TDS and SS of water/wastewater sample
4. Determination of hardness & alkalinity of water sample
5. Determination of Turbidity and SO_4^{-2} of water sample
6. Determination of Ca^{+2}, Na^{+} and K^{+} of water sample
7. Determination of residual chlorine and Cl^{-} of water sample
8. Determination of BOD of water/wastewater sample
9. Determination of COD of water/wastewater sample
10. Microbiological analysis of water/wastewater sample

Course Outcomes

1. Determination of physical, chemical and biological characteristics of water and wastewater
2. Assess the quality of water and wastewater

FIFTH SEMESTER

CE 15014: STRUCTURAL DESIGN (3-1-0) CR-04

(IS: 456-2000 and other related codes are permitted in the examination)

Course Objectives:

To understand the concept of limit state methods and gain the knowledge of limit state design for flexure, shear, torsion, bond and anchorage
To introduce the fundamentals of reinforced concrete design with emphasis on the design of rectangular and T beams, short and slender columns, slabs, and footings .
Learn, analyze and design reinforced concrete structural members under bending, shear, and/or axial loads according to the Indian Standard code of practices.

Course Content:

Module-I **(10 Hours)**

Properties of concrete and reinforcing steel, Philosophy, concept and methods of reinforced concrete design, Introduction to limit state method: Limit state of collapse and limit state of serviceability. Application of Limit state method to rectangular beams for flexure, shear, bond and torsion.

Module-II **(10 Hours)**

Design of doubly reinforced beams. Design of T-and L-beams. Design of one way and two way slabs, Design of staircases.

Module-III **(10 Hours)**

Design of short and long columns with axial and eccentric loading, design of isolated column footing.

Module-IV **(10 Hours)**

Design principle of masonry structures: Brick and stone masonry. Design of masonry short and long walls, columns and retaining walls.

Text Books:

1. Reinforced concrete: Limit state by A.K. Jain
2. IS 456, SP-16 and SP-32.

Reference Books:

1. Limit state design of reinforced concrete by P.C. Verghese, PHI
2. Reinforced concrete by B.C. Punmia, A.K. Jain and A.K. Jain

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Understand the general mechanical behavior of reinforced concrete
2. Interpret limit state approaches in current structural design philosophy and identify concrete material properties relevant to design
3. Perform analysis and design of reinforced concrete members (i.e. beams, slab, stairs, column and footing) using IS code.

4. Draw and interpret detailing of various RCC structural elements.

5. Become familiar with professional, ethical and contemporary issues in the design, fabrication and construction of reinforced concrete members.

6. Participate industry relevant design project in a team setting

CE 15015: WATER RESOURCES ENGINEERING (3-1-0) CR-04

Course Objectives:

To build on the student's background in hydrology and hydraulics and understanding of water resources systems
To develop the skills in modeling of flood flows and flood routing
To develop skills in the ground water flow, type of aquifer and yield from the well
To provide the knowledge of design of reservoir, operation and sedimentation
To study the effect, causes and remedial measures of water logging

Course Content:

Module –I **(10 Hours)**

Hydrologic cycle, availability of water on earth, importance of hydrology and its applications in engineering.

Precipitation: Forms & types, measurement of rainfall, optimum number of rainguage stations, consistency of rainfall data, presentation of precipitation data, mean aerial rainfall, depth–area-duration curve, design storm, lossess from precipitation, evaporation, infiltration.

Module – II **(12 Hours)**

Run off: Computation, factors affecting runoff, Design flood: Rational formula, Empirical formulae, Stream flow: Discharge measuring structures, approximate average slope method, area-velocity method, stage-discharge relationship.

Hydrograph; Concept, its components, Unit hydrograph: use and its limitations, derivation of UH from simple and complex storms, S-hydrograph, derivation of UH from S-hydrograph. Synthetic unit hydrograph: Snyder's approach, introduction to instantaneous unit hydrograph (IUH).

Module – III **(10 Hours)**

Reservoir management: Fixation of reservoir capacity, Rippl's mass curve, sequent peak algorithm, allocation of storage space for various uses, reservoir sedimentation and tis control, determination of sediment yield at a reservoir site.

Module – IV **(8 Hours)**

Flood frequency analysis: Gumbel's method. Flood routing: Hydrologic channel routing, Muskingum equation, hydrologic reservoir routing: Modified Plus method, Flood control measures.

Text Books

1. Engineering Hydrology by K. Subramanya. Tata Mc Graw Hill Publication

Reference Books:

1. Elementary Hydrology by V.P. Singh, Prentice Hall Publication
2. Hydrology by P. Jayarami Reddy
3. Handbook of applied hydrology, V.T. Chow, Mc Graw Hill.

Course outcomes:

CO1: Ability to develop a simulation model related to water resources planning.

CO2:Ability to explain reservoir operation, planning and management of water resources projects.

CO3: Ability to explain economics for hydro-systems, water pricing and allocation policies

CE 15016: GEOTECHNICAL ENGINEERING-I (3-1-0) CR-04

Course objectives:

To explain what Geotechnical Engineering is and how it is important to civil engineering.

To explain how three phase system is used in soil and how are soil properties estimated using three phase system.

To explain role of water in soil behavior and how soil stresses, permeability and quantity of seepage including flow net are estimated.

To determine shear parameters and stress changes in soil due to foundation loads To estimate the magnitude and time-rate of settlement due to consolidation

Course Content:

Module –I **(10 Hours)**

Introduction: Origin of soils, formation of soils, clay mineralogy and soil structure, basic terminology and their relations, index properties of soils.

Soil classification: Particle size distribution, use of particle size distribution curve, Particle size classification, textural classification, HRB classification, Unified classification system, Indian standard soil classification system, Field identification of soils.

Soil moisture: Types of soil water, capillary tension, capillary siphoning.

Stress conditions in soil: Total stress, pore pressure and effective stress.

Module – II **(10 Hours)**

Permeability: Darcy's law, permeability, factors affecting permeability, determination of permeability (laboratory and field methods), permeability of stratified soil deposits. Estimation of yield from wells.

Seepage analysis: Seepage pressure, quick condition, laplace equation for two –dimensional flow, flow net, properties and methods of construction of flow net, application of flow net, seepage through anisotropic soil and non-homogenous soil, seepage through earth dam.

Module – III **(10 Hours)**

Soil compaction: Compaction mechanism, factors affecting compaction, effect of compaction on soil properties, density moisture content relationship in compaction test, standard and modified proctor compaction tests, field compaction methods, relative compaction, compaction control.

Soil consolidation: Introduction, spring analogy, one dimensional consolidation, Terzaghi's theory of one dimensional consolidation, consolidation test, determination of coefficient of consolidation.

Module –IV **(10 Hours)**

Shear strength of soils: Mohr's stress circle, theory of failure for soils, determination of shear strength (direct shear test, tri-axial compression test, unconfined compression test, van shear test), shear characteristics of cohesionless soils and cohesive soils.

Stabilization of soil: Introduction, mechanical stabilization, cement stabilization, lime stabilization, bituminous stabilization, chemical stabilization, thermal stabilization, electrical stabilization, Introduction to modern methods of stabilization

Text Book: Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.

Reference Books:

1. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co.
2. Soil Mechanics, T.W. Lambe & Whiteman, Wiley Eastern Ltd, Nw Delhi.

Course outcomes:

On completion of the course, the students will be able to:

Carry out soil classification solve three phase system problems.

Solve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram..

Estimate the stresses under any system of foundation loads.

Solve practical problems related to consolidation settlement and time rate of settlement

CE 15017: ENVIRONMENTAL ENGINEERING (3-1-0) CR-04

Course objectives:

To make the students familiar with sources of water

To provide the knowledge on demand of water and population forecast

To understand the design of basic components of water supply lines

To expose the students to understand the characteristics of water and its measurement

To depict the information on water treatment processes and its design

To provide adequate knowledge on water distribution system

To have adequate knowledge ondifferent sewage collection system and its design

To have adequate knowledge on various waste water treatment processes

Develop an understanding of the classification, sources and effects of pollutants

To understand the fundamentals of meteorology

Study the principles and equipment description of control technologies

Course Content:

Module – I **(10 Hours)**

1. Quantity of water: Sources of water, Percapita demand, design period, population forecast, fluctuation in demand. General requirement for water supply: Sources, Types of intakes, Pumping and Transportation of water.
2. Quality of water: Physical, chemical and biological characteristics of water and their significance, necessity of treatment, water quality standards for various water uses

Module – II **(10 Hours)**

3. Engineering system for water purification: Aeration, Screening, Coagulation and Flocculation, Sedimentation, Softening, Filtration, Disinfection
4. Methods of treatment: Removal of color, tastes and odour control, removal of iron and manganese, fluoridation and defloridation.
5. Advanced water treatment: Ion exchange, electro-dialysis, RO (principles only)

Module – III **(10 Hours)**

6. Generation and collection of wastewater, sanitary, storm and combined sewerage systems, quantities of sanitary wastes and storm water, design of sewerage system.
7. Engineered system for wastewater treatment: Primary treatment, Screening, Grit removal, Sedimentation, Sedimentation aided with coagulation.
8. Secondary treatment: Basis of microbiology, Growth and food utilization, Suspended-culture systems, Attached-culture systems, Secondary clarification, Disinfections of effluents.
9. Sludge treatment and disposal: Sludge characteristics, thickening, disposal

Module – IV **(10 Hours)**

10. Air pollution: Units of measurement, Sources and Classification of air pollutants.
11. Influence of meteorological phenomena on air quality: Lapse rate and dispersion, Pressure systems and dispersion, Winds and dispersion, Moisture and dispersion, Gaussian dispersion equation, Determination of stack heights.
12. Engineered systems for air pollution control: Gravitational settling chamber, cyclone, ESP, Bag filter and scrubbers, National Ambient air quality standards.

13. Text Book:

14. 1. Environmenatal Engineering (Volume I & II) by S. K. Garg-Khanna Publishers

15. Environmental Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous, MGH.

16. Environmental Impact Assessment by Larry W. Canter, Mc Graw Hill.

Course outcome:

- Identify the source of water and water demand.
- Apply the water treatment concept and methods.
- Prepare basic process designs of water treatment plants.
- Apply water distribution processes.
- Design sewage collection system.
- Prepare basic process designs ofwaste water treatment plants.
- Understand the sources and effects of key types of environmental pollutants.
- Have insight into fundamentals of meteorology.
- Appreciate different pollution control strategies.

Reference Books:

1. Environmenatal Engineering (Volume I & II) by B. C. Punmia-Khanna Publishers

2. Environmenatal Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous, MGH

CE 15018: STRUCTURAL ANALYSIS -II (3-1-0) CR-04

Course Objectives

1. To understand the concept of analysis of indeterminate structures by various classical methods

2. To study behaviour of arches and their methods of analysis

3. To know the concept and analysis of cable stayed bridge

4. To understand the concept of plastic analysis of structures

5. To analyze the forces in structures like continuous beam, truss and frames using stiffness and flexibility matrix method

Course Content

Module – I **(15 Hours)**

Introduction to Force and Displacement methods of structural analysis, Analysis of continuous beam and plane frame by slope deflection method and moment distribution method.

Module –II **(7 Hours)**

Analysis of continuous beam and simple portals by Kani's method, Analysis of two pinned and fixed arches with dead and live loads, suspension cable with two pinned stiffening girders.

Module – III **(8 Hours)**

Plastic Analysis: Plastic modulus, shear factor, plastic moment of resistance, load factor, plastic analysis of continuous beam and simple rectangular portals, Application of upper and lower bound theorems

Module – IV **(10 Hours)**

Matrix method of analysis: flexibility and stiffness method, Application to simple trusses and beam

Text Book

1. Indeterminate Structures by C.K. Wang.

Reference Books

1. Indeterminate Structures by J.S. Kenney
2. Matrix methods of Structural Analysis By Pandit and Gupta

Course outcomes

On completion of the course, the students will be able to**:**

1. Use various classical methods for analysis of indeterminate structures
2. Analyze cables and suspension bridges
3. Apply the basic concepts of matrix methods in structural analysis

CE 15019: FLUID FLOW LAB (0-0-3) CR-02

Course objectives:

To understand the application of momentum principle of impact of jets on plane and curved surfaces
To study types of centrifugal Pumps, work done and efficiency of the different types centrifugal pumps and also study about performance of pumps & characteristic curves
To study about specific speed and performance characteristics of different types of turbines
To study about hydroelectric power plant and estimation of hydropower potential
To explain the concept of positive displacement

1. Establishment of different types of hydraulic jumps and their classification
2. Determination of characteristics of the jumps
3. Flow measurement using Acoustic Doppler Velocimeter (ADV)
4. Determination of characteristics of PVC pipes
5. Determination of Rankine efficiency of hydraulic ram and D'Aubussin's efficiency
6. Determination of overall efficiency of Francis turbine with constant DC loading
7. Determination of overall efficiency of Pelton turbine under constant speed with alternating load
8. Determination of percentage of slip and efficiency of the double acting reciprocating pump and draw its characteristic curve

Course outcomes:

CO1: To understand different runners and impellers of various t turbines and pumps

CO2: Ability to measure rainfall quantity

CO3: Ability to study of hydraulic Jump,

CE 15020: GEOTECHNICAL ENGINEERING LABORATORY (0-0-3) CR-02

Course objectives:

To estimate index properties of soils (coarse and fine)

To estimate consistency limit of fine grained soils

To estimate shear strength of soils by direct shear test, triaxial shear test, vane shear test & unconfined compressive test.

To estimate the engineering properties of the soils by density test, CBR test permeability test and consolidation test.

Course Content:

1. Determination of specific gravity of soil grains
2. Determination of grain size distribution of soil: (a) sieve analysis; (b) Hydrometer/pipette test
3. Determination of Atterberg limits of soil: (a) liquid limit, (b) plastic limit, (c) shrinkage limit
4. Measurement of unit weight of soil in the field: (a) Core cutter method, (b) Sand replacement method
5. Determination of Density-water content relationship of soil: Proctor compaction tests.

6. Determination of relative density of granular soil

7. Determination of shear strength of soil: (a) Direct shear test (b) Tri-axial shear test, (c) Unconfined compression test (d) Vane shear test

8. Determination of consolidation characteristics of soil using fixed ring Oedometer

9. Determination of California Bearing Ratio (CBR) of soaked and un-soaked soil samples

10. Determination of coefficient of permeability of soil: (a) Constant head permeameter (b) Falling head permeameter

Course Outcome:

On completion of the course, the students will be able to:

Classify soil by physical observation of the soils.

Classify soil based on estimated index and engineering characteristics of soils

Carry out interpolation among the estimated soil design parameters..

CE 15021: ENVIRONMENTAL ENGINEERING DESIGN (0-0-3) CR-02

Course Objectives:

To determine population forecast using various methods

To Design conventional water treatment plant.

To Design conventional waste water treatment plant.

Course Content:

1. Design of conventional water supply system for a city. The system must include design of intake well, clariflocculators, filtration unit, disinfection, aeration & distribution network etc. including underground & overhead tank.

2. Design of waste treatment system (suspended growth process & attached growth process) for the city.

3. Design of septic tank & soak pit.

4. Design of aerobic, facultative & anaerobic ponds.

Course outcomes:

CO1: Ability to determine the quality of water and wastewater.

CE 15022: DESIGN OF CONCRETE STRUCTURE (0-0-3) CR-02

Course objectives:

To understand the concept of working stress and limit state methods

To gain the knowledge of limit state design for flexure, shear, torsion, bond and anchorage

To understand the behavior of columns subjected to eccentric load and use of interaction diagrams

Course Content

1. Design and detailing of singly and doubly reinforced sections

2. Design and detailing of flanged sections

3. Design and detailing of slabs: one way, two way, cantilever and continuous

4. Design and detailing of staircases

5. Design and detailing of axial, uniaxial and biaxial loaded columns

6. Design and detailing of isolated footings

7. Design and detailing of framed building with different structural elements : manual and using commercial software

Course outcomes

Ability to determine strength of reinforced concrete beams and slabs at various support conditions as per Limit state design

Ability to design reinforced concrete beams and slabs at various support conditions for different loadings as per Limit state design

CE 15029: TRANSPORTATION ENGINEERING LAB (0-0-3) CR-02

Course Objectives:

1. To practice CBR Test.
2. To practice characterisation of aggregates to be used as highway materials.
3. To practice characterisation of bitumen to be used as highway materials.
4. To determine optimum bitumen content for a stable bituminous mix.

Course Practice:

Test on Soil-CBR Test

Tests on Aggregate:

(1) Crushing Value Test

(2) Impact Value Test

(3) Los Angeles Abrasion Value Test

(4) Shape Test

Tests on Bitumen:

(1) Penetration Test

(2) Softening Point Test

(3) Ductility Test

(4) Specific gravity Test

Test on Bituminous Mix by Marshall Test.

Course Outcome:

1: Ability to determine the properties of different types of road construction materials and thereby select the appropriate material for given condition.

SIXTH SEMESTER

CE 15023: FLUID DYNAMICS (3-1-0) CR-04

Course Objectives:

To introduce dimensional analysis for fluid flow problems
To study in detail about boundary layers theory and drag and lift
To develop an understanding of fluid flow patterns and learns to use boundary layer theory and drag and lift
To analyze turbulent flow in a pipe
To provide insights to the open channel hydraulics
To classify the types of flows in open channel and also to design open channel sections in a most economical fashion with minimum wetted perimeter and learn about critical flows
To study about non uniform flows in open channel and longitudinal slopes in open channel and also to learn about the characteristics of hydraulic jump
To understand the application of momentum principle of impact of jets on plane and curved surfaces
To study types of centrifugal Pumps, work done and efficiency of the different types centrifugal pumps and also study about performance of pumps & characteristic curves
To study about specific speed and performance characteristics of different types of turbines
To know about working principles of reciprocating pump and to explain the concept of positive displacement

Course Content;

Module-I (10 Hours)

Dimensional Analysis: Introduction, Dimensional homogeneity, Methods of Dimensional Analysis, Model investigation, Similitude, Types of similarity, Model Laws, types of Models, Dimensionless numbers, Application of dynamic similarity to specific models.

Module – II (10 Hours)

Boundary Layer Theory: Introduction: Thickness of boundary layer, Boundary layer along a long thin plate and its characteristics, Boundary layer Equations, Momentum Integral Equations of boundary layer, separation of Boundary Layer, Methods of controlling Boundary layer.
Navier-Stokes Equations of Motion: Significance of Body Force, Boundary Conditions, Viscous Force, Limiting cases of Navier – Stokes Equations, Applications of N-S Equations to Laminar flow between two straight parallel boundaries, and between concentric rotating cylinders.

Module – III (10 Hours)

Drag and Lift: Introduction; Types of Drag, Drag on a sphere, Cylinder, Flat plate & on an air foil, Polar diagram, Profile Drag, Lift on immersed bodies.
Turbulent Flow in pipes: Reynolds observation on pipe flow, Causes and characteristics of turbulence. Reynolds stresses, Prandtl's Mixing length Theory, Velocity distribution in Rough pipes, Karman – Prandtl's resistance equations.

Module-IV (10 Hours)

Impact of free jet: Introduction, force exerted by fluid jet on stationary flat plate, moving flat plate, Stationary curved vane, moving curved vane, Torque exerted on a wheel with radial curved vanes.
Turbines: Classification, reaction, impulse, outward flow, inward flow & mixed flow turbines, Francis & Kaplan turbines, Pelton Wheel, Physical description and principle of operation, Governing of turbine.
Centrifugal Pump: Principles of classification, Blade angles, Velocity triangle, Efficiency, Specific Speed, Characteristic curves.
Reciprocating Pump: Principle of working, Slip, work done, effect of acceleration & Frictional resistance, Separation.

Text Book:

1. Fluid Mechanics by A.K. Jain, Khanna Publishers

Reference Book:

1. Fluid Mechanics and Hydraulic Machines, Modi & Seth, Standard Pulishers
2. Introduction to Fluid Mechanics and Fluid Machines, S.K. Som & G. Biswas,

Course outcomes:

On completion of the course, the students will be able to:

- Apply dimensional analysis
- Apply concept of boundary layer and drag and lift to fluid flow problems
- Visualize fluid flow phenomena observed in Civil Engineering systems such as flow in a pipe
- Compute the frictional loss in turbulent flow
- Analyze fluid flows in open channel hydraulics
- Design open channels for most economical sections like rectangular, trapezoidal and circular sections
- Calculate forces and work done by a jet on fixed or moving plate and curved plates
- Apply the working principles of Impulse and Reaction turbines
- Select the type of turbine required with reference to available head of water and discharge
- Determine the characteristics of centrifugal pump
- Apply the working principles of the Reciprocating pump

CE 15024: TRANSPORTATION ENGINEERING-I (3-1-0) CR-04

Course Objectives:

1. To understand current trends in transportation.

2. To learn geometric design of highway and structural design of pavement.

3. To understand traffic characteristics and their control.

4. To understand highway material characteristics and highway maintenance.

5. To have an overview of bridge superstructure and foundation.

Course Content:

Module-I **(12 Hours)**

Transportation by roads, railways, water ways & air ways – their importance& limitation. Road development & planning in India. Financing, Highway alignment & engineering surveys for highway location.
Geometric design-Cross section elements, Design speed, sight distance, super elevation, horizontal & vertical alignment including curves.

Module-II **(10 Hours)**

Traffic Engineering – Traffic studies & their importance.
Highway materials – Properties & tests, selection, requirements of bituminous mixes, marshall test.

Earthwork – measurement & rates, setting out of earth work, computation of areas & volumes-Prismoidal & Trapezoidal methods.

Module-III **(10 Hours)**

Pavement design-Use of CBR method for design of flexible pavement, IRC recommendation for design of rigid pavement.

Highway drainage, pavement failure, Evaluation, Maintenance & Strengthening of existing pavement.

Module-IV **(8 Hours)**

Classification of bridges, Consideration of location of bridge site, Investigation & data collection, Calculation of run off under bridge, Determination of water way, Choice of bridge span-economic span, Determination of maximum scour depth.
Bridge Superstructure-types, suitability. Bridge foundation-Types, Sinking of well.

Text Books:
(1) Highway Engineering-By Khanna & Justo (Nemchand & Bros., Roorkee (U.A))
(2) Bridge Engineering – By S.P. Bindra (Dhanpat Rai publication)

Reference Books:
(1) Principles & Practice of Highway Engineering – By Dr. L.R. Kadiyalli (Khanna publisher)
(2) Bridge Engineering-By D.J. Victor

Course Outcomes:

1: Ability to identify the current trends of transportation.

2: Ability to determine the characteristics of pavement materials and develop the acceptance criteria.

3: Ability to analyze and design the highway geometric elements & ability to design the pavement.

4: Ability to design traffic managing infrastructure based on given situation.

CE 15025: GEOTECHNICAL ENGINEERING-II (3-1-0) CR-04

Course objectives:

To emphasize the importance of soil investigations including destructive and nondestructive methods.

To explain how earth pressure theory is important in retaining structure design.

To explain the concept of bearing capacity and how to estimate the safe bearing capacity for various foundation system including settlement consideration.

To explain how do select a suitable shallow foundation system for various site conditions and also analysis of different foundation system.

To explain in what circumstances pile is needed and how do analysis the pile and pile group under various soil condition.

Course Content:

Module – I **(10 Hours)**

Stress distribution in soil: Boussinesq equations, Stress isobar and pressure bulb concept, pressure distribution on horizontal and vertical planes, stresses due to point load, line load, strip load, uniformly loaded circular and rectangular areas. Use of newmark's chart. Westergaard's solution. Approximate methods (point load method, two-to-one load distribution method). Contact pressure distribution due to loaded areas. Concept of active zone.

Module –II **(10 Hours)**

Lateral earth pressure and retaining structures: Earth pressure at rest, active and passive earth pressure. Earth pressure theories, Rankine's theory, Coloumb's wedge theory, Rebhann's and Culmann's graphcal methods, stability conditions for retaining walls. Stability of earth slopes: Stability of infinite slopes, stability analysis of finite slopes, Swedish method of slices, fiction circle method, Bishop's method. Use of Taylor stability number. Fellnious metod for locating centre of critical slip circle.

Module – III **(10 Hours)**

Subsoil exploration: Methods, direct (test pits, trenches), semi-direct (borings), indirect (sounding, penetration tests, and geophysical methods).

Planning of exploration programme, spacing and depth of boring, soil sampling, types of samples, standard penetration test, static and dynamic cone penetration test, in-situ vane shear test. Seismic refraction method, electrical resistivity methods,

Module-IV **(10 Hours)**

Shallow foundation: Introduction, bearing capacity, methods and determination of bearing capacity, settlement of foundations.

Deep foundation: Classification of pile, pile driving methods, pile capacity (static and dynamic analysis) pile-group analysis, load test on piles.

Text Books:

1. Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.

Reference Books:

1. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co.
2. Soil Mechanics, T.W. Lambe & Whiteman, Wiley Eastern Ltd, Nw Delhi.
3. Foundation Engineering, P.C. Verghese, Prentice Hall of India

Course Outcome:

On completion of the course, the students will be able to:

Carry out soil investigation for any civil engineering construction analyse earth retaining structures for any kind of soil medium.

To estimate bearing capacity using IS code methods.

Design proper foundations for any kind of shallow foundation system.

Estimate pile and pile group capacity for any kind of soil including group efficiency and negative friction.

CE 15026: STEEL STRUCTURES (3-1-0) CR-04

(IS: 800-2007) and Steel tables are permitted in the examination

Course Objectives:

Design of bolted and welded connections

Design of tension and compression members

Design of beams and beam columns

Design of built up members and column base

Course Content:

Module – I **(10 Hours)**

Philosophy, concept and methods of design of steel structures, structural elements, structural steel sections, Bolted Connections, Failure of Bolted Joints, Specifications for Bolted Joints, Analysis and design of bolted connections,

Welded connections, Welding Processes and defects, Design of fillet welds, Failure of welds,

Design of tension members

Module – II **(10 Hours)**

Design of compression members, Types of Buckling, Design of axially loaded compression member, Design of Columns Lacing, Design of Column battening, Design of Column Slab base, Design of Column Gusseted base, Design of Moment Resisting base plates, Design of Foundation Bolts.

Module – III **(10 Hours)**

Design of beams, Lateral stability of beams, Lateral torsional buckling, Bending strength of beams, Shear strength of beams, Web buckling, Web crippling, Design of rolled beams,
Plate girder, Design of plate girder, Plastic section modulus, Design of a Welded plate girder, Design of Gantry girder.

Module – IV **(10 Hours)**

Design of Roof trusses, Selection of the type of trusses, Loads and Load combinations in roof trusses, Design procedure, Design of component members in a roof truss.

Text Book:

1. Limit state design of steel structures by S.K. Duggal, Tata McGrawhill 2011

Reference Books:

1. Design of Steel Structures by B.C. Punmia, A.K. Jain and A.K. Jain. Laxmi Publishers.
2. Design of Steel Structures, Vol 1, By Ram Chandra and Virendra Gehlot. Scientific Publishers, Jodhpur.
3. Design of Steel Structures by L.S. Negi, Tata McGraw Hill Book Co.
4.

Course Outcomes: At the end of the course, the student will be able to:

CO1: design different types of connections (bolted & welded) as per Limit state design

CO2: determine strength of connections and different rolled steel structural members as per Limit state design

CO3: design different types of rolled steel structural members for axial and bending load as per Limit state design

CO4: design built up members and column base as per Limit state design

CE 15027: DESIGN OF STEEL STRUCTURES (0-0-3) CR-02

1. Types of steel sections and their properties
2. Design and detailing of bolted connections
3. Design and detailing of welded connections
4. Design and detailing of tension members
5. Design and detailing of compression members
6. Design and detailing of lacing and battening system

7. Design and detailing of slab base and gusseted base
8. Design and detailing of beams and plate girders
9. Design and detailing of roof truss
10. Detailing of framed and bracket connections

CE 15028: TRANSPORTATION & GEOTECHNICAL ENGINEERING DESIGN

(0-0-3) CR-02

Course Objectives:

1. To learn stability of slope.

2. To learn design of foundation, retaining walls and sheet piles and landfill.

3. To learn geometrical design of Highway, Runway, Turn out and structural design of pavements by IRC method.

4. To learn earthwork calculation by Mass Haul Diagram.

Course Content:

1. Design of earthen slope
2. Landfill Design
3. Design of retaining walls and sheet piles
4. Design of shallow foundation
5. Design of deep foundation
6. Design of machine foundation
7. Geometrical design of Highway
8. Design of flexible and rigid pavements by IRC method
9. Orientation and geometrical design of Runway.
10. Turn out design.
11. Earthwork calculation.

Course Outcomes:

1: Study of stability analysis of slopes, pressure distribution diagram and bearing capacity of shallow foundation.

2: Ability to design and analyse highway geometric elements & ability to design pavement.

3: Ability to calculate cost of earthwork.

CE 15029: TRANSPORTATION ENGINEERING LAB (0-0-3) CR-02

Test on Soil-CBR Test
Tests on Aggregate:
(1) Crushing Value Test
(2) Impact Value Test
(3) Los Angels Abrasion Value Test
(4) Shape Test
Tests on Bitumin-
(1) Penetration Test
(2) Softening Point Test
(3) Ductility Test
(4) Specific gravity Test
Test on Bituminous Mix by Marshall Test

CE 15030: SURVEY PRACTICE II (0-0-3) CR-02

Course objectives:

The Lab sessions would include extensive experiments on

Theodolite survey

Trignometric leveling to determine heights/elevations

Tacheometry

Setting of curves

Course Content:

1. Determination of sensitivity of bubble tube
2. (a) Determination of tacheometric constants.
   (b) Solution of Height & distance using tacheometer
3. Measurement of distance, angle and height using total station
4. Layout of a building using total station
5. (a)Setting out of simple circular curve and transition curve using total station
   (b) Transition Curve
6. Measurement of angles and distances using Differential Global Positioning System (DGPS)

Course outcome:

Ability to prepare a layout of certain area using different techniques.

Ability to use RS & GIS to prepare a map of a certain area.

SEVENTH SEMESTER

CE 15031: ADVANCED CONCRETE STRUCTURES (3-1-0) CR-04

Course Objectives:

- To introduce the basics of Earthquake Engineering, introduce ductility and cyclic loading behaviour of concrete, steel and RC
- To understand the design concept of various foundations and detailing of reinforcements
- To understand the design of ground and underground liquid retaining structures
- To understand prestressed concrete

Course Content

Module-I **(10 Hours)**

Introduction to EQ Engineering: Cyclic behavior of concrete and reinforcement, significance of ductility, ductility of beam, design and detailing for ductility, simple problems based on above concept, Computation of earthquake forces on building frame using Seismic Coefficient Method as per IS 1893-2002

Module-II **(10 Hours)**

Design of Foundations: Combined Footing: Design of Rectangular and Trapezoidal footing, Design of Raft Foundation, Design of Pile Foudation

Module-III **(10 Hours)**

Retaining walls: Forces acting on retaining wall, Stability requirement, Design of Cantilever and Counterfort Retaining walls

Module-IV **(10 Hours)**

Design of Water tanks: Design requirements, Design of tanks on ground and underground

Introduction to Prestressed Concrete: Prestressing methods, Analysis of prestressing systems and losses

Text Book:

1. Advanced Concrete Structure Design by P. C. Verghese, Prentice Hall of India
2. Limit state design- A K Jain, Nem Chand and Brothers

Reference books

3. Limit state design of reinforced concrete by B.C. Punmia, AK Jain and A.K. Jain, Laxmi Publishers New Delhi 2007
4. A K Chropra,Dynamics of Structures: Theory and Applications to Earthquake Engineering, Prentice Hall of India

Course Outcome

- Ability to estimate forces coming to structure due to earthquakes.
- Ability to design different foundations and several retaining structures
- Ability to determine the prestressing force required in beam for a prestressing systems

CE 15032: HYDRAULIC STRUCTURES (3-1-0) CR-04

Course Objectives:

To understand the basic types of irrigation, irrigation standards and crop water assessment

To study the different aspects of design of hydraulic structures

To provide knowledge on various hydraulic structures such as energy dissipaters, head and cross regulators, canal falls and structures involved in cross drainage works

To understand the analysis of seepage and hydraulic jump

To design different types of dams

Course Content:

Module – I (10 Hours)

Water requirement of crops, factors affecting water requirement, crop season, crop period, base period, delta and duty, consumptive use of water, frequency of irrigation, irrigation efficiency.

Water logging: causes and effects of water logging, anti-water logging measures, Land drainage, Design of drainage system, Tile drains.

Module - II (10 Hours)

Systems of irrigation, lift irrigation, flow irrigation, methods of distribution of water, Flow irrigation: selection of dam or barrage site, types of canals, alignment of canals, Design of canal section: Kennedy's and Lacey's theory, canal lining, Diversion head works, Canal head regulators, canal falls, outlets..

Cross drainage works (Theory only).

Module - III (14 Hours)

Weirs and barrages: types of weirs and barrages and their components, Bligh's creep theory, Khosla's theory. Calculation of scour depth.

Dams: classification of dams, forces acting on gravity dams, economical height of gravity dams, Gravity dams (Stability Analysis, Design and construction), earth dams, causes of failure of earth dams, methods of preventing failure of earthen dams, design of filters.

Module – IV (6 Hours)

Spillways: Type of Spillways, Spillway gates, Types of hydraulic jumps, Energy dissipaters, River training works.

Text Book

1. Irrigation Engineering and Hydraulic Structures by S.K. Garg, Standard Publishers

Reference Books

1. Engineering Hydrology by K. Subramanya, Tata Mc Graw Hill
2. Irrigation Engineering by N.N. Basak, PHI

Course outcomes:

CO1: Ability to solve problem on flood routine and design various hydraulic structures

- assess the irrigation needs of crops
- design weirs on pervious foundation
- design gravity dam and earthen dam design the canal systems
- select and design canal fall

CE 15033: TRANSPORTATION ENGINEERING-II (3-1-0) CR-04

Course Objectives:

1. To introduce basics of railway transportation.

2. To understand components of permanent way.

3. To learn geometric design of permanent way and control of railway traffic.

4. To have elementary idea about air transportation, its' functional components and air traffic control.

Course Content

Module – I **(10 Hours)**

History of Indian Railways, Component parts of railway track, Problems of multi gauge system, Wheel and axis arrangements, Coning of wheels, Various resistances and their evaluation, hauling capacity and tractive effort, stresses in rail, sleepers, ballast and formation.

Permanent way component parts : Types of rail section creep, wear and failure in rails, Rail joints, bearing plates, anti-creep devices, check and guard rails, Ballast requirements, Specifications, Formation, Cross-section, drainage.

Module – II **(10 Hours)**

Geometric design : Alignment, horizontal curves, super elevation, equilibrium cant and cant deficiency, Length of transition curves, Gradients and grade compensation, vertical curves.

Point and Crossing : Design of simple turn out, various types of track junction and their configurations.

Module – III **(10 Hours)**

Signaling and interlocking : Control of train movement and monitoring, types of signals, principles of interlocking.

Air Transport Development : Airport scenario in India – Stages of development, Aircraft characteristics, airport planning, site selection, Obstruction and zoning laws, Imaginary surfaces, Approach zones and turning zones.

Module – IV **(10 Hours)**

Runways and Taxiway design : Elements of runway, orientation and configuration, Basic runway length and corrections, Geometric elements design, Taxiway design, Main and exit taxiway, Separation clearance, Holding aprons, Typical airport layouts, Terminal building, gate position.

Visual Aids and Air Traffic Control : Airport making and lighting, Airway and airport traffic control, Instrumental landing systems and Air navigation aids.

Text books:

1. A Text Book of Railway Engineering by S C Saxena and S P Arora, Dhanpat Rai & Sons
2. Airport Planning & design by S. K. Khanna, M.G. Arora & S. S. Jain- Nemchand & Bros.

Reference books:

1. Railway Engineering, M.M. Agrawal, Prabha & Co., New Delhi
2. Railway Track Engineering by J. S. Mundrey, Tata McGraw Hill Book Co.

Course Outcomes:

1: Ability to design the Railway Geometric Elements for different conditions.

2: Ability to design the Railway Track using standard codes.

3: Ability to design the Railway Turnout and signals.

4: Ability to select feasible airport site, decide runway orientation, design geometric elements of runway and taxiway and suitable air traffic control system.

CE15043 STRUCTURAL ENGINEERING LAB (0-0-3) CR-02

Course Objectives:

1. To effectively link theory with practice and application by demonstration
2. To have hands on practice to get exposure on equipments and machines like UTM, rebound hammer, three and two hinged arch, concrete mixer etc
3. To provide all inputs required to help to attain professional expertise to analyze data, interpret results, and write technical reports
4. To emphasize the knowledge and application of safety regulations

Course Contents:

1. Determination of tensile strength and percentage of elongation of steel, Stress- strain curve of steel, Modulus of Elasticity.
2. Bend and rebend test of steel reinforcement.
3. Mix design of Concrete as per IS:10262-1982
4. Testing of RCC beam
5. Non-destructive tests of concrete
6. ILD for indeterminate structure
7. Finding reactions and forces for three hinged arch.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Find tensile strength and percentage of elongation of steel, stress- strain curve of steel, modulus of elasticity. And bend and rebend test of steel reinforcement
2. Analyze three hinged and two hinged arch structures and obtain the influence lines
3. Find deflections of beams using classical methods.
4. Perform concrete mix design, aggregate analysis, prepare and test concrete cubes, cylinders and reinforced concrete beams
5. Ability to compare experimental results to the theoretical results and write technical reports

EIGHT SEMESTER

BCE407-CONSTRUCTION MANAGEMENT (3-1-0) CR-04

Course objectives:

To make student understand various steps in project planning and execution.

To make student understand and apply the PERT and CPM network tools to optimize the cost and time for project execution.

To make students to select the suitable equipments and materials required for the execution of a project.

To apply various optimization techniques used in project management.

Module-I

Objectives and functions of construction management. Project Management: Project Planning, Scheduling and Controlling, Bar charts: Development of Bar charts and its shortcomings. Network techniques: Event, activity, Dummy activity. Network rules, Numbering of events. Critical Path Method, Critical activities, Slack. Project Evaluation and Review Techniques(PERT): Time estimates, Different types of Float of activity. Probability of meeting schedule date for the project.

Cost Model: Project cost, indirect and direct cost, slope of direct cost curve, optimum project duration, contracting the network for cost optimization. Introduction to updating, resources smoothing and resources leveling.

Module-II

Construction equipments: Different types of construction equipments, earth moving, dewatering and pumping, grouting, pile driving equipments. Conveyors, cranes, concrete mixture, vibrators, Rollers, Compactors and other road construction equipments. Factors affecting selection of construction equipments., Safety and safety measures in construction works. Quality control

Module-III

Introduction to optimization. Linear system: graphical method, simplex method. Sensitive analysis.Dynamic programming. (

Module-IV

Inventory management: Functional role of Inventory, factors involved in inventory problem Deterministic Inventory control model: single and multiple item inventory control model with and without shortage.

Equipment management: Replacement and maintenance model. Owing and hiring cost, depreciation. Work motion study. Multiple activity chart. (

Text books.

1. Construction planning, Equipments and Methods, R. L.Peurify. Tata McGraw Hill
2. Construction Management and Planning, B Sengupta & H Guha, Tata McGraw Hill
3. Construction Planning and Management, Mahesh Verma
4. PERT & CPM, L. S. Sreenath. East - West Press.
5. Optimization, S.S. Rao, Tata Mc Graw Hill

Course outcomes:

Ability to identify different aspects of project management

Ability to optimize the cost and time of a Project by using CPM & PERT Techniques

Ability to optimize resources in a project

Ability to describe material procurement method and control for a project

CE15037- ESTIMATION & PROFESSIONAL PRACTICE (3-1-0) CR-04

Course objectives:

To know the importance of preparing the types of estimates under different conditions

To know about the rate analysis and bill preparations

To study about the specification writing

To understand the valuation of land and buildings

Course Content:

Module – I

Quantity Estimation: Principles of estimation, methods and units, Estimation of materials in Buildings, Culverts and Bridges. Specifications of different items.

Module – II

Principles of general and detailed specification for various types building works.

Module – III

Analysis of rates: Description, Prime cost, Schedule of rates, Analysis of rates for various types of works.

Module – IV

Contract Management: Legal aspects, contract laws related to land acquisition, labour safety and welfare, Different types of contacts, their relative advantages and disadvantages, Elements of tender operation, Evaluation of tenders and Award of work, Disputes and arbitration.

Valuation of Civil Engineering structures.

Text books :

Estimating and costing in Civil Engineering Theory & Practice, B.N.Dutta, UBS Publishers.

Construction Management and Planning, B. Sengupta & H Guha, Tata McGraw Hill

Course outcomes: On completion of the course, the students will be able to:

Apply different types of estimates in different situations

Carry out analysis of rates and bill preparation at different locations

Demonstrate the concepts of specification writing

Carry out valuation of assets

OPEN ELECTIVE-II

CE 15038 - COMPREHENSIVE VIVA VOCE(0-0-2): CR-02

CE15039 SEMINAR(0-0-3) :CR-02

CE 15040- MAJOR PROJECT (0-0-6): CR-08

OPEN & CORE ELECTIVES

CE 15041: ADVANCED SURVEYING (3-1-0) CR-04

Course objectives:

1. To understand the basics and elements of different types of curves on roads and their

Preliminary survey

2. To learn about surveying applications in setting out of curves, buildings, culverts and tunnels

3. To get introduced to different geodetic methods of survey such as triangulation, trigonometric leveling

4. To learn about errors in measurements and their adjustments in a traverse

5. To get introduced to modern advanced surveying techniques involved such as remote sensing, Total station, GPS, Photogrammetry etc.

Course Contents:

Module – I **(10 Hours)**

Application of Theodolite Surveying – Tacheometry, Height & distance, Curve setting problems (Compound, Reverse & Transition), Traversing & Triangulation survey: Principle, Planning & Methods. Geodesy

Module – II **(10 Hours)**

Photogrammetric Surveying – Principle, Scale, Numbe r of Photographs, Deduction of distance & height, Elements of Astronomical survey, Solution of problems dealing with celestial triangle.

Module – II **(12 Hours)**

Principles of Remote Sensing & Geographic Information System, Application to Civil Engineering.

Module – IV **(8 Hours)**

Electronic distance measurement, Total Station, Global Positioning System.

Text Book

(1) Surveying – Vol –II – By B.C. Punmia, A K Jain and A K Jain, Laxmi Publishers
(2) Higher Surveying – Vol –II By B.C. Punmia, A K Jain and A K Jain, Laxmi Publishers

Books for Reference:

(3) Surveying – Vol – I – By S.K.Duggal, Tata McGraw Hi ll Book Co.
(4) Surveying – Vol – II – By S.K. Duggal, Tata McGraw Hill Book Co.

Course outcome:

CO1: Ability to prepare a layout plan using Total Station instrument.

CO2:Ability to calculate area of a traverse by using different methods such as triangulation , aerial photogrammetry .

CO3: Ability to use RS & GIS to prepare a map of a certain area

CE 15042: TOWN PLANNING & ARCHITECTURE (3-1-0) CR-04

Course Objectives:

1. To understand elements of city plan.
2. To learn principles of architecture.
3. To learn orders in architecture.
4. To learn about Indian architecture

Course Contents:

Module – I **(8 Hours)**

Elements of City plan, Surveys, Zoning, Housing, Slums, Parks & Play grounds, Public buildings & Town centres and Industries

Module – II **(8 Hours)**

Communication & Traffic Control, Urban renewal & replanning the existing towns, Master plan, Planning law & Legislation.

Module – III **(12 Hours)**

i) Architecture as a fine art, its aim, importance and methods of study. Fundamental principles of architecture- Truth, beauty and Goodness.
ii) Qualities and factors of beauty.
iii) Qualities : Strength, Vitability, Restraint, Refinement, Repose, Grace, Breadth, Scale, Expression or setting out of purpose, Unity in concept, Factors : Mass, Form, Proportion, Balance, Symmetry, Solids, and voids, Light and shade.

Module – IV **(12 Hours)**

i) Influence on architectural development : Effects of topography, Climate, Religion, Customs, Traditions, Technological development and aspirations of time.
ii) Class in Orders : Definition, Doric, Ionic, Corinthian, Composite and Tuscan orders, Knowledge of the details of their parts and proportions.
iii) Indian Architecture : Stupas, Chaityas and Viharas with examples. Jain style - Architectural character and example .
Hindu style – Dravidian temples and gopuram, Ori ssan group of temples with examples, Indo- Islamic architecture with examples.
iv) Architectural character of modern architecture.

Text Book

1. Fundamentals of town planning -G.K. Hiraskar - Dhanpat Rai & Publication

Books for reference :

1. Architects & Builders hand book – Kiddar & Parke r
2. The great ages of world architecture - G.K.Hiraska

Course Outcomes:

1. Ability to understand the functional role of elements for their judicious allocation in master plan.

2. Ability to understand the trend in Indian architecture.

CE 15043: ECONOMIC EVALUATION AND ANALYSIS OF TRANSPORT PROJECT (3-1-0) CR-04

Course Objectives:

To assess the financial feasibility of the project.

To know the impact on cash flow and revenue streams (varies depending on financing strategy – current revenue versus bonding).

Eligibility for various funding programs/sources.

Fiscal impact analysis – long-term impact of project on tax revenues

Course Contents:

Module-I (10 Hours)

Project Formulation: Project Preparation – Flow Cha rt for Project preparation. Project Cycle- Project Formulation – Need and Scope of Project Formulation - Various Aspects and Approaches in Project Formulation. Stages in Project Formulation. Preparation of Feasibility Report and DPR – Guidelines.

Module -II (10 Hours)

Economic Evaluation: Need for Economic Evaluation; Stages involved in Economic Analysis; Cost and Benefit components; Discounting Criteria; Welfare economics; Social costs; Rate of Return; Road User Cost study in India ; Value of Travel time Savings - Economic concept of evaluation of travel time savings; Issues connected with evaluation of travel time savings. Vehicle operating costs - Components of VOC, Accident costs; Methodologies for economic evaluation of an accident.

Module -III (12 Hours)

Economic Analysis; Basic Concepts of Economic Analysis, Principles of Economic Analysis; Cash flow diagrams; Time value of Money; Development of cash flow Diagrams; Methods of Economic Evaluation -Equivalent Uniform Annual Cost Method; Present worth of cost method;- Equivalent uniform annual net return method; Net present value method; Benefit cost ratio method; Rate of Return Method. Applications of these methods to highway projects.

Module -IV (8 Hours)

Project appraisal by shadow pricing with case studies; Toll system analysis, Financial analysis;Budgeting.

Text Book

1. Traffic Engineering and Transport Planning - L.R Kadiyali, Khanna Publishers.
2. Transportation Engineering Economics - Heggie. I. G.; Mc Graw Hill Publishers.

Reference Book

1. IRC: SP: 19; 2001, Manual For Survey, Investigation & Preparation of Road Projects.
2. IRC:SP: 30, Manual on Economic Evaluation of Highway Projects in India.
3. Economic Analysis for Highways - Winfrey.R; International TextBook Company.
4. Road User Cost Study, CRRI
5. Road Project Appraisal, for Developing Countries, J.W.Dickey ,John Wiley & Sons.

Course Outcomes:

Ability to assess the financial feasibility of the project.

Ability to analyse the impact on cash flow and revenue streams

Ability to analyse the impact analysis – long-term impact of project on tax revenues

CE 15044: PAVEMENT MANAGEMENT SYSTEM (3-1-0) CR-04

Course Objectives:

1. To understand principles of pavement design.

2. To learn methods for flexible pavement design.

3. To learn methods for rigid pavement design

Course Contents:

Module -I **(9 Hours)**

Components of PMS and their activities; Major steps in implementing PMS; Inputs; Design, Construction and Maintenance; Rehabilitation and Feedback systems; Pavement Maintenance Management Components of Maintenance Management and Related Activities – Network and Project Level Analysis; Prioritization Techniques and Formulation of Maintenance Strategies.

Module -II **(15 Hours)**

Techniques for functional and structural evaluation of pavements: Serviceability Concepts; Visual Rating; Pavement Serviceability Index; Roughness Measurements ;Distress Modes – Cracking, Rutting, etc; Pavement Deflection – Different Metho ds and BBD, Skid Resistance, Roughness, Safety – Aspects; Inventory System. Causes of Deter ioration, Traffic and Environmental Factors, Pavement Performance Modeling Approaches and Methods of Maintaining WBM, Bitumen and Cement Concrete Roads, Quality Assurance; Quality Control – ISO 9000, Sampling Techniques – Tolerances and Controls related to Profile and Compaction

Module -III **(8 Hours)**

Pavement rehabilitation techniques: overlay design procedures, recycling of flexible and rigid pavements

Module -IV **(8 Hours)**

Maintenance of paved roads: Fog spray, Slurry seal and micro surfacing, Treatments of cracks and joints in Rigid pavement, Mud Jacking.

Text Book

1. Y. H. Huang, Pavement Analysis and Design, Second ed.,Pearson Education
2. Rajib B. Mallick,Tahar El-Korchi, Pavement Engineering: Principles and Practice, Second Edition, CRC Press

References Book

1. Ralph Haas, W. Ronald Hudson, John P. Zaniewski, Modern pavement management Modern Pavement Management, Krieger Pub Co

2. Croney, D. and P. Croney, The design and performance of road pavements, McGraw-Hill Book Company, London, UK.
3. Derek Pearson, Deterioration and Maintenance of Pavements, ICE Publishing
4. IRC: 81-1997 Guidelines for strengthening of flexible pavement.

Course Outcomes:

1. Ability to design flexible pavement by various methods.

2. Ability to design rigid pavement by various methods.

CE 15045: ENVIRONMENTAL GEOTECHNICS (3-1-0) CR-04

Course Objective:

To know about waste generation and its impact on environment

To explain the engineering properties of various waste.

To explain design aspect of geosynthetics towards waste management.

To explain the selection & design of landfill.

To explain the concept of ash pond disposal process and stability analysis of ashpond.

Course Contents:

Module-I **(10 Hours)**

Sources and Site Characterization: Scope of Environmental Geotechnics, Various Sources of Contaminations, Need for contaminated site characterization; and Characterization methods.

Solid and Hazardous Waste Management: Classification of waste, Characterization solid wastes, Environmental Concerns with waste, waste management strategies.

Module-II **(10 Hours)**

Contaminant Transport: Transport process, Mass-transfer process, Modeling, Bioremediation, Phytoremediation.

Module-III **(10 Hours)**

Remediation Techniques: Objectives of site remediation, various active and passive methods, remediation NAPL sites, Emerging Remediation Technologies.

Module-IV **(10 Hours)**

Landfills: Types of landfills, Site Selection, Waste Containment Liners, Leachate collection system, Cover system, Gas collection system.

Text Books:

1. Phillip B. Bedient, Refai, H. S. & Newell C. J. - Ground Water Contamination - Prentice Hall Publications, 4th Edition, 2008
2. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering, John Wiley & Sons (2004)

References:

1. Rowe, R. K. - Geotechnical & Geoenvironmental Engineering Handbook, Kluwer Academic, 2001

2. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York (2000).
3. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management, New York: McGraw-Hill, 2001

Course Outcomes:

On completion of the course, the students will be able to:

Analyze and able to find various engineering properties of wastes.

Analyze and design the geosynthetics for waste containment.

Analyze and design engineering landfill

Analyze and design ash pond dykes

CE 15046: GROUND IMPROVEMENT TECHNIQUE (3-1-0) CR-04

Course Objectives:

- Identifying the basic principles of various ground improvement techniques
- How to select the most appropriate ground improvement technique in specific circumtances
- Understanding the design procedure of various ground improvement techniques
- Introducing an overview of the observational method and instrumentation used in Geotechnical Engineering.
- Knowledge of reinforcement to soils in the form of geo textiles and other synthetic materials.

Course contents:

Module – I **(10 Hours)**

Introduction, Necessity of ground improvement, Dewatering, methods, Analysis and design of dewatering systems. Grouting types, Properties, Method of grouting, Ground selection and control.

Module – II **(10 Hours)**

Compaction, Methods of compaction, Engineering prosperities of compacted soil, Field compaction and its control.

Module – III **(10 Hours)**

Soil stabilization, Use of chemical additives, Stone columns, Principle, design and method of installation.

Module – IV **(10 Hours)**

Reinforced earth, Concept, Materials, Application and design, Use of geo-synthetics and geo-cells in construction work.

Text books:

1. Ground Improvement Technique, P. Purusothom Raj

Reference Book

1. Foundation Design and Construction, M.J. Tomlinson

2. Foundation Engineering, G.A. Leonard, Tata McGraw Hill

3. Modern Geotechnical Engineering, Alam Singh, IBT Publishers

Course Outcome:

Ability to apply the ground improvement technique using admixture and advanced technique using grouting.

Ability to identify the relevance of reinforcing elements to resist the lateral earth pressures

Ability to apply suitable techniques for the deep compaction of granular soils and improvement of cohesive soils

Ability to utilize ground anchors and soil nails for design of soil retained structures.

CE 15047: CONCRETE TECHNOLOGY (3-1-0) CR-04

Course Objectives:

To understand the properties of ingredients of concrete.

To study the behavior of concrete at its fresh and hardened state.

To study about the concrete design mix.

To know about the procedures in concreting.

To understand special concrete and their use

Course Contents:

Module 1 (10 Hours)

Introduction of concrete, Historic development, Composition of concrete, Advantages of concrete over other materials, Advances and future trends in concrete, Overview of Sustainability and Concrete development.

Cement: Production, composition, and properties; cement chemistry, Types of cements; special cements; Aggregates: Classification, IS specifications, Properties, Grading, Methods of combining aggregates, specified gradings, Testing of aggregates; Water : General requirements & limiting values of impurities

Module 2 (8 Hours)

Admixtures: Water reducers, air entrainers, set controllers, special admixtures - structure properties and effects on concrete properties; Introduction to supplementary cementing materials and pozzolans; Other mineral additives - reactive and inert.

Concrete mix design**:** Basic principles; IS method; ACI method; new approaches based on rheology and particle packing.

Module 3 (10 Hours)

Concrete Production & Fresh concrete**:** Batching of ingredients; mixing, transport, and placement; Consolidation, finishing, and curing of concrete; initial and final set - significance and measurement; Workability of concrete and its measurement.

Engineering properties of concrete**:** Compressive strength and parameters affecting it; Tensile strength -direct and indirect; Modulus of elasticity and Poisson's ratio; Stress strain response of concrete.

Dimensional stability and durability: Introduction to durability; relation between durability and permeability; Chemical attack of concrete; corrosion of steel rebars; other durability issues**;** Creep and relaxation - parameters affecting; Shrinkage of concrete - types and significance; Parameters affecting shrinkage; measurement of creep and shrinkage**.**

Module 4 **(12 Hours)**

Non-Destructive testing of concrete: Introduction to Destructive, semi -destructive & Non-destructive testing methodology, Problems faced during Non-destructive evaluation, Test methods like Rebound Hammer test, Ultra-sonic pulse velocity, Penetration tests, Pull out test

Special concretes**:** Properties and applications of: High strength - high performance concrete, reactive powder concrete; Lightweight, heavyweight, and mass concrete; fibre reinforced concrete; self-compacting concrete; shotcrete; other special concretes.

Overview of Fracture Mechanics: Origin of fracture mechanics, Understanding the quassi-brittle nature of concrete, Failure of concrete under low stress, Micro-cracking, crack propagation, stress concentration at openings.

Text books:

1. A. M. Neville, Concrete Technology (English) 1st Edition; Pearson India publications.
2. M.L. Gambhir, Concrete Technology, 5th Edition; by; McGraw Hill Education (India) Private Limited.

Reference Books:

1 P. Kumar Mehta, and Paulo J.M. Monteiro; Concrete: microstructure properties and materials: Tata Mcgraw Hill Education Private Limited
2. M S Shetty, Concrete Technology: Theory and Practice; 7th Edition;; S. Chand & Company Ltd-New Delhi.

Course Outcomes:

On completion of the course, the students will be able to:

Test all the concrete materials as per IS code.

Design the concrete mix using ACI and IS code methods.

Determine the properties of fresh and hardened of concrete design special concretes and their specific applications.

Ensure quality control while testing/ sampling and acceptance criteria

CE 15048: PRE-STRESSED CONCRETE (3-1-0) CR-04

(Relevant IS Codes are permitted in the examination)

Course Objectives:

To understand prestressingmaterials , system and various prestressing losses and deflections

Analysis and design of various prestressed structural components

To understand the stress distribution in end-block by various methods

To understand the design of prismatic continuous beams

Course Contents:

Module –I **(10 Hours)**

Different systems of prestressing, Characteristics of concrete and steel, Other suitable materials, Losses in prestress.

Analysis and design of section for flexure, shear and torsion. Design of flexural member. Limit state design as per IS code.

Module –II **(10 Hours)**

Deflection of prestressed structures- short term as well as long term deflections of uncracked and cracked members.

Module –III **(10 Hours)**

Stress distribution in end-block of post tensioned section. Magnel's method, Guyen's method, Rowe's method and IS code method.

Module –IV **(10 Hours)**

Indeterminate structures- Principles of design of prismatic continuous beams of two equal, unequal spans with same and variable moments of inertia, Cap cable, Design concept of concordancy of cable, Secondary design consideration.

Design of Pre-tensioned and Post-tensioned beam

Text Book

1. N. Krishnaraju- "Prestressed concrete"- Tata McGraw -Hill, New Delhi-2004.

2. S. K. Mallik & A. P. Gupta- "Prestressed concrete"- Oxford & IBH, New Delhi-1982

Reference Books:

3. E. W. Bennet- "Prestressed concrete theory & design "- Chapman & Hall, London-1962.

4. T. Y. Lin & H. Burns Ned,- "Design of prestressed c oncrete structures", Johnwilley & Sons, New York-1982.

Course Outcomes:

Ability to determine the prestressing force required in beam for a prestressing systems.
Ability to compute losses and deflections of prestressed concrete members
Ability to compute Flexural Strength & Torsional Resistance of Prestressed Concrete Members

Ability to design End Blocks of a post tensioned prestressed concrete member.

CE 15049: BRIDGE ENGINEERING (3-1-0) CR-04

Course objectives

To understand various stages of bridge planning

To understand various types of IRC loadings

To analyze cables and suspension bridges subjected to IRC loadings

To study the design of various types bridge and culverts

Course contents:

Module 1: **(10 Hours)**

Introduction: classification and components of a standard bridge, Engineering and aesthetic requirements, introduction to bridge codes.

Investigation for bridge: Site selection, data drawing, design discharge linear water way, economical span, location of piers and abutments, vertical clearance above HFL, scour depth and choice of bridge type.

Standard Loadings for Road Bridges: Dead load, Live loads, Impact effect, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects, and Seismic force.

Module 2: **(10 Hours)**

Foundation and substructures: Types of foundation (open, pile, well and caisson), design of piers, abutments, wing wall and bed blocks.

Design of Culverts: Design of Pipe culverts (hydraulics and structural), Analysis and design of right, skew and curved slab culvert; design of single vent rectangular box culvert.

Module 3: **(10 Hours)**

Design of Girders: Design and detailing T-beam bridge (without footpath), load distribution, design and orthographic plate analysis of bridge deck.

Bearings: Bearings for slab bridges and girder bridges, design of elastomeric bearing.

Joints: Design and construction of expansion joints.

Module 4: **(10 Hours)**

Introduction to long span bridges: Cantilever bridges, Arch bridges, Cable stayed bridges, suspension bridges, Pre-stressed concrete bridge (pre-tensioned and post-tensioned) and steel bridges.

Bridge Launching: Methods of erection of concrete, steel, pre-stressed and composite bridges

Inspection and Maintenance of Bridges: Types of inspection (routine inspection, principal inspection and special inspection), Types of maintenance (Ordinary maintenance and specialized maintenance).

Text Book

1. Essentials of Bridge Engineering, by DJ Victor, Oxford IBH.

Reference Books:

2. Design of Bridge Structures, by T. R. Jagadeesh, PHI.

3. Principles and Practice of Bridge Engineering, SP Bindra, Dhanpat Rai Publications

Course outcome

Design the slab culvert, Box culvert

Design the T beam bridge and substructures

Design the Bridge bearings

Design the steel bridge for railways

CE 15050: GROUND WATER ENGG (3-1-0) CR-04

Course Objectives:

To know the types of aquifers
To understand the surface and subsurface investigation in detail
To integrate the fundamental and basic knowledge of ground water movement
To introduce the different model studies
To know steady and unsteady ground water flow to wells in unconfined and confined aquifers
To understand the surface and subsurface investigation in detail
To understand the process of artificial recharge of ground water
To understand the process of sea water intrusion in coastal aquifers
To understand the concept of ground water basin management

Course Contents:

Module-I **(10 Hours)**

Groundwater Occurrence: Groundwater hydrologic cycle, origin of groundwater, rock properties effecting groundwater, vertical distribution of groundwater, zone of aeration and zone of saturation, geologic formation as Aquifers, types of aquifers, porosity, Specific yield and Specific retention.

Groundwater Movement: Permeability, Darcy's law, storage coefficient. Transmissivity, differential equation governing groundwater flow in three dimensions, groundwater flow equation in polar coordinate system. Groundwater flow contours their applications.

Module – II **(10 Hours)**

Analysis of Pumping Test Data – I: Steady flow grou ndwater flow towards a well in confined and unconfined aquifers – Dupuit's and Theim's equation s, Assumptions, Formation constants, yield of an open well, well tests.

Analysis of Pumping Test Data – II: Unsteady flow t owards a well – Non equilibrium equations – Thesis solution – Jocob and Chow's simplifications, Leak aquifers.

Tube wells- Types, strainers, yield of a tube well, Interference of wells, causes of failure, optimum capacity, rehabilitation and maintenance of tube wells.

Module – III **(12 Hours)**

Surface and Subsurface Investigation: Surface methods of exploration – Electrical resistivity and Seismic refraction methods. Subsurface methods – Ge ophysical logging and resistivity logging. Aerial Photogrammetry applications along with Case Studies in Subsurface Investigation.

Artificial Recharge of Groundwater: Concept of artificial recharge – recharge methods, relative merits, Applications of GIS and Remote Sensing in Artificial Recharge of Groundwater along with Case studies.

Module – IV **(8 Hours)**

Saline Water Intrusion in Coastal aquifer: Occurrence of saline water intrusions, Ghyben- Herzberg relation, Shape of interface, control of seawater intrusion. Groundwater Basin Management: Concepts of conjunctive use, Case studies.

Text Books:

1. Groundwater - H.M.Raghunath [Wiley Eastern Ltd.]

References :

1. Groundwater Systems Planning & Management - R.Willes & W.W.G.Yeh [Prentice Hall of India.]
2. Applied Hydrogeology - C.W.Fetta [CBS Publishers & Distributors]
3. Groundwater Hydrology - David Keith Todd [John Wiley & Son, New York.]

Course outcomes:

On completion of the course, the students will be able to:

- identify types of aquifers carry out surface and subsurface investigation
- to locate groundwater visualise the occurrence and movement of groundwater
- Assess discharge potential of wells in unconfined and confined aquifers
- Carry out surface and subsurface investigation to locate groundwater
- Select suitable type of ground water recharge
- Assess sea water intrusion in coastal aquifers and its control
- Analyze conjunctive use of ground water

CE 15051: MECHANICS OF COMPOSITE MATERIALS (3-1-0) CR-04

Course Objectives

To understand the characteristics and uses different type of composite materials

To develop stress strain relationship for composite materials with various orientations

To analyze the load- defection and flexural behavior of composite plates

Course Contents:

Module –I **(10 Hours)**

Classification and characteristics of Composite materials, advantages and limitations,

Basic Concepts and characteristics: Homogeneity and Heterogeneity, Isotopy, Orthotopy and Anisotropy; Characteristics and configurations of lamina, laminate, micromechanics and macromechanics. Constituent materials and properties.

Module –II **(10 Hours)**

Elastic behaviour of unidirectional lamina, Strength of unidirectional lamina, Macromechanical failure theories : Maximum stress theory, maximum strain theory, Deviatoric strain energy theory (Tsai-Hill),Interactive tensor polynomial theory (Tsai-Wu)

Module –III **(10 Hours)**

Elastic Behaviour of multidirectional laminates: Basic assumptions, Stress-strain relations, load deformation relations, symmetric and balanced laminates, laminate engineering properties,

Module –IV **(10 Hours)**

Bending of laminated plates: Governing equations, Deflection of simply supported rectangular symmetric angle-ply, specially orthotropic, anti-symmetric cross-ply laminates.

Text Book

1. Robert M. Jones, "Mechanics of Composite materials ", McGraw-Hill Book Company
2. I M Daniel and O. Ishai, "Engineering mechanics of Composite materials", Oxford university press

Reference Books:

1. P.K. Mallick , "Fiber-reinforced Composites", M arcel Dekker inc
2. D. Hull and T W Clyne, "An introduction to compo site materials", Cambridge university press
3. J N Reddy, Mechanics of laminated composite plates and shells: theory and analysis, CRC Press

Course outcomes

On completion of the course, the students will be able to**:**

Understand the Classification, characteristics and advantages of Composite materials
Determine the load carrying capacity of various types of laminates
Determine flexural strength of composite plates with various orientations

CE 15052: REMOTE SENSING AND GIS (3-1-0) CR-04

Course Objectives:

To know about the principles of remote sensing and spectral signatures

To know about satellites, types of remote sensing and digital image processing

To study about the history and components of GIS To study about data types and operations

To know the applications of remote sensing and GIS

Course Contents:

Module – I **(10 Hours)**

Remote Sensing : Basic concepts and foundation of remote sensing – elements involved in remote sensing, electromagnetic spectrum, remote sensing terminology and units. Energy resources, energy interactions with earth surface features and atmosphere, resolution, sensors and satellite visual interpretation techniques, basic elements, converging evidence, interpretation for terrain evaluation, spectral properties of water bodies, introduction to digital data analysis.

Module – II **(10 Hours)**

Geographic Information System: Introduction, GIS definition and terminology, GIS categories, components of GIS, fundamental operations of GIS, A theoretical framework for GIS.

Data collection and input overview, data input and output. Keyboard entry and coordinate geometry procedure, manual digitizing and scanning, Raster GIS, Vector GIS – File management, Spatial data – Layer based GIS, Feature based GIS mapping.

Module – III **(10 Hours)**

GIS Spatial Analysis: Computational Analysis Methods (CAM), Visual Analysis Methods (VAM), Data storage-vector data storage, attribute data storage, overview of the data manipulation and analysis. Integrated analysis of the spatial and attribute data.

Module – IV **(10 Hours)**

Applications: Land use/Land cover in water resources, Surface water mapping and inventory, Rainfall – Runoff relations and runoff potential in dices of watersheds, Flood and Drought impact assessment and monitoring, Watershed management for sustainable development, Watershed characteristics.

Reservoir sedimentation, Fluvial Geomorphology, water resources management and monitoring, Ground Water Targeting, Identification of sites for Artificial Recharge Structures, Drainage Morphometry, Inland water quality survey and management, water depth estimation and bathymetry.

Text Books:

1. Remote Sensing and its applications - LRA Narayana [University Press 1999.]

References:

1. Concepts & Techniques of GIS - C.P.Lo Albert, K.W. Yonng,[Prentice Hall (India) Publications.]
2. Remote Sensing and Geographical Information systems - M.Anji Reddy [B.S.Publications.]
3. GIS by Kang – tsung chang, [TMH Publications & C o.]
4. Basics of Remote sensing & GIS - S.Kumar [Laxmi Publications.]

5. Principles of Geophysical Information Systems – P. A. Burragh and R. A. Mc Donnell [Oxford Publishers 2004.]

Course outcomes:

On completion of the course, the students will be able to:

- demonstrate the concepts of Electro Magnetic energy, spectrum and spectral signature curves
- apply the concepts of satellite and sensor parameters and characteristics of different platforms
- apply the concepts of DBMS in GIS analyze raster and vector data and modelling in GIS
- apply GIS in land use, disaster management, ITS and resource information system

CE 15053: WATER POWER ENGG (3-1-0) CR-04

Course Objectives:

To estimate the available hydropower

To understand types of hydro-power stations

To understand the components and functions of hydro-power system

To expose to the types of hydro-power system

To study the different types of loads on power plants

Course Contents:

Module-I **(10 Hours)**

Instruction: Sources of Energy, Status of hydro power in the World. Transmission Voltages and Hydro-power, estimation of water power potential, General load curve, load factor, capacity factor, utilization factor, diversity factor, load duration curve, firm power, secondary power, prediction of load.

Classification of Hydel Plants: Run off river plants, general arrangement of run off river plants, valley dam plants, diversion canal plants, high head diversion plants storage and pondage, Pumped storage plants: Types of Pumped storage plants, relative merits of two unit and three unit arrangement. Three unit arrangement, reversible pump turbines, problems of operation, power house, efficiency of P-S plants.

Module-II **(10 Hours)**

Water Conveyance: Classification of penstocks, design criteria for penstocks, economical diameter of penstock, anchor blocks, conduit valves, types of valves, bends and manifolds, illustrative, water hammer, resonance in penstocks, channel surges, surge tanks. Intakes: Types of intakes, losses of intakes, air entrainment at intakes, inlet aeration, canals fore bay, tunnels.

Module-III **(10 Hours)**

Power House Planning: Surface power stations: power house structure, power house dimensions, lighting and ventilation, variations in design of power house.

Module-IV **(10 Hours)**

Underground power station: Location of U.G. power station, Types of U.G. power stations, advantages of U.G. power house, components of U.G. power house, types of layout, limitations of U.G. power house structural design of power house.

Tidal power: Basic principle, location of tidal power plant, difficulties in tidal power generation, components of tidal power plants, modes of generation, single basin arrangement, double basin system.

Text Book:

1. Water Power Engineering by M.M. Dandekar and K.N. Sharma, Vani Educational Books

References:

1. Irrigation and water resources Engg. By G.L. Asawa, New Age international Publishers.
2. Irrigation and water power Engineering by B.C. Punamia, Pande B.B. Lal, Laxmi Publications Private Limited

Course outcomes:

On completion of the course, the students will be able to:

- estimate the available hydropower in a project
- select suitable types of hydro-power system
- design penstock and anchor blocks analyze the different types of loads on power plants
- design the components of Tidal power plant

CE 15054: GREEN BUILDINGS (3-1-0) CR-04

Course Objectives:

Familiarize students with green principles and choices in home design and construction.

Raise awareness of innovative materials, systems, and construction methods.

Learn about energy-efficient systems including onsite power generation.

Distinguish levels and cost-benefits of retrofitting, remodeling, or renovating existing homes.

Course Contents:

MODULE - I Green Building Process and Ecological Design (10Hours)

Fundamental Principles of Green Building, Introduction to high-performance green buildings, Conventional versus green building delivery systems - Design and construction relationships - Green building project execution - the integrated design process - green building documentation requirements - design versus ecological design - historical perspective - contemporary ecological design - future ecological design - green design to regenerative design.

MODULE - II Green Building Systems (9 Hours)

Sustainable sites Design and landscaping – enhancing ecosystems - building envelop – selection of green materials - products and practices - passive design strategy – internal load reduction – indoor environment quality strategies - Building energy system strategies – Water cycle strategies- building water and waste management – relevance to LEED / IGBC standards.

MODULE - III Green Building Implementation (9 Hours)

Site protection planning - health and safety planning - construction and demolition waste management - reducing the footprint of construction operations - maximizing the value of building commissioning in HVAC System, lighting and non mechanical Systems - costs and benefits relevance to LEED / IGBC standards.

MODULE - IV Assessment and Economics (15 Hours)

Methods and tools for building assessment- USGBC LEED building assessment standard - LEED certification process – Green Globes building assessment protocol- international building assessment systems - LEED-NC Platinum / gold / silver building case studies – trends in building rating systems – IGBC standards – ECBC compliances. Florida Green Building Coalition. Future directions in green high performance building technologies-Carbon accounting-Green Building specifications.

Business case for high-performance green buildings - the economics of green building - benefits - managing initial costs - cost barrier in project management – long term environment benefits.

TEXT BOOKS:

1. Jerry Yudelson, Green building A to Z, Understanding the buildings, 2008.

2. Green building guidelines: Meeting the demand for low-energy, resource efficient homes. Washington, D.C.: Sustainable Buildings Industry Council, 2004.

REFERENCES:

1. Jerry Yudelson, Green Building through Integrated Design, McGraw Hill, 2008 2. Alex Wilson and Mark Peipkorn., Green Building Products: the GreenSpec guide to residential building materials, 2nd Edition, Gabriola Island, BC:

3. Jane Anderson, David E. Shiers, and Mike Sinclair. The green guide to specification: an environmental profiling system for building materials and components, 3rd Edition, Oxford; Malden, MA: Blackwell Science, 2002. 4. Charles J. Kibert, Sustainable Construction: Green Building Design and Delivery, 2nd Edition, Wiley, 2007.

5. ECBC 2007 Manual, Bureau of Energy Efficiency, New Delhi

Course Outcomes:

Ability to understand the principles and choices in home design and construction.

Ability to know innovative materials, systems, and construction methods.

Ability to learn about energy-efficient systems including onsite power generation.

Ability to distinguish cost-benefits of retrofitting, remodeling, or renovating existing homes

CE 15055: WASTE MANAGEMENT (3-1-0) CR-04

Course objectives:

- Study the basic characteristics of industrial waste water
- Understand the environmental impacts caused by the industrial effluents
- Learn about different treatmentprocesses of industrial wastewater
- Review the sources and control of indoor air pollution
- Address the simple air quality models
- To have adequate knowledge onadvanced waste water treatment processes.
- To Study various Industrial manufacturing processes and understand their waste treatment requirements and air quality management

Course Contents:

Module - I (10 Hours)

Solid waste – sources and engineering classificatio n, characterization, generation and quantification.

Transport - collection systems, collection equipment, transfer stations, collection route optimization.

Treatment methods - various methods of refuse processing, recovery, recycle and reuse, composting – aerobic and anaerobic, incineration, pyrolysis an d energy recovery,

Disposal methods – Impacts of open dumping, site se lection, sanitary land filling – design criteria and design examples, leachate and gas collection systems, leachate treatment.

Module - II **(10 Hours)**

Hazardous Waste Management- Introduction, Sources, Classification, Physico-chemical, Chemical and Biological Treatment of hazardous waste, regulations.

Thermal treatment - Incineration and pyrolysis.

Module - III **(10 Hours)**

Biomedical Waste management - Definition, sources, classification, collection, segregation Treatment and disposal.

Radioactive waste management - Definition, Sources, Low level and high level radioactive wastes and their management, Radiation standard by ICRP and AERB

Module - IV **(10 Hours)**

E- waste management: Waste characteristics, generation, collection, transport and disposal

Soil contamination and site remediation – bioremedi ation processes, monitoring of disposal sites.

Text Book:

1. Tchobanoglous G., Theissen H., and ElIassen R.(1991), "Solid Waste Engineering - Principles and Management Issues", McGraw Hill, New York.

References:

1. Pavoni J.L(1973)., "Handbook of Solid Waste Disposa l".
2. Peavy, Rowe and Tchobanoglous (1985), "Environmenta l Engineering", McGraw Hill Co. 4th Edition
3. Mantell C.L., (1975), "Solid Waste Management", Joh n Wiley.
4. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental
5. Engineering Organisation, Government of India, New Delhi, 2000.
6. WHO Manual on Solid Waste Management.
7. Vesiland A.(2002), "Solid Waste Engineering", Thomp son Books.
8. Hazardous waste (management and handling) rules, 2001
9. Biomedical (Handling and Management) Rules 2008

Course outcome:

- Understand the characteristics and environmental impacts of industrial wastewater.
- Determine appropriate strategies for treatment and management of industrial pollutants.
- Understand indoor air pollution and be aware of the control technologies.
- Predict the quality of water and air through modelling.
- Apply the concepts ofadvanced waste water treatment processes.
- Study and obtain the flow sheets for waste treatment in various Industrial manufacturing processes.
- Determine appropriate strategies for air quality management in the industries

CE 15056: PAVEMENT DESIGN (3-1-0) CR-04

Course Objectives:

1. To understand principles of pavement design.

2. To learn methods for flexible pavement design.

3. To learn methods for rigid pavement design

Course Contents:

Module I: (10 Hours)

Classification of pavements: Difference between Highway and Airport pavements, Geometric and structural design requirements of pavements. Factors affecting pavement – design principles and criteria for design of flexible pavements. Wheel loads on Pavements: Different configurations, contact area, equivalent single wheel load (ESWL) and equivalent wheel load (EWL)

Module II (10 Hours)

Design methods for flexible pavements: Main aspects of group index, North Dakota. Kansas, U.S.Navy/C.B.R. Highway methods, Design of flexible pavements and IRC, CBR design curves, Burmister's layer theory and its application in flexible pavement design.

Module III (10 Hours)

Rigid Pavements: Critical loading regions, Formulas for corner stresses by Older, Picket and others-Westergard's theory for stresses in concrete pavements for corner, Edge and interior loadings.

Module IV (10 Hours)

Temperature stresses in rigid pavements, Westergard, Bradbury and concepts.

Text Book

1. Principles of Pavement Design, Yoder.J. & Witzorac Mathew, W. John Wiley & Sons Inc
2. Pavement Analysis & Design, Yang H. Huang, Prentice Hall Inc.

Reference Book

1. Design of Functional Pavements, Nai C. Yang, McGraw Hill Publications
2. Concrete Pavements, AF Stock, Elsevier, Applied Science Publishers
3. Pavement and Surfacing for Highway & Airports, Micheal Sargious, Applied Science Publishers Limited.
4. IRC:37-2012 & IRC :58- 2011 Codes for Flexible and Rigid Pavements Design.

Course Outcomes:

1. Ability to design flexible pavement by various methods.

2. Ability to design rigid pavement by various methods.

CE 15057: ROCK MECH AND TUNNEL ENGG (3-1-0) CR-04

Course Objectives:

To provide basic knowledge of Rock Mechanics.

To understand the design aspects of various structures in/on rock like tunnels and other underground openings, slopes etc.

To provide a comprehensive understanding to determine physico-mechanical properties of intact rock and rock mass, rock discontinuities, stresses and deformations around the excavation, in-situ stresses and failure mechanisms in rocks.

Course Contents:

Module-1 **(10 Hours)**

Rock formation and weathering, rock masses, in situ stresses and groundwater, applied mechanics, Properties of rock material, strength and failure criteria, anisotropy, dynamic strength, rock material testing Characteristic and strength of rock joints, flow in joints, coupled properties, joint testing Rock mass classifications, field tests and characterizations, projection method.

Module-2 **(10 Hours)**

Rock mass strength criteria, rock mass modulus, Estimation of foundation bearing capacity, rock slope stability, rock slope rating RSR, slope reinforcement. Simple engineering applications in rock mechanics, underground openings, rock slopes, foundations, mining subsidence – case studies, Rock bolt systems- installation techniques, testing of rock bolts, choice of rock bolts.

Module-III **(10 Hours)**

Tunnel Engineering: Necessity, planning of tunnels, site investigation for tunnels, types of tunnels, tunnel alignment and grade, size and shape of a tunnel, Rock and soil mechanics applied to tunnelling, tunnelling construction methods and technology Stress around opening and ground response, convergence-confinement method, ground-support interaction Tunnel failure and support mechanisms, observational based support method Tunnel support design using rock mass classification systems

Module-IV **(10 Hours)**

Method of constructions, methods of tunneling in hard rocks - full face method - heading and bench method - drift method - different methods of tunneling in soft soils including compressed air and shield tunneling - shafts in tunnels - ventilation of tunnel and various methods - lining of tunnels - drainage and lighting of tunnels, problems in tunnel constructions, boom tunnelling machines, full face tunnel boring machines; support of tunnels; adverse ground conditions; ground treatment and hazards in tunnelling.

Text Book

1. Godman, P.E."Introduction to Rock Mechanics", John Wiley, New York,1989.

2. Jager, G. "Rock Mechanics and Engineering", Camb ridge University Press, 1972.

Reference

1. Stillborg, B. "Professional user handbook for ra cok bolting", Tran Tech publications, 1986.
2. Hock, E. and Brown, E.T. "Underground excavation in rock", Institute of Mining and Metallurgy,1980.
3. Hock, E. and Bray, J. "Rock slope Engineering", Institute of Mining and Metallurgy,1981.
4. Bickel, J.O., T.R. Kuesel, and E.H. King, "Tunne l Engineering Handbook", Chapman & Hall/ITP Publishing Company, 1996, 544 pp.
5. Parker, A. D."Planning and Estimating Undergroun d Construction", McGrawHill, 1970.

Course Outcomes:

Ability to understand the design aspects of various structures in/on rock like tunnels and other underground openings, slopes etc.

Ability to determine physico-mechanical properties of intact rock and rock mass, rock discontinuities, stresses and deformations around the excavation, in-situ stresses and failure mechanisms in rocks

CE 15058: MACHINE FOUNDATION (3-1-0) CR-04

Course Objectives:

- To familiarize students with the dynamic properties of soil.
- To create an understanding about the importance of designing machine foundation.

Module I **(10 Hours)**

General Theory: Resonance and its effect; Theory of single-degree,two degree and multiple-degree of freedom system; Transient Response.

Module II **(10 Hours)**

Evaluation of Design Parameters: Importance of design parameters; Geometric properties of machine foundations; Physical properties of the elastic base and their experimental evaluation

Module III **(10 Hours)**

Analysis and Design of Block Type Machine Foundation: Mode of vibration of a block foundation; Methods for dynamic analysis; Foundation for machines inducing periodical and impact-type forces.

Module IV **(10 Hours)**

Vibration Isolation: Active and passive type isolation; Methods of isolation in machine foundation; Isolation in existing machine foundation.

Text book

1. Shamsher Prakash, “Soil Dynamics”, McGraw-Hill Book Company.
2. Braja M. Das, “Principles of Soil Dynamics”, PWS- KENT Publishing Company.

References

1.Steven L. Kramer, “Geotechnical Earthquake Engine ering”, Prentice Hall Inc.

2. D. D. Barkan, “Dynamics of Bases and Foundations ”, McGraw-Hill Book Company.

3. E. E. Richart et al. “Vibrations of Soils and Found ations”, Prentice Hall Inc.
4. Tien Hsing Wu, “Soil Dynamics”, Allyn and Bacon Inc .

Course Outcome:

CO1: Ability to analyse ground vibration
CO2: Ability design foundations forvibratingmachinary
CO3: Ability to design vibration isolation system

CE 15059: SOIL DYNAMICS & EARTHQUAKE ENGINEERING (3-1-0) CR-04

Course Objectives:

To analyse the types of dynamic loading system.

To study the seismograph and its characteristics.

To study various dynamic soil properties and their measurements.

To design the earthquake resistance foundation

To analyse retaining walls subject to earthquake.

Course Contents:

Module-I **(10 Hours)**

Introduction: Dynamic loading and dynamics of vibrations, Earthquake records, Earthquake records of India,

Seismology: Plate tectonics, Causes of Earthquake, seismic waves, faults, earthquakes magnitude and intensity, seismographs, locating the epicenter of an earthquake

Module-II **(10 Hours)**

Seismic hazards in India: Earthquake hazards in India, Earthquake records in north-eastern region, Earthquake hazard zoning, risk evaluation and mitigation, awareness campaign.

Dynamic soil properties: Introduction, soil properties for dynamic loading, measuring dynamic soil properties.

Module-III **(10 Hours)**

Seismicity: site seismicity, seismic soil response and design earthquake. Liquefaction: introduction, factors affecting liquefaction, liquefaction analysis, anti-liquefaction measures.

Module-IV **(10 Hours)**

Earthquake resistant design of shallow and deep foundations.Analysis of retaining walls and slope stability for earthquakes.

Text book

1. Fundamentals of Soil Dynamics & Earthquake Engineering by B.B. Prasad, PHI Learning Pvt. Ltd
2. Basic Geotechnical Earthquake Engineering: Kamalesh Kumar, New Age International Publishing

Reference Books:

1. Geotechnical Earthquake Engineering: S. L. Kramer, Prentice Hall International Publishing
2. Geotechnical Earthquake Engineering Hand Book: R. W. Day, © 2002 McGraw-Hill

Course Outcomes:

Ability to characterize various dynamic loading

Ability to study seismograph data and analysis

Ability to design earthquake resistance foundation.

Ability to design earthquake resistance retaining wall.

CE 15060: ADVANCED STRUCTURAL ANALYSIS (3-1-0) CR-04

Course Objectives:

To develop an understanding of structural analysis theory necessary to be a judicious and effective user of computer analysis.

To obtain some experience in the use of modern structural analysis programs.

To write a computer program for the structural analysis of two-dimensional frames.

Course Contents:

Module I **(10 Hours)**

Matrix methods of structural analysis: Introduction, equilibrium, static and kinematic indeterminacy, kinematics, virtual work, concepts of stiffness and flexibility, analysis by displacement and force methods.

Module II **(10 Hours)**

Application of flexibility method to beams and plane trusses

Module III **(10 Hours)**

Application of stiffness method to beams, plane frames and plane trusses.

Module IV **(10 Hours)**

Application of stiffness method to space truss, space frames and grids, basic concepts associated with computer implementation of stiffness method. Substructure Analysis.

Text Book:

1. G. Pandit & S. Gupta, "Structural Analysis, A Matrix Approach", Tata McGrawhill, New Delhi

References:

2. H.C.Martin," Introduction to Matrix Methods of Structural Analysis.
3. M.B.Kanchi, "Matrix Methods of Structural Analysis", New Age International Publishers, New Delhi
4. Bhavikatti, "Matrix Methods of Structural Analysis", IK International Pvt Ltd

Course Outcomes:

Ability to analyze and evaluate systems in structural engineering using force and displacement methods.

Perform analysis of various structures

Ability to carry out stability analysis of various structural systems.

Ability to write computer program for the structural analysis of two-dimensional frames.

CE 15061: RIVER ENGINEERING (3-1-0) CR-04

Course Objectives:

Introduction to flow pattern in river

Computation of sediment load and analysis of sediment properties

To compute resistance to flow, river turbulence, mechanics of the entrainment, transportation and deposition of solids by fluids, threshold movement

To analyze regime theories, bed forms, suspended load, bed load and total load equations, stable channel design and regime rivers.

To know about river training works.

To learn river flow modelling.

To analyze social and environmental impacts.

Course Contents:

Module-I **(10 Hours)**

Introduction to fluvial system and overview of river morphology: regime concept, longitudinal stream profile, river classifications, thresholds in river morphology, hydraulic geometry, geomorphic analysis of river channel responses, Hydraulics of flow in river channels.

Module-II **(10 Hours)**

Alluvial bed forms and flow resistance, Bed forms, prediction of bed form, critical shear, Shields diagram, Sediment transport, Physical properties of sediment, sediment movement in rivers: bed-load formulas, turbulent diffusion and diffusion equation, suspended-sediment discharge.

Module-III **(10 Hours)**

Meander plan form, Flow in curved river channels; basic equations, transverse velocity profiles for fully developed flow, transverse bed slope and grain size distribution, energy expenditure in curved open channels, transverse flow and cross-stream flow, plan geometry and processes of river meanders.

Module-IV **(10 Hours)**

Analytical basis for hydraulic geometry, analytical river morphology, Design of stable alluvial channel, scour criteria, local scour around bridge piers and around embankments, analytical basis of the fluvial model. River protection works.

Text Book

Fluvial Processes in River Engineering , Chang, Howard H., John Wiley & sons

Reference Book

Petersen, M.S., River Engineering, Prentice-Hall, Englewood Cliffs, New Jersey

Jogelkar D.V., Manual on River Behaviour Control and Training, "Publication No. 60, Central Board of Irrigation and Power, New Delhi, India

Course outcomes:

To understand various elements of river morphology

Ability to analyse flow reststance sediment movement in rivers

Ability to analyse meandering rivers

CE 15062: COMPUTATIONAL HYDRAULICS (3-1-0) CR-04

Course Objectives:

To introduce basic computer programming with MATLAB

To model different types of open channel flow using HEC-RAS

To introduce EPANET/WaterCAD for pipe network analysis

To use analytical methods for solving PDEs

To use different algorithms like SIMPLE and SOLA, introduction to FEM

Course Contents:

Module-I **(10 Hours)**

Ordinary and Partial differential equations, well-posed, ill-posed problem, Finite difference schemes, Stencil diagrams, basic aspect of discretization, truncation error, implicit and explicit types, accuracy, convergence, errors and stability analysis,

Module-II **(10 Hours)**

Von Neumann method, CFL condition, some hydrodynamic techniques – Lax-Wendroff, MacCormack, Crank-Nicolson, staggered grid, ADI, ADE, pressure correction,

Module-III **(10 Hours)**

SIMPLE and SOLA algorithm, method of characteristics, finite element method. Variational and weighted residual formulations,

Module-IV **(10 Hours)**

Applications to steady and unsteady flows, Pollutant dispersion, flood wave propagation, tidal model, applications with computer programming, etc.

Text Book

1. Computational Fluid Dynamics: John D. Anderson, Jr.

References:

1. Computational Fluid Dynamics: T. J. Chung
2. Computational Fluid Mechanics and Heat Transfer: Series in Computational and Physical Processes in Mechanics and Thermal Sciences: John C. Tannehill, Dale A. Anderson and Richard H. Pletcher
3. Computational Methods in Surface/Subsurface Flow & Transport Problems: Computational Methods in Water Resources XI, Volume 1 & 2 : A.A. Aldama and J.Aparicio
4. Computational Methods in Subsurface Flow & Transport Problems: Computational Methods in Water Resources XI, Volume 2: A.A. Aldama and J. Aparicio
5. Computational Fluid Dynamics: Principles and Applications: J.Blazek

Course outcomes:

- CO1: Ability to formulate ordinary and partial differential equations
- CO2: Ability to apply numerical procedures to solve ODE and PDE

CE 15063: WATER RESOURCES PLANNING & MANAGEMENT (3-1-0) CR-04

Module I **(10 Hours)**

Introduction, Role of water in national development, assessment of water resources of country, scope of water resources development in context of environment

Module II **(10 Hours)**

Water resources planning process, planning for single purpose and multipurpose projects, estimation of different water needs and project formulations, comparison of alternatives, cost-benefit analysis. Introduction to optimization techniques and systems approach.

Module III **(10 Hours)**

Evaluation and monitoring of water quantity and quality, managing water distribution networks for irrigation, flood control and power generation, inter-basin transfer of water.

Module IV **(10 Hours)**

Conjuctive use of surface and groundwater, water quantity and quality modeling, evaluation of impacts of water resources projects on river regimes and environment, reservoir sedimentation and watershed management.

TEXT BOOKS:

1. Water Resources System Analysis – Vedula & Mujum dar – Tata Mc.Graw Hill Company Ltd.

REFERENCES:

1. Optimal design of water distribution networks P.R.Bhave, Narosa Publishing House.

CE 15064: OPEN CHANNEL FLOW (3-1-0) CR-04

Course Objectives:

To know how to estimate normal and critical depth

To compute water surface profile (WSP) - gradually varied flow estimation using standard step and direct step methods

WSP in presence of hydraulic structures

Unsteady flow- Saint-Venant equation, kinematic wave routing, diffusion routing, overland flow.

Course Contents:

Module I **(10 Hours)**

Basic Fluid flow concepts: Classification of open channels, classification of flow, basic equations, velocity distribution, pressure distribution, energy and momentum coefficients.

Uniform flow in rigid boundary channels: Shear stress on the boundary, flow over scattered roughness elements, Chezy's equation, Manning's equ ation, effect of channel shape on resistance equation, section factor curves for rectangular and trapezoidal channels, flow in a circular channel, relation between conveyance and depth, channels of efficient cross-section.

Module II **(10 Hours)**

Uniform flow in mobile boundary channels: Incipient motion condition, regimes of flow, resistance to flow in alluvial streams.

Design of channels: Rigid boundary channels, non-scouring erodible boundary channels, alluvial channels, Shield's diagram and its application

Specific energy, specific force, critical depth computations, control section, application of specific energy in channel transition

Module III **(10 Hours)**

Gradually varied flow: Types of non uniform flow, governing equations, characteristics of surface curves, classification of water surface profiles, sketching of water surface profiles, discharge from reservoir, profiles in compound channels, computation of gradually varied flow in prismatic channels, gradually varied flow in non prismatic channels, critical slope, limit slope

Module IV **(10 Hours)**

Rapidly varied flow: Application of conservation laws, channel transitions, supercritical flow past weirs, spillways, hydraulic jumps

Unsteady flow: Waves and their classification, celerity of a wave, surges, equation of motion, method of characteristics, dam break problem.

Text Books

1. Flow in open channels - K. Subramanya

Reference Books

1. Open Channel Hydraulics - V. T. Chow
2. Flow through open channels - K. G. Ranga Raju
3. Open channel flow - M. Hanif Chaudhry

Course outcomes:

Ability to Analyze uniform flow calculations in open channels
Ability to solve problems on dynamics of gradually and spatially varied flow
Ability to Analyze rapidly varied flow calculations in open channels
Ability to determine the parameters of unsteady flow

CE 15065: WATERSHED MANAGEMENT (3-1-0) CR-04

Course Objectives:

To learn how to analyse and comprehend basic principle of water resources and its planning and management,

To visualise systematic process on environmentally water resource management and sustainable water resource development.

To launch the skilful techniques on application of IT for water resource planning and management

Course Contents:

Module I **(10 Hours)**

Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making. Sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, Soil erosion and conservation;

Watershed Management Practices in Arid and Semiarid Regions, Case studies, short term and long term strategic planning.

Module II **(10 Hours)**

Introduction to integrated approach, Integrated water resources management, conjunctive use of water resources, rainwater harvesting; roof catchment system. Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall runoff process, subsurface flows and groundwater flow.

Module III **(10 Hours)**

Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies. Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management. Water quality and pollution, types and Sources of pollution, water quality modeling, environmental guidelines for water quality.

Module IV **(10 Hours)**

Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage. Drought assessment and classification, drought analysis techniques, drought mitigation planning. Perspective on recycle and reuse, Waste water reclamation.

Text Book

Murty, J.V.S. “Watershed Management”, New Age Intl, New Delhi 1998.

REFERENCES

American Socy. of Civil Engr., Watershed Management, American Soc. of Civil Engineers, New York, 1975.

Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994.

Purandare, A.P., Jaiswal A.K., Waterhed Development in India, NIRD, Hyderabad, 1995.

Vir Singh, Raj, Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.

Course Outcomes:

Understanding of the processes in hydrologic cycle that includes measurement, computation, estimation and determination in each area.

Water resources problems, the conception, planning and design of functional elements and facilities to control and utilize water, basic to all water management.

CE 15066: NUMERICAL METHODS IN ENGINEERING (3-1-0) CR-04

Course Objectives:

Computer- oriented methods for solving numerical problems in science and engineering;

Numerical solutions to systems of simultaneous linear equations, nonlinear algebraic equations (root solving), differentiation and integration, ordinary differential equations, interpolation, and curve fitting

Course Contents:

Module 1 **(10 Hours)**

Introduction to digital computers and programming-an overview, Errors-polynomial approximation ,interpolation: finite differences, Newton's formula for interpolation ,central difference interpolation formulae, interpolation with unevenly spaced points, divided difference and their properties, inverse interpolation and double interpolation

Numerical differentiation: errors in numerical differentiation, differentiation formula with function values.

Numerical integration: Trapezoidal rule, Simpson's 1/3rd & 3/8th rule, Romberg integration, newton cote's integration formula, Euler-maclaurin formula, Gaussian integration, numerical double integration

Module 2 **(10 Hours)**

Solution of linear system - Gaussian elimination and Gauss-Jordan methods, necessity for pivoting, LU decomposition methods, Jacobi and Gauss-Seidel iterative methods sufficient conditions for convergence, Power method to find the dominant Eigen value and eigenvector Diagonal dominance, condition number, ill conditioned matrices, singularity and singular value decomposition. Banded matrices, storage schemes for banded matrices, skyline solver.

Solution of nonlinear equation - Bisection method - Secant method - Regula falsi method - Newton-Raphson method

Module 3 **(10 Hours)**

Approximate solution technique, static condensation, Rayleigh-Ritz method, subspace iteration, Application of finite difference method, solution of equilibrium equations in dynamics, direct method, central difference method, Houbolts method, Wilson θ method, Newmarks method

Module 4 **(10 Hours)**

Numerical Solution of Ordinary Differential Equations- Euler's method - Euler's modified method Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations - Multistep methods - Milne's and Adams' methods

Text Book

Numerical methods for Scientists and Engineers by M.K. Jain, S.R. Iyengar & R.K. Jain, Wiley Eastern Ltd.

Numerical methods in engineering and science, Grewal, B.S., Khanna Publishers, Delhi.

Reference Books

Mathematical Numerical Analyis by S.C. Scarborough, Oxford and IBH Publishing Company. Introductory methods in Numerical Analysis by S.S. Sastry, Prentice Hall of India.

Theory and problems in Numerical Methods by T. Veeranjan and T. Ramachandran, Tata McGraw-Hill Publishing Company, New Delhi-2004.

Numerical Methods for Mathematics Sciences and Engineering 2nd ed. By John H. Mathews, Prentice Hall of India, New Delhi 2003.

Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyengar, Narosa-200 &

Computational engineering: introduction to numerical methods, Schafer, Michael, Springer Verlag, Berlin,

Numerical Methods in Science & Engg., Rajasekaran, S Chand Publication, 1983

Course Outcomes:

1. Be aware of the use of numerical methods in modern scientific computing,
2. Be familiar with finite precision computation,
3. Be familiar with numerical solutions of nonlinear equations in a single variable,
4. Be familiar with numerical interpolation and approximation of functions,
5. Be familiar with numerical integration and differentiation
6. Be familiar with numerical solution of ordinary differential equations
7. Be familiar with calculation and interpretation of errors in numerical methods,

CE 15067: PROJECT MANAGEMENT (3-1-0) CR-04

Course Objectives:

Understand and articulate the importance of Project Management in any business project.
Clearly define project objectives.
Create a project Work Breakdown Structure.
Develop a manageable project schedule.
Understand scope creep and change control.
Use tools and techniques to manage a project during execution.

Course Contents:

Module-I **(10 Hours)**

Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization. Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management.

Module-II **(10 Hours)**

Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks. Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource Constraints: Resource Leveling and Resource Allocation.

Specific methodologies for planning: Critical Path Method (CPM); Precedence Diagramming Method (PDM); Program Evaluation and Review Technique (PERT); Graphical Evaluation and Review Technique (GERT); Queue - Graphical Evaluation and Review Technique (GERT); Simulation Language for Alternative Modelling (SLAM); Dynamic Planning and Control Methodology (DPM); Critical Chain Planning; Resource Loading.

Module-III **(10 Hours)**

Time Cost Tradeoff: Crashing Heuristic. Project Implementation: Project Monitoring and Control with PERT/Cost, Contract Management, Project Procurement Management; Post Project Analysis. life-cycle and post-mortem analysis.

Module-IV **(10 Hours)**

Computers applications in Project Management, Such as Microsoft® Project, Primavera Project Planner®, Primavera® Monte Carlo, Crystal Ball® and Pro Chain are available to the project manager for deterministic and probabilistic planning. In this course we will use the following: Primavera® P3 — for deterministic time and resource scheduling; Primavera® Monte Carlo — for probabilistic time and resource scheduling; Primavera® Expedition — for documenting multiple and complex projects; Pro Chain® — for scheduling with the critical chain method; Crystal Ball® — for risk analysis; Vensim® — for system dynamics analys is

Text Book

1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, PH Inc.
2. Lock, Gower, Project Management Handbook.

References:

1. Cleland and King, VNR Project Management Handbook.
2. Wiest and Levy, Management guide to PERT/CPM, PHI.
3. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
4. S. Choudhury, Project Scheduling and Monitoring in Practice.
5. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd.

Course Outcomes:
At the end of the course the students will be skilled in expediting projects by prudently crashing certain activities, conducting Risk analysis, Resource allocation, use MS Project® and Critical Chains; Six Sigma case application.

CE 15068: FINITE ELEMENT METHOD (3-1-0) CR-04

Course objectives:

To study the strain –displacement and linear constitutive relation

To understand the numerical techniques applied in FEM

Establishment of element stiffness and load vector

To study about the 2-D isoparametric concepts

To analyze the 2-D frame elements using FEM techniques

Course Content

Module – I **(7 Hours)**

Introduction: The Continuum, Equations of Equilibrium, Boundary Conditions, Strain displacement relations, Stress strain Relations, Plane stress and plane Strain problems, Different methods of structural analysis including numerical methods. Basics of finite element method (FEM), different steps involved in FEM, Different approaches of FEM, Direct method, Energy approach, Weighted residual Method.

Module – II **(17 Hours)**

One and Two Dimensional Problems: Detail formulation including shape functions. stress strain relations, strain displacement relations and derivation of stiffness matrices using energy approach, Assembling of element matrices, application of displacement boundary conditions, Numerical solution of one dimensional problems using bar, truss, beam elements and frames. Derivation of shape function using Lagrange's interpolation, Pascal's triangle, Convergence criteria. Finite Element modeling of two dimensional problems using Constant strain Triangle(CST) elements, Stress strain relations for isotropic and orthotropic materials, Four nodded rectangular elements, axisymmetric solids subjected to axisymmetric loading.

Isoparametric Elements: Natural coordinates, isoparametric elements, four node, eight node elements. Numerical integration, order of integration.

Module – III **(8 Hours)**

Plate Bending: Bending of plates, rectangular elements, triangular elements and quadrilateral elements, Concept of 3D modeling.

Module – IV **(8 Hours)**

Dynamic Considerations: General Equation of motion, Lagrange's approach, mass matrix, lumped and consistent mass matrices, Evaluation of eigenvalue and eigenvectors, stability problems.

Text Book

1. R. D. Cook., Concepts and Applications of Finite Element Analysis , Wiley.
2. C. S. Krishnamoorthy, Finite Element analysis-Theory and Programming, Tata Mc Hill.

Reference

1. Logan, D. L., A First Course in the Finite Element Method, PWS Publishing, Boston,

2. O. C Zienkiewicz .and R. L. Taylor, Finite Element Method, Mc Graw Hill

Course outcomes:

Ability to explain the concept of finite element methods

Ability to identify element properties and Isoparametric elements

Ability to determine internal stresses in simple beam by direct stiffness method

Ability to determine internal stresses in plate bending problems

CE 15069: THEORY OF ELASTICITY & PLASTICITY (3-1-0) CR-04

Course Objectives:

Theory of pure bending of plates

Theory of circular and rectangular plate problems and solutions

Membrane theory of shells

Theory of cylindrical shells

Course Content:

Module- I **(12 Hours)**

Plane stress and plane strain problems. General stress and strain equations (Equilibrium and compatibility equations).Two dimensional problems in rectangular coordinates.

Stress and strain components, differential equation, equilibrium equations and compatibility equations in polar coordinate. Stress distribution for axisymmetric problems. Pure bending of curved bars, thick walled cylinder. Concentrated force at a point of straight boundary. Force acting on the end of a wedge. Concentrated force acting on a beam. Effect of circular holes on stress distributions in plates.

Module- II **(9 Hours)**

Stress and strain in three dimensions: Principles stresses, maximum shearing stress, principal axes of strain. Stretching of prismatical bar by its own axis. Elementary problems of elasticity in three dimension.

Module- III **(9 Hours)**

Torsion of non-circular prismatic bars. Saint Venant's theory. Various analogies. Torsion of hollow and thin section. Application of energy methods.

Module- IV **(10 Hours)**

Introduction to the theory of plasticity., the yield criteria of metals, stress space representation of yield criteria. stress-strain relations plastic potential, flow rules and maximum work hypothesis. Two dimensional plastic flow problems. Incompressible two dimensional flow, stresses in plastic materials in condition of plane strain, equation of equilibrium the simplest slip-line fields.

Text Book

1. S P Timoshenko and J N Goodier, Theory of Elasticity, Mc Graw Hill
2. Hoffman and Sachs, Theory of plasticity

Reference

1. N.Filonenko-Borodich, Theory of Elasticity, Mir Publishers,Moscow,1965
2. W. Johnson and P B Meller, Plasticity of Mechanical Engineers
3. C.R. Calladine, 'Plasticity for Engineers', Ellis Herwood, Chichester, U.K., 1985

Course Outcomes: At the end of the course, the student will be able to:

Apply theory of plates and formulate symmetrical bending problems

Apply theory of plates and formulate circular and rectangular plate problems

Apply membrane theory of shells and formulate spherical and conical shell problems

Apply theory of shells and formulate cylindrical shell problems

CE 15070: TRAFFIC ENGG & MANAGEMENT (3-1-0) CR-04

Course Objectives:

1. To learn traffic studies, their analysis and their interpretation.
2. To learn analysis of LOS.
3. To learn design of signal.
4. To learn transportation system management.

Course Contents:

Module I: **(15 Hours)**

Traffic Studies: Basic characteristics of Traffic, Volume, Speed and Density; Definitions and their interrelationships; Traffic Volume studies - Objectives, Methods of Volume counts, Presentation of Volume Data; Speed studies- Types of Speeds, Objectives, Methods of speed studies, Statistical Methods for speed data Analysis, Presentation of speed data. Delay Studies; Head ways and Gap Studies - Headway and Gap acceptance, Origin and Destination Studies.

Parking Studies: parameters of parking, definitions, Parking inventory study, Parking survey by Patrolling method; Analysis of Parking Survey data; Accident studies- Causative factors of Road accidents, Accident data collection: Accident analysis and modeling; Road Safety Auditing, Measures to increase Road safety.

Module II: **(10 Hours)**

Capacity and LOS Analysis: Introduction to Traffic capacity. Analysis, Concepts of Level of Service, Basic definitions, Factors affecting Capacity and LOS, Capacity of Urban/Rural Highway, With or without access control, Basic freeway segments - Service flow rate of LOS, Lane width or Lateral clearance adjustment; Heavy vehicle adjustment; Driver population adjustment.

Module III: **(8 Hours)**

Signal Designing – Fixed Time signals, Determination of Optimum Cycle length and Signal setting for Fixed Time signals, Warrants for Signals, Time Plan Design for Pre-Timed Control- Lane group analysis, Saturation flow rate, and Adjustment factors, Uniform and Incremental Delay, Vehicle Actuated Signals, Signal Coordination.

Module IV: **(7 Hours)**

Transportation System Management - Measures for Improving vehicular flow – one way Streets, Signal Improvement, Transit Stop Relocation, Parking Management, Reversible lanes- Reducing Peak Period Traffic - Strategies for working hours, Congestion Pricing, Differential Toll Policies**.**

Text Book

1. Transportation Engineering - An Introduction - C.Jotin Khisty, Prentice Hall Publication

2. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers

Reference Book

1. Traffic Engineering - Theory & Practice - Louis J.Pignataro, Prentice Hall Publication.

2. Traffic Engineering by Roger P.Roess, William R. Mc. Shane, Elena S.Prassas , Prentice Hall,1977.

3. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India

4. Fundamentals of Traffic Engineering – McShane & Rogers.

5. Principles of Highways Engineering and Traffic Analysis - Fred Mannering & Walter Kilareski, John Wiley & Sons Publication

6. IRC Codes

7. Highway Capacity Manual -2010.

Course Outcomes:

1. Ability to conduct traffic survey, collects data, analyse and interpret them.
2. Ability to analyse LOS of an operating highway.
3. Ability to design of signal and manage the traffic.

CE 15071: ENVIRONMENTAL MANAGEMENT (3-1-0) CR-04

Course Objectives:

To develop skills and knowledge for translating the theory and concepts of resource and environmental management into practice relevant to communities and workplaces today.

To apply monitoring and environmental management tools used by resource and environmental practitioners.

To consider the impacts of flows (energy, water, resources/waste) within the built, urban, agricultural and natural environments.

Course Contents:

Module I **(10 Hours)**

Principles of Environmental Management, Ecosystem Concepts, Environmental Concerns in India, Policy and Legal Aspects of Environmental Management, Introduction to Environmental Policies, Environmental Laws and Legislations, Environmental Legislations in India.

Module II **(10 Hours)**

Environmental Impact Assessment (EIA), Impact Prediction, Evaluation and Mitigation, Forecasting Environmental Changes, Strategic Environmental Assessment (SEA), Environmental Clearance Procedure in India, EIA Documentation and Processes, EIA Monitoring and Auditing.

Module III **(10 Hours)**

Environmental Auditing, Elements of Audit Process, Waste Audits and Pollution Prevention Assessments, EA in Industrial Projects. Life Cycle Assessment (LCA), Stages in LCA of a Product, Procedures for LCA, Different Applications of LCA. Sustainable approach towards Environment Management, Environmental Protocols

Module IV **(10 Hours)**

Environmental Management System Standards, Implementation of EMS Conforming to ISO 14001. Environmental Economics: Introduction, economic tools for evaluation, Green GDP, Cleaner development mechanisms and their applications.

Text Book:

1. Vijay Kulkarni and Ramachandra T.V., 2006. Environmental Management, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore.

References:

1. Lohani B.N (1984)., "Environmental Quality Manag ement", South Asian Publishers, New Delhi

2. Chanlett, (1973) "Environmental Protection", McGr aw Hill Publication, Newyork.

3. Danoy G.E., and Warner R.F., (1969), "Planning a nd Design of Engineering Systems",Unwin Hyman Publications.

4. MOEF, Government of India, "Carrying Capacity Ba sed Developmental Planning Studies for the 6. National Capital Region", 1995-96.

5. NEERI, Nagpur, Annual Reports 1995 & 1996.

6. UNEP / UNDP – "Environmental Sustainable Develop ment".

7. ISO 14001:2004 Environmental management systems -- Requirements with guidance for use

Course Ooucomes:

After attending the course, the students would be

1. acquainted with the environmental management system and its benefits

2. able to identify and review audit-related documentation, prepare checklists and audit process

3. able to apply tools such life cycle assessment, environmental audits, evaluation of environmental performance for environmental decision-making.

4. to evaluate the effectiveness of systematic EMS monitoring processes.

CE 15071: STRUCTURAL DYNAMICS (3-1-0) CR-04

Course Objectives

Learning methods to analyze structures subjected to any kind of dynamic excitation and computing quantities like displacements, forces, stresses, etc.

Understanding the analytical methods and procedures in a way that emphasize physical insight. Ability to apply the structural dynamics theory to real-world problems like seismic analysis and design of structures.

Course Contents:

Module I **(16 Hours)**

Oscillatory motion; harmonic motion, periodic motion, vibration terminology, Single degree of freedom system; equation of motion, damped and undamped free vibration, response to harmonic, periodic, impulse load and general dynamic load, Duhamel's integral, vibrating measuring instruments.

Module II **(8 Hours)**

Multi-degrees of freedom system: equation of motion, free vibration analysis, dynamic response and modal analysis.

Module III **(8 Hours)**

Normal mode vibration of continuous beams, vibrating beams, vibrating strings, longitudinal vibration of rods, torsional vibration of rods, Euler equation for beams, effect of rotary inertia and shear deformation

Module IV **(8 Hours)**

Random vibrations, random phenomena, time averaging and expected value, frequency response function.

Text Book

1. M. Paz, 'Structural Dynamics- Theory and Computation', Van Nostrand, 1985

References

1. WT Thomsen, 'Theory of vibration', CBS Publicati ons

2. R.W. Clough and J. Penzien, 'Dynamics of Structures', McGraw-hill Inc

3. A.K. Chopra, 'Dynamics of Structures: Theory and Applications to Earthquake Engineering, Printice Hall of India

Course Outcomes:

At the conclusion of this course, the students will be able to:

Apply knowledge of mathematics, science, and engineering by developing the equations of motion for vibratory systems and solving for the free and forced response.

Create simple computer models for engineering structures using knowledge of structural dynamics interpret dynamic analysis results for design, analysis and research purposes.

Apply structural dynamics theory to earthquake analysis, response, and design of structures.