VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY: BURLA

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SCHEME OF INSTRUCTION AND SYLLABI

FOR

B.TECH PROGRAM IN CIVIL ENGINEERING

Effective from 2011-12

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 products 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 involvement 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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DEPARTMENT OF CIVIL ENGINEERING

B.TECH IN CIVIL ENGINEERING

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

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

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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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VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY, BURLA

DEPARTMENT OF CIVIL ENGINEERING

B.TECH IN CIVIL ENGINEERING

COURSE STRUCTURE OF B.TECH SYLLABUS

FIRST YEAR
(COMMON TO ALL BRANCHES)

FIRST SEMESTER THEORY				
Sl No.	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**CR**
1	BMA 101	Mathematics-I	3-1-0	4
2	BPH 101/BCH 101	Physics/Chemistry	3-1-0	4
3	BME 101/BCS 101	Engg. Mechanics/ Programming & Data Structures	3-1-0	4
4	BEE 101/BEC 101	Basic Electrical Engg/ Basic Electronics	3-1-0	4
5	BHU 101/BCE 101	English for Communication/ Env Sc. & Engg	3-1-0	4
SESSIONAL				
1	BPH 191/BCH 191	Physics Lab/ Chemistry Lab	0-0-3	2
2	BHU 191/BCS 191	Language Lab/Programming Lab	0-0-3	2
3	BCE 191/BME 191	Engg. Drawing./ Workshop Practices	0-0-3	2
4	BEE 191/BEC 191	BEE Lab/B.E. Lab	0-0-3	2
Total			**15-5-12**	**28**
SECOND SEMESTER THEORY				
1	BMA 102	Mathematics-I	3-1-0	4
2	BCH 101/BPH 101	Chemistry /Physics	3-1-0	4
3	BCS 101/BME 101	Programming & Data Structures / Engg. Mechanics	3-1-0	4
4	BEC 101/BEE 101	Basic Electronics /Basic Electrical Engg	3-1-0	4
5	BCE 101/BHU 101	Env Sc. & Engg / English for Communication	3-1-0	4
SESSIONAL				
1	BCH 191/BPH 191	Chemistry Lab /Physics Lab	0-0-3	2
2	BCS 191/BHU 191	Programming Lab /Language Lab	0-0-3	2
3	BME 191/BCE 191	Workshop Practices /Engg. Drawing Lab.	0-0-3	2
4	BEC 191/BEE 191	B.E. Lab /BEE Lab	0-0-3	2
Total			**15-5-12**	**28**

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THIRD SEMESTER THEORY				
Sl No.	**Course Code**	**Subject**	**Contact Hrs. L-T-P**	**CR**
1	BMA 201	Mathematics-III	3-1-0	4
2	BHU 201/BHU 202	EEC/OB	3-1-0	4
3	BCE 201	Object Oriented Programming	3-1-0	4
4	BCE 202	Mechanics of Materials	3-1-0	4
5	BCE 203	Civil Engg Materials & Constructions	3-1-0	4
SESSIONAL				
1	BCE 291	Building Drawing	0-0-3	2
2	BCE 292	Concrete Lab.	0-0-3	2
3	BME 293	Material Testing Lab	0-0-3	2
4	BCS	OOP Lab.	0-0-3	2
Total			**15-5-12**	**28**

FOURTH SEMESTER THEORY				
1	BMA 202	Mathematics-IV	3-1-0	4
2	BHU 202/BHU 201	OB /EEC	3-1-0	4
3	BCE 204	Fluid Mechanics	3-1-0	4
4	BCE 205	Structural Analysis-I	3-1-0	4
5	BCE 206	Engg. Surveying	3-1-0	4
SESSIONAL				
1	BCE 294	Hydraulics Lab	0-0-3	2
2	BCE 295	Survey Practice-I	0-0-3	2
3	BCE 296	Geology Lab.	0-0-3	2
4	BCE 297	Environmental Engg 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	BCE 301	Structural Design	3-1-0	4
2	BCE 302	Water Resources Engg.	3-1-0	4
3	BCE 303	Geotech. Engg-I	3-1-0	4
4	BCE 304	Environmental Engg.	3-1-0	4
5	BCE 305	Transportation Engg-I	3-1-0	4
SESSIONAL				
1	BCE 391	Fluid Flow Lab	0-0-3	2
2	BCE 392	Geotech. Engg. Lab	0-0-3	2
3	BCE 393	Env. Engg. Design	0-0-3	2
4	BCE 394	Transportation Engg. Lab.	0-0-3	2
Total			**15-5-12**	**28**

SIXTH SEMESTER THEORY				
1	BCE 306	Structural Analysis-II	3-1-0	4
2	BCE 307	Fluid Dynamics	3-1-0	4
3	BCE 308	Transportation Engg-II	3-1-0	4
4	BCE 309	Steel Structures	3-1-0	4
5	BCE 310	Advanced Surveying	3-1-0	4
SESSIONAL				
1	BCE 395	Design of Concrete Structures	0-0-3	2
2	BCE 396	Transportation & Geotechnical Engg Design	0-0-3	2
3	BCE 397	Structural Engg. Lab.	0-0-3	2
4	BCE 398	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	BCE 401	Concrete Structure	3-1-0	4
2	BCE 402	Geotech. Engg-II	3-1-0	4
3	BCE 403	Hydraulic Structures	3-1-0	4
4	BCE 404	Elective-I	3-1-0	4
5	BCE 405	Elective-II	3-1-0	4
SESSIONAL				
1	BCE 491	Design of Steel Structures	0-0-3	2
2	BCE 492	Design of Irrigation Structure	0-0-3	2
3	BCE 493	Minor Project	0-0-3	2
4	BCE 494	Seminar	0-0-3	2
Total			**15-5-12**	**28**
EIGHTH SEMESTER THEORY				
1	BCE 406	Estimation & Professional Practice	3-1-0	4
2	BCE 407	Construction Management	3-1-0	4
3	BCE 408	Elective-III	3-1-0	4
4	BCE 409	Elective-IV	3-1-0	4
SESSIONAL				
1	BCE 495	Comprehensive VivaVoce	0-0-2	2
2	BCE 496	Major Project	0-0-3	6
Total			**12-4-5**	**24**

Elective-I		Elective-II		Elective-III		Elective-IV	
1	Advanced Mechanics of Materials	1	Advanced Foundation Engineering	1	Open Channel Flow	1	Pre-stressed Concrete
2	Theory of Plates & Shell	2	Finite Element Method	2	Environmental Geo technique	2	Composite Materials & Structures
3	Traffic & Transportation Planning	3	Computer Aided Design of Structures	3	Theory of Elasticity & Plasticity	3	Pavement Design
4	Waste Management & Pollution Control	4	Bridge Engineering	4	Remote Sensing and GIS	4	Ground Improvement Technique
5	Ground Water Engineering	5	Water Power Engg	5	Town Planning & Architecture	5	Soil Dynamics & Earthquake Engineering
6	Machine Foundation	6	Computational Hydraulics	6	River Engineering	6	Water Resources Planning & Management

BCE101-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 – 1

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

Concept of hydrology: Hydrological cycle, water balance, energy budget, precipitation, infiltration, evaporation and evapotranspiration, Ground water, Ground water chemistry, contamination and pollution prevention.

Water quality Requirements: In- stream standards, potable water standards and wastewater effluent standards.

Water Quality in rivers: Organic content parameters DO and BOD demand in streams, Transformation and transport processes in water bodies, Streeter- Phelps Oxygen sag model.

Module – II

Water treatment: Water sources and their quality, Water treatment unit operations: Sedimentation, coagulation, fieeculation, Filtration, Disinfection. Lay out of a water treatment plant.

Waste water treatment: Waste water characteristics, waste water treatment processes, Pretreatment, Primary treatment, Secondary Treatment system: Activated sludge system, attached growth system, secondary clarification and wastewater disinfection. Lay out of a wastewater treatment plant.

Anaerobic digestion, its microbiology, methane production and application of anaerobic digestion.

Module-III

Air Pollution: Units of measurement, sources and classification of air pollutants, criteria and non-criteria pollutants.

Elemental properties of atmosphere: Heat, pressure, wind, Moisture and RH. Influence of meteorological phenomena on air quality cr4iteria pollutants: Lapse rate, Pressure systems, winds and moisture.

Air Quality: National Ambient Air quality Standards. Emission standards from industries. Noise pollution: Physical properties of sound, Noise criteria, Noise standards, Noise measurements, Noise control.

Module-IV

Solid waste management: Source, classification and composition of MSW, Properties and classification, separation, storage and transport of MSW, MSW management, Waste minimization of MSW, Reuse and recycling, Biological treatment, Thermal treatment, land fill, integrated waste management,

Hazardous Waste management: Hazardous waste and their generation, Medical hazardous waste, Household hazardous waste. Transportation and treatment of hazardous waste: Incinerators, Inorganic waste treatment, handling of treatment plant residue.

Environmental impact Assessment: Origin and procedure of EIA, project screening for EIA, Scoping studies, preparation and review of EIS. Indian environmental laws.

Text Book:

1. Environmental Engineering, G. Kiely, TMH, 2007

References:

1. Environmental Engineering, H.S. Peavy, D.R.Rowe and G. Tchobanoglous, McGraw Hill, 1985.
2. Principles of E Environmental Engineering and Science, M.L Davis and S.J. Masen, MGH, 2004.

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

BCE191-ENGINEERING DRAWING (0-0-3) CR-02

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 practice, lines, lettering and dimensioning;

Concept of orthographic projection: projections of points, straight lines, planes and solids;

Sections of solids; Development of surfaces; Isometric Projection;

Text Book:

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

Reference Books:

Engineering Drawing by Venugopal

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

BCE202-MECHANICS OF MATERIALS – I (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

1. 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
2. Shear Stress: Shear stress, Complementary shear stress, shear strain, modulus of rigidity

Module – II

3. Two dimensional stress and strain systems: Principal stresses, Maximum shear stresses, Analysis of stresses, Mohr's stress circle.
4. Principal strains and principal axes of strain measurement, calculation of principal stresses from principal strains, Analysis of strains, Mohr's strain circle.

Module – III

5. Simple bending of beams: Theory of pure bending of initially straight beams, Distribution of normal and shear stresses, Composite beams.
6. 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.
7. Theories of Failure: Maximum normal stress theory, maximum normal strain theory, maximum shearing strain theory, maximum strain theory, maximum distortion energy theory, maximum octahedral shearing stress theory, comparison of failure theories for 2-D stress system, Mohr's theory of failure.

Module – IV

8. Thin cylinders and spheres: Stresses in thin cylinders and spherical shells under internal pressure, wire winding of thin cylinders.
9. 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.

Reference Books:

1. Strength of Matrials by G.H. Ryder, Macmillan
2. Strength of Matrials by S. P. Timoshenko and D. H. Young

3. 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

BCE203-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

Bricks: Methods of bricks manufacture, testing of bricks

Cement, classification, chemical composition, hydration, tests for cement.

Concrete: Composition, Water- Cement ration, workability.

Module – II

Masonary arches: Terms used types of arches, stability, line of thrust, depth of arch at the crown. Cavity walls: Purpose, method of construction

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

Module – III

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

Plastering: Materials for plastering, methods of plastering, defects in plastering and remedy. Damp prevention: causes, effects, different methods of prevention of dampness.

Module – IV

Types of Doors and Windows.

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

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

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

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

Timer: Preservation and seasoning of timber

Foundation: Brief idea on various types of foundation.

REFERENCE BOOKS:

1. A Text book of Building Construction, A.P. Arora and S.P. Bindra, Dhanpat Rai & Sons.
2. A Text Book of Building Materials, C.J. Kulkarrni
3. Building Materials, Varghese, PHI, Pvt. Ltd.
4. 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.

BCE291-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.

COURSE CONTENT

1. Plan, elevation, side view of residential/office building
2. 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
3. Detailing of doors/windows
4. Drawing of several types of footing, brick work, floor staircase, masonry, arches and lintels.
5. Types of steel roof trusses
6. Project on establishment like Bankbuilding/Post office/ hostel/ Library/ Auditorium/Factory building etc.
7. Introduction to Auto-CAD:Use of Auto-CAD in building drawing.

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

BCE292-CONCRETE LAB. (0-0-3) CR-02

Course Objectives:

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

Course Content:

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

Course Outcomes:

- Ability to characterize cement, aggregates and concrete.

FOURTH SEMESTER

BCE204-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 buoyancy 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

BCE-205: 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

Module – I (10 Hrs)

1. Introduction to statically determinate/ indeterminate structure with reference to 2D and 3D structures. Free body diagram of structure.
2. Introduction to kinematically determinate/indeterminate structures with reference to 2D and 3D structures. Degree of freedom.
3. B.M. and S.F. diagrams for different loading on simply supported beam, cantilever and overhanging beams.
4. B.M. shear and normal thrust of three hinged arches.

Module – II (10 Hrs)

5. Deflection of statically determinate beams:

   Integration method, Moment area method, Conjugate beam method.
6. Deflection of statically determinate beams by energy methods- strain energy method, Castigliano's theorems, reciprocal theorem, unit load method. Deflection of pin-jointed trusses, Williot-Mohr diagram.

Module – III (6 Hrs)

7. BM. and S.F. diagrams for statically indeterminate beams – propped cantilever and fixed beams.
8. Application of three moment theorem to continuous and other indeterminate beams.

Module – IV (8 Hrs)

9. 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 series of wheel loads, UDL less than or greater than the span of the beam, Absolute Maximum bending moment.
10. ILD for B.M., S.F., normal thrust and radial shear of a three hinged arch.

Module – V (8Hrs)

11. Suspension cables, three hinged stiffening girders.
12. Introduction to space frames.

REFERENCE BOOKS:

1. Sructural Analysis – Norris & Wilber
2. Indeterminate Sructures – J.S. Kenney
3. 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

BCE206-ENGG. 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

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

Linear measurement: Different methods of direct measurement instrument for chaining, ranging, chaining on uneven slopping 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

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

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

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

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

Reference Books:

1 Surveying &Levelling – Kanetkar&Kulkarni, Vol.-I, Pune VidyarthiGrihaPrakashan.

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

3 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

BCE294-HYDRAULICS LAB (0-0-3) 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 Cc, Cv and Cd of an circular orifice
4. Determination of discharge coefficient (Cd) of Venturimeter
5. Determination of discharge coefficient (Cd) 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

BCE295-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.

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

BCE296-GEOLOGY LAB (0-0-3) CR-02

Course Objectives:

To characterize rocks and minerals based on physical and engineering properties.
To identify geological features using topographical maps.

Course Content

1. Study of topographical map for geological engineering application

2. Physical properties of rocks and minerals

3. Engineering properties of rocks

4. Lithological and structural mapping (field study)

Course Outcomes:

Ability to study topographical map for engineering purposes

Ability to determine various properties of rocks

Ability to classify rocks.

BCE297-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 turbidity of different samples of water.
2. Determination of colour and pH of different samples of water.
3. Determination of dissolved solids and suspended solids of different samples of water.
4. Determination of hardness of different samples of water.
5. Determination of optimal chlorine dose for different samples of water.(Break- point Chlorination)
6. Determination of organic content of different samples of water.
7. Determination of inorganic content of different samples of water.
8. Determination of Bio-Chemical Oxygen Demand for different samples of water.
9. Determination of Chemical Oxygen Demand for different samples of water.
10. Determination of bacteriological status of different samples of water.

Course Outcomes

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

FIFTH SEMESTER

BCE301-STRUCTURAL DESIGN (3-1-0) CR-04

(IS: 456-2000 and other relevant 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

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

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

Module-III

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

Module-IV

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

Reference Books:

1. Limit state design of reinforced concrete by P.C. Verghese, PHI
2. Reinforced concrete: Limit state by A.K. Jain
3. Reinforced concrete by B.C. Punmia, A.K. Jain and A.K. Jain
4. SP-16 and SP-32.

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

BCE302-WATER RESOURCE 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–areaduration 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 andallocation policies

BCE303-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 Hrs)

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 Hrs)

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 Hrs)

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 Hrs)

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, vane 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, stabilization by grouting, use of geo-synthetic materials, reinforced earth.

Reference Books:

1. Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.
2. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co.
3. 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

BCE304-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 provideadequate 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

Quantity of water: Per capita demand, design period, population forecast, fluctuation in demand.

General requirement for water supply: Sources, Types of intakes, Pumping and Transportation of water.

Quality of water: Physical, chemical and biological characteristics of water and their significance. Water quality criteria and standards.

Module II

Engineering system for water purification: Aeration, Coagulation and Flocculation, Sedimentation, Softening, Filtration, Disinfection, Water distribution systems.

Methods of treatment: Removal of color, tastes and odour control, algicid treatment, removal of iron and manganese, fluoridations.

Module III

Generation and collection of wastewater, sanitary, storm and combined sewerage systems, quantities of sanitary wastes and storm water, design of sewerage system.

Engineered system for wastewater treatment: Primary treatment, Screening, Grit removal, Sedimentation, Sedimentation aided with coagulation.

Secondary treatment: Basis of microbiology, Growth and food utilization, Suspended-culture systems, Attached-culture systems, Secondary clarification, Disinfections of effluents.

Sludge treatment and disposal: Sludge characteristics, thickening, disposal

Module IV

Air pollution: Units of measurement, Sources and Classification of air pollutants.

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.

Engineered systems for air pollution control: Gravitational settling chamber, cyclone, ESP, Bag filter and scrubbers, National Ambient air quality standards.

Text Books

1. Environmental Engineering (Volume I and II) by S. K. Garg-Khanna Publishers
2. Environmental Engineering (Volume I and II) by B. C. Punmia-Khanna Publishers
3. Environmental Engineering by H. S. Peavy, D.R. Rowe and G. Tchobanoglous, MGH.
4. 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.

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.

Module-I

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

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

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

Classification of bridges, Consideration of location of bridge site, Investigation & data collection,

Calculation of runoff 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.

BCE391-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

Course Content:

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 turbinesand pumps

CO2: Ability to measure rainfall quantity

CO3: Ability to study of hydraulic Jump,

BCE392-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 soil compaction in the field: (a) Cure 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..

BCE393-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 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

BCE 306 - 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

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

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

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

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

Reference Books

1. Indeterminate Structures by J.S. Kenney
2. Indeterminate Structures By C.K. Wang.
3. Matrix methods of Structural Analysis ByPandit 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

BCE 307 - 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

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

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

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

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 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

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

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

Signalling 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

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.

BCE 309 - 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

Philosophy, concept and methods of design of steel structures. Structural elements, Structural steel sections, Rivetted and welded connections, Design of tension members.

Module – II

Design of compression members, Design of columns, lacing and battening, Column base and foundation.

Module – III

Design of beams, Plate girder and Gantry girder.

Module – IV

Design of Roof trusses

Reference Books:

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

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

BCE 310 - 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 Content:

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

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

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

Module – IV Electronic distance measurement, Total Station, Global Positioning System.

Books for Reference: (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 (3) Surveying – Vol – I – By S.K.Duggal, Tata McGraw Hill 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

BCE395-DESIGN OF CONCRETE STRUCTURES (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

Design of a Building with different structural elements like RCC Footings, Columns, Beams, Slabs, Staircases etc.

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 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 Practice:

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.

BCE397- 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

BCE 398 - 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. Sensitivity of bubble tube
2. Application of Tacheometry
   (a) Determination of tacheometric constants.
   (b) Solution of Height & distance problem.
   (c) Traversing
3. Setting out
   (a) Simple Circular Curve
   (b) Transition Curve
4. Layout of a building
5. Demonstration of celestial sphere
6. Total Station
7. Trigonometric surveying

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

BCE 401 - 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

Reference books

1. Dynamics of Structures: Theory and Applications to Earthquake Engineering, A K Chropra , Prentice Hall of India
2. Advanced Concrete Structure Design by P. C. Verghese, Prentice Hall of India
3. Limit state design- A K Jain, Nem Chand and Brothers

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

BCE402-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

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

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 graphical methods, stability conditions for retaining walls. Stability of earth slopes: Stability of infinite slopes, stability analysis of finite slopes, Swedish method of slices, friction circle method, Bishop's method. Use of Taylor stability number. Fellnious method for locating centre of critical slip circle.

Module – III

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

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.

Reference Books:

1. Geotechnical Engineering, C. Venkatramaiah, New Age International publishers.
2. Geotechnical Engineering, T.N. Ramamurthy & T.G. Sitharam, S. Chand & Co.
3. Soil Mechanics, T.W. Lambe& Whiteman, Wiley Eastern Ltd, Nw Delhi.
4. 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.

BCE403-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

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

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

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

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 varioushydraulic 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

ELECTIVE-I (BCE404)

Advanced Mechanics of Materials (4-0-0): Credits-04

Course objectives:

Principles of elasticity theory for stress and strain problems
Theory of elasticity for plane stress and plane strain problems
Experimental techniques for field problems
Theory of photo-elasticity for elastic problems

Course Content:

Module-I

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, Comparison of failure theories for 2-D stress system. Mohr's theory of failure.

Module-II

Unsymmetrical bending: Properties of beam cross section, slope of neutral axis, stress and deflection in unsymmetrical bending, shear centre.

Curved Beams: Bending of beams with large initial curvature, Stress distribution in beam with rectangular, circular cross section, stresses in crane hooks, rings and chain links.

Module-III

Elementary concept of elasticity, stresses in 3D, equation of equilibrium and compatibility, plane stress and plane strain. Computer analysis of 2D state of stress and strain at a point.

Repeated stresses and fatigue in metals, Concept of stress concentration, notch and stress concentration factors.

Module-IV

Experimental stress analysis: Resistance strain gauges, strain rosettes, 2D photoelastic methods of stress analysis, stress optic law, light and dark field in a polariscope, isoclinic and isochromatic fringe patterns.

Reference Books:

1. Advanced Mechanics of Solids by L. S. Srinath, TMH
2. Advanced Mechanics of Materials by Kumar &Ghai, Khanna Publisher

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

Apply principles of elasticity theory to determine stresses and strains

Apply theory of elasticity and formulate plane stress and plane strain problems

Apply experimental techniques using strain gauges to solve field problems.

Apply principles of photo-elasticity to solve elastic problems

Theory of Plates and Shells (3-1-0): Credits-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:

Plates: Pure bending of plates, Slope and curvature of slightly bent plates, relationship between moment and curvature, strain energy in bending of plates.

Differential equations for symmetrical bending of circular plates under lateral loads. Uniformly loaded, concentrically loaded and loaded at the center of simply supported and fixed circular plates. Differential equation of the deflection surface and boundary conditions of laterally loaded rectangular plates by classical theory. Solutions of simply supported rectangular plates due to sinusoidal loads, uniformly distributed loads and concentrated load by Navier's Solution, Levy approach.

Shells: Membrane theory of symmetrical loaded shells of revolution, Spherical shells, conical shells, Membrane theory of cylindrical shells and shells of Double curvature such as Hyperbolic paraboloids and elliptic paraboloids, conoids.

Circular cylindrical shells loaded symmetrically with respect to its axis, particular cases of symmetrical deformation of circular cylindrical shells, cylindrical tanks of uniform wall thickness.

Structural Design: Design of spherical dome.

Essential Reading

1. S P Timoshenko and S. W. Krieger ,Theory of Plates and Shells
2. O.P Billington, Thin Shell Concrete Structures

Supplementary Reading

1. Eduard Ventsel&Theodor Krauthammer, Thin Plates & Shells: Theory, Analysis, & Applications CRC; 1st edition, 2001
2. Maan H. Jawad, Theory and design of plate and shell structures,Kluwer Academic Pub
3. Philip L. Gould, Analysis of shells and plates, Pearson Higher Education

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 15042: Town Planning & Architecture (3-1-0) Credit: 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 Content:

Module – I

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

Module – II

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

Module – III

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

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, Orissa 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

Reference Books:

1. Architects & Builders hand book – Kiddar& Parker
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.

WASTE MANAGEMENT AND POLLUTION CONTROL (3-1-0) CREDIT: 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.
- Study various Industrial manufacturing processes and understand their waste treatment requirements and air quality management.

Course Content:

Module-I

Industrial Waste Water Treatment: Sources, Quantification and characterization of effluent, Waste water treatment process, Primary and secondary treatment of waste water, Aerobic and anaerobic treatment processes, various reactor configurations

Module-II

Industrial Air Quality Management: Sources, Quantification and characterization of emission, Control of particulate from flue gas, Particle dynamics, Particle size distribution, Dispersion and diffusion of pollutants in air, Gaussian dispersion equation, different types of dispersion models, Selection and design of air pollution control equipments: gravitational settling chamber, cyclone, bag filter, electrostatic precipitator, various type of scrubbers, Control of fugitive emission, Procedure for sampling of particulate matter in stacks

Module-III

Advanced Waste Water Treatment Processes: Fundamentals and mechanism of adsorption, adsorption isotherms, absorption, membrane separation and chemical oxidation processes and their design principles.

Module-IV

Waste Water and Air Quality Management in specific industries: Power plant, Fertilizer plant, Steel plant, Alumina refinery and smelters, Pulp and paper, Sugar and distillery, Dairies, Cement, Sponge iron industries

Reference books:

1. Wastewater treatment processes, Metcalf and Eddy, Tata McGraw hill
2. Environmental Engineering, Peavy and Rowe, Tata McGraw Hill

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.

GROUND WATER ENGINEERING (3-1-0): CREDIT-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 Content:

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 groundwater flow towards a well in confined and unconfined aquifers – Dupuit's and Theim's equations, Assumptions, Formation constants, yield of an open well, well tests. Analysis of Pumping Test Data – II: Unsteady flow towards 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 – Geophysical 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 Books:

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

Machine Foundation (3-1-0): Credit-04

Course Objectives:

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

Course Content:

Module I

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

Module II

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

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

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

REFERENCES

1. ShamsherPrakash, “Soil Dynamics”, McGraw-Hill Book Company.
2. Braja M. Das, “Principles of Soil Dynamics”, PWS-KENT Publishing Company.
3. Steven L. Kramer, “Geotechnical Earthquake Engineering”, Prentice Hall Inc.
4. D. D. Barkan, “Dynamics of Bases and Foundations”, McGraw-Hill Book Company.
5. E. E. Richart et al. “Vibrations of Soils and Foundations”, Prentice Hall Inc.
6. TienHsing 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

ELECTIVE-II (BCE405)

ADVANCED FOUNDATION ENGINEERING (3-1-0) CREDIT: 04

Course objectives:

To analysis vibration theory with and without damping condition

To explain the analysis of sheet pile wall under different support conditions

To explain fundamentals of soil dynamics and its application to machine foundation analysis including codel provisions

To explain problems related to expansive soils and solution to overcome

To explain the concept of floating foundation

Module – I

Foundation subjected to Vibration :

Introduction, type of machine foundation, single degree freedom system, free and forced vibration with and without damping. Parameters influencing the design of machine foundation. Measurement of dynamic soil parameters.

Module – II

Sheet pile walls : Cantilever and anchored sheet pile walls, methods of analysis, Vertical cuts and ditches, earth pressure analysis,

Module – III

Coffer dams : Types, description

Floating foundation: Introduction, type methods to prevent floatation, necessity of using raft for full floating foundation.

Module – IV

Foundation on expansive soil : Shrinkage and expansion of clays, identification of expansive soil, swelling pressure measurement, causes and type of damages in building on expansive clays, Principles of design of foundation in expansive soil deposits.

REFERENCE BOOKS :

1. Handbook of Machine Founadtion, P. Srinivasulu and C.V Vaidyanathan, TMH, New Delhi
2. Foundation Engineering, P.C. Verghese, Prentice Hall of India
3. Textbook of Geotechnical Engineering, I. Q. Khan, Prentice Hall

Course outcomes:

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

Analyze and design any kind of sheet pile wall system including coffer dam

Estimate soil parameters under dynamic conditions including machine foundations

Design a suitable foundation system for any kind of problematic soils

Finite Element Method (3-1-0) Credits: 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

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

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

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

Module – IV

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

Essential Reading

1. R. D. Cook., Concepts and Applications of Finite Element Analysis , Wiley.
2. O. C Zienkiewicz .and R. L. Taylor, Finite Element Method, Mc Graw Hill

Supplementary Reading

1. Logan, D. L., A First Course in the Finite Element Method,PWS Publishing, Boston,
2. C. S. Krishnamoorthy, Finite Element analysis-Theory and Programming, Tata Mc 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

Computer Aided Design of Structures (3-1-0) Credits:04

Course objectives:

To learn the fundamentals of Computer Aided Design

To learn the programming of numerical methods

To use the computer to apply numerical techniques

Course Content:

Module-I

Introduction to CAD, Description of Computer hardware and software, Use of graphic terminal, various commands, Generation of points

Module-II

Various forms of lines including curved lines, 2D transformations, 3-D transformations, hidden line removal, Data base management, Application of graphics packages.

Module-III

Matrix method of structural analysis and associated computer programmes, Introduction to interactive computer programmes for design and detailing of structural elements, RCC slabs, beams, columns, isolated footings, etc.

Module-IV

Steel- Typical members and connection

Essential Reading

Computer Aided Design by C. S. Krishnamoorthy

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

Understand concepts of computer aided design.

Develop computer programs using numerical methods like FEM.

Apply the software skills for analysis and design of structures.

Bridge Engineering(3-1-0) Credits: 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 Content:

Module-I

Introduction, historical review, engineering and aesthetic requirements in bridge design. Introduction to bridge codes. Economic evaluation of a bridge project. Site investigation and planning;. Scour - factors affecting and evaluation.

Module-II

Bridge foundations - open, pile, well and caisson. Piers, abutments and approach structures; Superstructure - analysis and design of right, skew and curved slabs.

Girder bridges - types, load distribution, design. Orthotropic plate analysis of bridge decks.

Module-III

Introduction to long span bridges - cantilever, arch, cable stayed and suspension bridges. Methods of construction of R.C Bridges,

Module-IV

Prestressed concrete bridges and steel bridges Fabrication, Lunching & creation. Design and construction of construction joints (use of relevant codes of practice are permitted in the examination).

Reference Books

1. Jacoby and Davis, Foundation of Bridges and Building
2. Road bridges- IRS Sec –I , II, III
3. Dunhan, Foundation of Structures
4. Concrete association of India, Concrete bridges
5. Tylor, Thomson andSmulki, . R C Bridges

6. IRS Codes of Practice for Railway bridges

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

WATER POWER ENGINEERING (3-1-0) CREDIT: 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 Content:

Module-I

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

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

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

Module-IV

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 Books: 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

Computational Hydraulics (3-1-0): Credit-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

Module-I

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

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

Module-III

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

Module-IV

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

References Books:

1. Computational Fluid Dynamics: John D. Anderson, Jr.
2. Computational Fluid Dynamics: T. J. Chung
3. 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
4. Computational Methods in Surface/Subsurface Flow & Transport Problems: Computational Methods in Water Resources XI, Volume 1 & 2 : A.A. Aldama and J.Aparicio
5. Computational Methods in Subsurface Flow & Transport Problems: Computational Methods in Water Resources XI, Volume 2: A.A. Aldama and J. Aparicio
6. 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

BCE 491 -DESIGN OF STEEL STRUCTURES (0-0-3) CR-02

Course Objectives:

1. Design of Plate Girder
2. Design of Gantry Girder
3. Design of Roof Truss
4. Design of Water Tank

Course Content:

1. Design of Plate Girder
2. Design of Gantry Girder
3. Design of Roof Truss
4. Design of Water Tank

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

CO1: Design Plate Girder

CO2: Design Gantry Girder

CO3: Design Roof Truss

CO4: Design Water Tank

BCE 492 - DESIGN OF IRRIGATION STRUCTURES (0-0-3) CR-02

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:

1. Design of a canal system with detailed design of its components e.g. impounding reservoir, Dam / Weir
2. Most efficient and economical canal section design
3. Canal lining, canal sections up to the field channel as per the crop-water requirements in the given command area. (6x3=18 Hours)
4. Design of a water supply system as per the per capita demand of a given locality with detailed design of the components e.g. Treatment plant, Over Head Storage Reservoir, pipe lines, pumps, appurtenances, booster pumps, (4x3=12 Hours)

Course outcomes:

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

Assess the irrigation needs of crops

Design the canal systems

Select and design canal fall

Design weirs on pervious foundation

Design head and cross regulator structures

Design of cross drainage works

Identify various types of reservoir and their design aspects

Design gravity dam and earthen dam

BCE 493 -MINOR PROJECT(0-0-3) CR-02

BCE 494 -SEMINAR (0-0-3) CR-02

EIGHT SEMESTER

BCE406 - 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

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

ELECTIVE-III (BCE408)

Open Channel Hydraulics (3-1-0): Credit-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 Content:

Module I

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 equation, 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.

Module II

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.

Specific energy: Specific energy, specific force, critical depth computations, control section, application of specific energy and critical depth concepts.

Module III

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.

Module IV

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

5.

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

ENVIRONMENTAL GEOTECHNIQUE (3-1-0): CREDIT-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.

Module- I

Introduction: Scope, importance, waste generation, subsurface contamination,

Geosynthetics: Types, manufacturing functions, applications and economics.

Module- II

Forms of waste and their properties: Municipal waste, mineral waste, industrial waste, hazardous waste, index properties, strength, compressibility and permeability of municipal and mineral waste.

Module- III

Selection of waste disposal sites, factors affecting site selection, siting criteria and siting rating method, Landfills for municipal and hazardous waste: components of land fills, layouts, daily cells, base lining systems, stability of slopes, constructing aspects.

Module- IV

Ash ponds and mine tailing impoundments: slurry deposition of mine tailing and coal ash in impoundments, layouts, components, design of tailing dam/ash dykes, slope stability.

Remediation: Principle of remediation: Planning, source control, soil gas extraction, soil washing, and bioremediation.

Reference books:

1. Geotechnology of waste management, I. S. Oweis and R. P. Khera, Butterwarths, London.
2. Engineering with geosynthetics, Ed. G. V. Rao and G.V.S.S. Raju, Tata McGraw Hill
3. Geotechnical practice for waste disposal, D. E. Daniel, Chapman and Hall, London.

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

Theory of Elasticity and Plasticity (3-1-0) Credits: 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

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

Module- II

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- III

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

Module- IV

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

Module- V

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 flows, stresses in plastic materials in condition of plane strain, equation of equilibrium the simplest slip-line fields.

Essential Reading

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

Supplementary Reading

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

REMOTE SENSING AND GIS APPLICATIONS (3-1-0): CREDIT-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

Syllabus:

Module – I

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

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

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

Applications: Land use/Land cover in water resources, Surface water mapping and inventory, Rainfall – Runoff relations and runoff potential indices 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 – tsungchang, [TMH Publications & Co.]

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

Traffic and Transportation Planning (3-1-0): Credit-04

Course Objectives:

1. To learn methodology for transportation system planning.

2. To learn methods of travel demand estimation.

3. To learn development of land use-transportation models.

Course Content:

Module -I

Urban transportation planning process & concepts: Role of transportation and changing concerns of society in transportation planning; transportation problems and problem domain; objectives and constraints; flow chart for transportation planning process-inventory, model building, forecasting and evaluation stages, planning in system engineering framework; concept of travel demand and its modelling based on consumer behaviour of travel choices-Independent variables, travel attributes.

Module –II

Methods of Travel Demand Estimation: Assumptions in Demand Estimation-Sequential, Recursive and Simultaneous Process -Introduction to Transportation Planning Practices; Definition of Study Area, Zoning. Trip Generation Analysis: Trip Generation Models-Zonal Models, Category analysis, Household Models, Trip Attractions of Work Centres& Commercial Trips Trip Distribution Analysis: Trip End and Trip Interchange Models; Trip Distribution Models –Growth Factor Models, Gravity Models, Opportunity Models and their calibration; Estimation of Travel Demand based on link volume philosophy.

Module –III

Mode Split and Route Split analysis: Mode Split Analysis-Mode Choice Behaviour, Competing Modes, Mode Split Curves, Probabilistic Models and Two Stage Mode Split Analysis; Route Split Analysis-Elements of Transportation Networks, Coding, Minimum Path Tress, Diversion Curves, All-or-Nothing Assignment, Capacity Restrained Assignment, Multipath Assignment

Module – IV

Land use-Transportation Models: Location models -Opportunity Models, Lowry based Land use-Transportation Models – Allocation Function, Constraints, Travel Demand Estimation – Iterative Solutions, Matrix Formulation, Dynamic and Disaggregated extensions.

Text Books:

1. Hutchinson, B.G., Principles of Urban Transportation System Planning, Mc-Graw Hill 1974.

2. Khisty, C J., Transportation Engineering – An Introduction, Prentice-Hall, NJ

Reference Books:

1. Dickey, J.W., Metropolitan Transportation Planning, Tata Mc-Graw Hill 1980

2. ITE (1982), 'Transportation and Traffic Engineering Hand Book', Chapters 10,12, and 17, Prentice Hall, New Jersey

3. Kanafani, A., Transportation Demand Analysis, McGraw-Hill.

4. Oppenheim, N., Applied Models in Urban and Regional Analysis, Prentice-Hall, NJ.

5. Bruton M.J., Introduction to Transportation Planning, Hutchinson of London.

6. Oppenheim N., Applied Models in Urban and Regional Analysis, Prentice-Hall.

7. Dickey J.W., et. al., Metropolitan Transportation Planning, Tata McGraw-Hill.

8. Gallion A.B and Eisner S., The Urban Pattern, Affluated East-West Press, New Delhi.

9. Wilson, A.G, Urban and Regional Models in Geography and Planning, John Wiley and Sons.

Course Outcomes:

1: Ability to identify the different aspects of traffic engineering.

2: Ability to determine traffic characteristics at various sections of road.

3: Ability to explain the concept of transportation planning

4: Ability to explain the economic evaluation of transportation plan.

6. River Engineering (3-1-0): Credit-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 Content:

Module-I

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

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

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

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:

- CO1: To understand various elements of river morphology
- CO2: Ability to analyse flow reststance sediment movement in rivers
- CO3: Ability to analyse meandering river

ELECTIVE-IV (BCE409)

Pre-stressed Concrete(3-1-0): Credits-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

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

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

Module –III

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

Module –IV

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

Reference Books:

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

2. T. Y. Lin & H. Burns Ned,- "Design of prestressed concrete structures", Johnwilley& Sons, New York-1982.
3. N. Krishnaraju- "Prestressed concrete"- Tata McGraw-Hill, New Delhi-2004.
4. S. K. Mallik& A. P. Gupta- "Prestressed concrete"- Oxford & IBH, New Delhi-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.

Composite Materials and Structures (3-1-0) Credits: 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 Content

Module –I

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

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

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

Module –IV

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

Reference Books:

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
3. P.K. Mallick , "Fiber-reinforced Composites", Marcel Dekker inc
4. D. Hull and T W Clyne, "An introduction to composite materials", Cambridge university press
5. 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 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 Content:

Module I

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

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

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

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

Text Books:

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 Books:

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, MichealSargious, 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 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 Content:

Module – I

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

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

Module – III

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

Module – IV

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

Textbooks:

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:

CO1:Ability to apply the ground improvement technique using admixture and advanced technique using grouting.

CO2:Ability to identify the relevance of reinforcing elements to resist the lateral earth pressures

CO3:Ability to apply suitable techniques for the deep compaction of granular soils and improvement of cohesive soils

CO4:Ability to utilize ground anchors and soil nails for design of soil retained structures.

Soil Dynamics and Earthquake Engineering (3-1-0): Credit-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:

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.

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.

Seismicity: site seismicity, seismic soil response and design earthquake.

Liquefaction: introduction, factors affecting liquefaction, liquefaction analysis, anti-liquefaction measures.

Earthquake resistant design of shallow and deep foundations.

Analysis of retaining walls and slope stability for earthquakes.

REFERENCE BOOKS

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
3. Geotechnical Earthquake Engineering: S. L. Kramer, Prentice Hall International Publishing
4. 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.

WATER RESOURCES PLANNING AND MANAGEMENT (3-1-0) CREDIT: 04

Course Objectives:

Civil Engineering: State-of-the-art water resources management techniques case studies of their application to Canadian situations.

Identification of major issues and problem areas; interprovincial and international river basins

Implications of development alternatives.

Institutional arrangements for planning and development of water resources; and, legal and economic aspects.

Course Content:

Module I

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

Module II

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

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

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& Mujumdar – Tata Mc.Graw Hill Company Ltd.

References Books: 1. optimal design of water distribution networks P.R.Bhave, Narosa Publishing House.

Course outcomes:

Ability to develop a simulation model related to water resources planning.
Ability to explain reservoir operation, planning and management of water resources projects.
Ability to explain economics for hydro-systems, water pricing and allocation policies

BCE 495 - COMPREHENSIVE VIVA VOCE(0-0-2): CR-02

BCE 496 - MAJOR PROJECT (0-0-3): CR-06