

SYLLABUS

OF

B. TECH

OF

II YEAR

B. TECH. (CBCS)

**DEPARTMENT OF CIVIL
ENGINEERING**

**INTEGRAL UNIVERSITY
LUCKNOW**

STUDY AND EVALUATION SCHEME

Branch: Civil Engineering

(w.e.f. 2021-22)

Year – II, Semester – III

S. No.	Course Category	Code No	Name of Subject	Periods				Evaluation Scheme			Exam ESE	Subject Total
				L	T	P	C	Continuous Assessment (CA)				
								UE	TA	Total		
1	BS	MT201	Engineering Mathematics-III	3	1	-	4	40	20	60	40	100
2	DC	CE201	Fluid Mechanics	3	1	-	4	40	20	60	40	100
3	DC	CE202	Basic Surveying	3	1	-	4	40	20	60	40	100
4	DC	CE203	Building Material and Construction	3	1	-	4	40	20	60	40	100
5	DC	CE204	Strength of Material	3	1	-	4	40	20	60	40	100
6	ESA	CS203/ ES202	Cyber Law & Information Security / Disaster Management	2	1	-	3	40	20	60	40	100
7	HM	BM226	Human Value & Professional Ethics	3	0	-	0	-	-	-	50	50
PRACTICAL / DRAWING / DESIGN												
8	DC	CE205	Fluid Mechanics Lab	0	0	2	1	40	20	60	40	100
9	DC	CE206	Basic Surveying Field Work	0	0	2	1	40	20	60	40	100
10	DC	CE207	Building Planning & Drawing	0	0	2	1	40	20	60	40	100
11	DC	CE208	Material Testing Lab	0	0	2	1	40	20	60	40	100
Total				20	6	8	27					1000

L – Lecture; **T** – Tutorial; **P** – Practical; **C** – Credits; **UE** – Unit Exams; **TA** – Teacher Assessment

Continuous Assessment (CA) = Unit Exams + Teacher Assessment

Subject Total = Continuous Assessment (CA) + End Semester Examination (ESE)

BS – Basic Sciences

DC – Departmental Core

HM – Humanities

OE – Open Elective

DE – Departmental Elective

ESA – Engineering Science & Art (Foundation Course & Engineering Courses)

STUDY AND EVALUATION SCHEME

Branch: Civil Engineering

(w.e.f. 2021-22)

Year – II, Semester – IV

S. No.	Course Category	Code No	Name of Subject	Periods				Evaluation Scheme			Exam ESE	Subject Total
				L	T	P	C	Continuous Assessment (CA)				
								UE	TA	Total		
1	ESA	MT205	Computer Based Numerical Techniques	3	1	-	4	40	20	60	40	100
2	DC	CE209	Hydraulic & Hydraulic Machines	3	1	-	4	40	20	60	40	100
3	DC	CE210	Advance Surveying	3	1	-	4	40	20	60	40	100
4	DC	CE211	Concrete Technology	3	1	-	4	40	20	60	40	100
5	DC	CE212	Structure Analysis-I	3	1	-	4	40	20	60	40	100
6	ESA	CS203/ ES202	Cyber Law & Information Security / Disaster Management	2	1	-	3	40	20	60	40	100
7	HM	BM226	Human Value & Professional Ethics	3	0	-	0	-	-	-	50	50
PRACTICAL / DRAWING / DESIGN												
8	DC	MT209	Numerical Techniques Lab	0	0	2	1	40	20	60	40	100
9	DC	CE213	Hydraulic & Hydraulic Machines Lab	0	0	2	1	40	20	60	40	100
10	DC	CE214	Advance Surveying Field Work	0	0	2	1	40	20	60	40	100
11	DC	CE215	Concrete Technology Lab	0	0	2	1	40	20	60	40	100
12	DC	CE252	Comprehensive Annual Assessment-I	-	-	-	1	-	-	100	-	100
Total				20	6	8	28					1100
** A non credit foundation course, Candidate has to pass the course by securing at least 50% marks up to second semester.												

L – Lecture; T – Tutorial; P – Practical; C – Credits; UE – Unit Exams; TA – Teacher Assessment

Continuous Assessment (CA) = Unit Exams + Teacher Assessment

Subject Total = Continuous Assessment (CA) + End Semester Examination (ESE)

BS – Basic Sciences

DC – Departmental Core

HM – Humanities

OE – Open Elective

DE – Departmental Elective

ESA – Engineering Science & Art (Foundation Course & Engineering Courses)

CE201/CEE201	FLUID MECHANICS				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	The main objective of this course is to understand the basics of the fluid mechanics such as fluid and flow properties, fluid behaviour at rest and in motion and fundamental equations like mass, energy and momentum conservation of the fluid flow.				
Unit-I	Introduction & Fluid Statics				08 Hrs
<p>Introduction: Fluid Statics Fluid and continuum, physical properties of fluids, ideal and real fluids, Newtonian and NonNewtonian fluids, measurement of surface tension.</p> <p>Fluid Statics: Pressure-density-height relationship, measurement of pressure, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to uniform acceleration.</p>					
Unit-II	Kinematics & Dynamics of Fluid Flow				08 Hrs
<p>Kinematics of Fluid Flow: Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, one, two and three dimensional flows, streamlines, streak lines, and path lines, continuity equation, rotation and circulation, elementary explanation of stream function and velocity potential, graphical and experimental methods of drawing flow nets.</p> <p>Dynamics of Fluid Mechanics: Euler's equation of motion along a streamline, Bernoulli's equation from Euler's equation. Application of Bernoulli's equation- Pitot Tube, flow through orifice, mouthpieces, nozzles, notches, weirs, Venturimeter, Orifice meter, sluice gates under free and submerged flow conditions. Aeration of nape, cavitations, free and forced vortex, momentum equation and its application to stationary and moving vanes, pipe bends, and problems related to combined application of energy and momentum equations, flow measurements, determination of C_v, C_c and C_d, energy loss.</p>					
Unit-III	Dimensional Analysis & Laminar Flow				08 Hrs
<p>Dimensional Analysis and Hydraulic Similitude: Dimensional analysis, Buckingham's π theorem, important dimensional numbers and their significance, similitude, similarity laws, geometric, Kinematics and dynamic similarity, model studies.</p> <p>Laminar Flow: Equation of motion for laminar flow through pipes, Stoke's Law, flow between parallel plates, flow through porous media, Fluidization, measurement of viscosity.</p>					
Unit-IV	Turbulent Flow & Boundary Layer Analysis				08 Hrs
<p>Turbulent Flow: Transition from laminar to turbulent flow, equation for turbulent flow, eddy viscosity, mixing length concept and velocity distribution in turbulent flow, Hot-wire anemometer and LDA.</p> <p>Boundary Layer Analysis: Boundary layer thicknesses, boundary layer over a flat plate, laminar boundary layer, application of momentum integral equation, turbulent boundary layer, laminar sub-layer, smooth and rough boundaries, atmospheric boundary layer, local and average friction coefficient, separation of boundary layer and its control, measurement of shear.</p>					
Unit-V	Flow Past Submerged Bodies & Pipe Flow				08 Hrs
<p>Flow Past Submerged Bodies: Drag and lift, drag on sphere, Cylinder and disc, lift, Magnus effect and circulation.</p> <p>Pipe Flow: Nature of turbulent flow in pipes, equation for velocity distribution over smooth and rough surfaces, resistance coefficient and its variation, flow in sudden expansion, contraction, diffusers, bends, valves and siphons, concept of equivalent length, branched pipes, pipes in series and parallel, simple networks.</p> <p>Compressibility Effects in Pipe Flow: Transmission of pressure waves in rigid and elastic pipes; Water hammer, analysis of simple surge tank excluding friction.</p>					
<p>References:</p> <ol style="list-style-type: none"> Grade,R.J and A.G Mirajgaoker, 'Engineering Fluid Mechanics (including Hydraulic Machines), Second Edition, Nem Chand and Bros., Roorkee, 1983. R. K. Bansal, 'Fluid Mechanics and Hydraulic Machines', Laxmi Publication, New Delhi 2007 R.K. Rajput, 'Fluid Mechanics and Hydraulic Machines', S.Chand Publication, New Delhi 2002 Hunter Rouse," Elementary Mechanics of Fluid", John Wiley & Sons. Omc/.1946. Grade,R.J 'Fluid Mechanics through Problems.', Wiley Eastern Limited, New Delhi, 1989 <p>Web links to e-learning:</p> <ol style="list-style-type: none"> https://nptel.ac.in/courses/105103095/7 https://nptel.ac.in/downloads/103104043/ https://nptel.ac.in/courses/112105171/8 https://nptel.ac.in/courses/112105183/ 					

CE202/CEE202	BASIC SURVEYING				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	1. To learn the different techniques of measurements of distances, directions and elevations by means of advanced surveying instruments. 2. To learn about the process of establishment of horizontal control points necessary for carrying out survey of the area. 3. To learn about the procedures of preparations of topographical maps of the areas.				
Unit-I	Introduction to Basic Surveying				08 Hrs
Introduction: Importance of surveying to Engineers- Examples from different branches; plane and Geodetic Surveying, Control points, Classification of surveys, Methods of location a point, , principles of surveying, Conventional signs, Surveying instruments, their care and adjustment. Measurement of Distances: Measurement by chain and tape. Source of errors and precautions, Corrections to tape measurements, Field problems, Use and adjustment of auxiliary instruments, Modern trends EDM and Total Station.					
Unit-II	Measurement of Angles and Bearings				08 Hrs
Measurement of Angles and Directions: Reference meridians and Bearings, Magnetic declination and its variations. Use of prismatic and surveyor compass, local attraction, Vernier and microptic theodolites, Temporary and permanent adjustments, Requirements of nonadjustable parts, Measurement of horizontal and vertical angles by different methods.					
Unit-III	Traversing and Tachometry				08 Hrs
Traversing: Principles of traversing by compass and theodolite, Field work and checks, Computation of coordinates, Sources of errors, precision of traversing, checking and adjusting of traverses, Omitted measurements. Tachometry: Definitions, principles of stadia systems, Instrument constants Substance and Tangential system, Construction and use of Reduction Tachometers, Range Finders, Errors and precision.					
Unit-IV	Levelling				08 Hrs
Measurement of Elevations: Different methods of determining elevations: Spirit, Trigonometric and Barometric methods, Spirit leveling- Definitions of terms, principle, Temporary and permanent adjustment of dumpy level. Sensitivity of bubble tube, Automatic levels, Levelling staff, Methods of spirit leveling Booking and reduction of fields notes , Curvature and refraction, Reciprocal leveling, plotting of profiles, Barometric leveling. Trigonometric leveling, sources of errors and precision of leveling procedures.					
Unit-V	Contouring and Sheet				08 Hrs
Contouring: Definition and characteristics of contours, contour interval, Use of contour maps, storage capacity of reservoir, direct and Indirect methods of contouring. Sheet Numbering System: CIM and I and A.C series, Scales and Numbering of Indian Topographic maps					
References: <ol style="list-style-type: none"> 1. Agor, R, "Surveying", Vol. I & II, Khanna Publications, Delhi, 1995. 2. Arora, K, R., "Surveying ", Vol. I & II, Standard Book House, Delhi, 1993. 3. Bannister, A. and Baker, R., "Solving Problems in Surveying "Longman Scientific Technical, U.K., 1994. 4. Kennie, T.J.M. and Petrie, G., "Engineering Surveying Technology", Blackie & Sons Ltd., London, 1990. 5. Punmia, B.C., "Surveying" Vol. I & II Laxmi Publications, New Delhi- 1996. 6. Duggal S.K., Surveying Vol. I and II TMH. 					
Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105107122/ 					

CE203/CEE203	BUILDING MATERIAL AND CONSTRUCTION				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	1. The objective of this course is to introduce students to the science and technology of construction materials. 2. To teach students how to select appropriate construction materials. 3. To teach technologies of basic construction materials, such as bricks, lime, timber, Plywood, Glass, plastics, P.V.C. Steel, Aluminum, Gypsum, pozzolana, Asphalt, Bitumen and Tar, Metals, insulating material. 4. To impart the state of art construction practices of buildings and other structures including Bye laws, site preparation etc.				
Unit-I	Introduction to Building Materials				08 Hrs
Building Materials: Classification, properties and selection criteria of Bricks, Stone, Lime, Timber, Mortar: Types, classification and strength, I.S. specifications.					
Unit-II	Advance Building Materials used in Construction				08 Hrs
Classification, properties and selection criteria Plywood, Glass, plastics, P.V.C. Steel, Aluminum, Gypsum, pozzolana, Asphalt, Bitumen and Tar, Metals, insulating material.					
Unit-III	Building Bye Laws				08 Hrs
Building Construction: Classification of buildings, Recommendations of NBC, Building byelaws, modular co-ordinations; orientation of buildings, desirable conditions of comforts, and components of building area considerations. Types of foundations and selection criteria, causes of unequal settlement.					
Unit-IV	Treatment in Construction				08 Hrs
Prefabricated construction. Plastering and pointing, Damp Proofing Materials and techniques, Antitermite treatment. Types of floors, construction details and selection criteria, Types of Roofs and roof covering, treatment of water proofing, Doors and Windows: Sizes and locations, materials.					
Unit-V	Building Services				08 Hrs
Stair and Staircases; types, materials, proportions. Lifts and escalators, White washing, colour washing, painting, distempering. Shuttering, Scaffolding and centering, Expansion and Construction joints. Sound and fire proof construction, I.S. specifications.					
References: <ol style="list-style-type: none"> 1. Jha. J. & Sinha S.K. ,”Building Construction”, Khanna Publishers, Delhi,1977 2. Arora, S.P & Bindra S.P.,” A Text Book of Building Construction”, Dhanpat Rai & Sons., Delhi 1977. 3. Kulkarni, C.J, “A Text Book of Engineering Construction”, Ahmedabad Book Depot, Ahmedabad, 1968. 4. Kumar Sushil, “Engineering Material”, Standard Publishers Distributors, Delhi, 1944. 5. McKay W.B. ,”Building Construction”, Vol. 1 to 4, Orient Longman Ltd., Hyderabad, Bombay, Madras, Delhi, Vol. 1 & 2-1955, Vol. 3-1996, Vol.4- 1998. 6. Punmia, B.C., “A Text Book of Building Construction”, Laxmi Publications, Delhi, Madras, 1987. 7. Singh Surendra,”Engineering Materials”, Konark Publishers Pvt. Ltd., 1994 					
Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105102088/ 					

CE204/CEE204	STRENGTH OF MATERIAL				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	1. To develop basic understanding of three dimensional state of stress in materials and structures. 2. To develop understanding of basic principles and methods of analysis: (a) theory of bending and torsion (b) Macaulay's method, Area Moment method, Conjugate Beam method for beams (c) Euler's Formula and Rankine's law for columns.				
Unit-I	Stress - Strain				08 Hrs
Stress and Strain: Concept of stress and strain relationship, Ductility, Toughness, Elastic constants, Hardness, Brittleness, Tension, Compression, Shear, and Elongation, Concept of thermal stresses [5] Principal stresses: Stress transformation, Application of Mohr's circle in stress analysis [3]					
Unit-II	Bending & Torsion Theory				08 Hrs
Bending of Beams: Review of bending of beams, shear forces & bending moment diagrams for statically Determinant Beams, Shearing and bending stresses in beam section. [5] Torsion of Shafts: Torsion of circular shaft, power transmitted by shaft, combined bending and torsion in shafts. [3]					
Unit-III	Strain Energy and Theories of Failure				08 Hrs
Strain Energy and Impact Loading: Concept of strain energy or resilience, Strain energy in simple tension and compression, Stress due to different types of loading. [4] Theories of Failure: Maximum principal stress theory, Maximum shear stress theory, Maximum principal strain theory, Strain energy theory, Shear strain energy theory and their comparison.[4]					
Unit-IV	Slope & Deflection and Compression Members				08 Hrs
Deflection of Beams: Deflection of beams, Integration method, Macaulay's method, Area Moment method, Conjugate Beam method. [4] Columns and Struts: Theory of columns & struts, Elastic stability, End conditions, Effective length and Buckling load, Euler's and Rankine's formulae and their limitations.					
Unit-V	Thin and Thick Cylinder				08 Hrs
Thin Cylinders: Theory of thin cylinders subjected to pressure, expression for hoop stress and longitudinal stress, Design of thin cylinders, Thin walled pressure vessels and uniform torsion. [4] Thick Cylinders and Spherical Shells: Stresses and strain in thick shells/cylinder subjected to pressures, compound cylinders press fits on solid shaft.[4]					
References: <ol style="list-style-type: none"> 1. Kazmi, S. M. A., 'Solid Mechanics' TMH, Delhi, India. 2. R. K. Rajput, 'Strength of Materials', S. Chand & Company Ltd., New Delhi. 3. Bansal R.K. 'Strength of Materials'. 4. Surendra Singh, 'Strength of Materials', Vikas Publishing House Pvt. Ltd., New Delhi. 5. Norris, C.H. and Wilber, J. B. 'Elementary Structural Analysis' McGraw Hill. 6. Timoshenko, S. and Young, D. H., 'Elements of Strength of Materials', New York. 7. Punamia B.C.' Mechanics of materials' 8. R.S. Khurmi 'strength of materials' 					
Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/Aeronautical/Strength%20of%20Materials/course_strength%20of%20materials.pdf 2. https://nptel.ac.in/courses/105105108/ 3. https://nptel.ac.in/downloads/105105108/ 					

CE205/CEE205	FLUID MECHANICS LAB				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	0	0	2	1
Objectives	The main objective of this lab course is to make the students in better understanding of fluid mechanics phenomena such as variation of velocity and pressure, measurement of flow rate by various devices such as orifice meter, weir etc.				
<p>(Minimum 08 experiments out of the following)</p> <ol style="list-style-type: none"> 1. To determine experimentally the meta-centric height of a ship model. 2. To verify the Bernoulli's equation experimentally. 3. To verify the Impulse Momentum equation experimentally. 4. To plot flow net using the Hele-shaw apparatus. 5. To calibrate an orifice meter and study the variation of the coefficient of discharge with the Reynolds number. 6. To calibrate an venturimeter and study the variation of the coefficient of discharge with the Reynolds number. 7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number. 8. To study the velocity distribution in a circular pipe 9. To calibrate a given V-notch and Rectangular notch and determine the coefficient of discharge. 10. To study the variation of friction factor 'f', for turbulent flow in commercial pipes. 11. To determine the loss coefficients for the pipe fittings. 12. To study the behaviour of forced vortex motion. 					
<p>References:</p> <ol style="list-style-type: none"> 1. Lab Manual Provided by the Department. 2. Modi P.N. and Seth S.N., "Hydraulics and Fluid Mechanics", Standard Book House, Delhi, India. 3. Shames, "Mechanics of Fluids", McGraw-Hill, Auckland, N. Land. 4. Garde R.J., "Fluid Mechanics" RPH, Roorkee, India. Additional Learning Source. 5. Streete V.L.R, "Fluid Mechanics", McGraw-Hill, N.Y., USA. 					

CE206/CEE206	BASIC SURVEY FIELD WORK				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	0	0	2	1
Objectives	<ol style="list-style-type: none"> 1. To apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying. 2. To use techniques, skills, and modern engineering tools necessary for engineering practice. 3. To use techniques, skills, and modern engineering tools necessary for engineering practice. 4. To function as a member of a team. 				
<ol style="list-style-type: none"> 1. Ranging and taking offset along a survey line. 2. To find out the reduced level of given points using Dumpy level by height of collimation method. 3. Study of Auto level and find out the reduced levels of given points by rise and fall method. 4. To perform fly leveling with a level. 5. To draw the longitudinal and cross sectional profiles along a given route. 6. Study and use of transit theodolite and total station. 7. Measurement of a horizontal angle by Repetition method using transit theodolite. 8. Measurement of a horizontal angle by reiteration method using transit theodolite 9. Determination of the Tacheometric constants of a given Theodolite. 10. To determine the bearing of a given traverse using prismatic compass and plotting of the traverse. 11. Determination of elevations of a given point. 					
References: <ol style="list-style-type: none"> 1. Lab Manual Provided by the Department. 2. Kanetkar, T. P., "Surveying and Levelling" Vol I and II, Pune Vidyarthi Griha Prakashan, Pune, India. 3. Punmia, B. C., "Surveying Vol I and II" Laxmi Publications, Delhi, India. 					

CE207/CEE207	BUILDING PLANNING AND ENGINEERING DRAWING				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	0	0	2	1
Objectives	To make the students understand the basic concept of engineering drawings with the help of Drawing sheets and Auto Cadd System.				
<ol style="list-style-type: none"> 1. Symbols Used in Civil Engineering Drawing. 2. Brick Masonry Bonds. 3. Panelled Door (Plan, Section & Elevation). 4. Glazed Window (Plan, Section & Elevation). 5. Staircase (Plan, Section & Elevation). 6. Comprehensive Drawing of Building Plan, Section & Elevation). 7. Electrical Drawing of a Building. 8. Plumbing and Sanitary Drawing of a Building. 9. Preparation of Plan for a residential building using Drawing Sheet along with AUTO CADD system. 					
References: <ol style="list-style-type: none"> 1. Lab Manual Provided by the Department. 2. Bhavikatt S. S. "Building Planning and Drawing" I K International Publication Pvt. Ltd. 3. Rangwala, "CIVIL ENGINEERING DRAWING" K.K. Publication India. 4. Verma B.P, " Civil Engineering Drawing & House Planning" Khanna Publishers. 					

CE208/CEE208	MATERIAL TESTING LAB				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	0	0	2	1
Objectives	The objective of this course is to understand the characteristics and behavior of brick and steel used in buildings and infrastructure.				
<p>BRICKS:</p> <ol style="list-style-type: none"> 1. Water absorption test 2. Dimension tolerance 3. Compressive strength 4. Efflorescence Test <p>STEEL:</p> <ol style="list-style-type: none"> 5. Hardness test 6. Impact Test 7. Torsion test 8. Tensile Strength test 9. Double Shear test 					
<p>References:</p> <ol style="list-style-type: none"> 1. Lab Manual Provided by the Department. 2. Neville, A.M., "Properties of Concrete", Longman, India. 3. Jha. J. &Sinha S.K. ,"Building Construction", Khanna Publishers, Delhi. 4. Arora,S.P&Bindra S.P.," A text book of building Construction", DhanpatRai& Sons.,Delhi. 5. Singh Surendra,"Engineering Materials", Konark Publishers Pvt. Ltd. 					

CE209/CEE209	HYDRAULIC & HYDRAULIC MACHINES				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE201/ CEE201	CE314/CEE314	3	1	0	4
Objectives	Students are expected to realize the importance of Hydraulics & Hydraulic Machines and its application in the field of Civil Engineering.				
Unit-I	Introduction & Uniform Flow				08 Hrs
<p>Introduction: Difference between open channel flow and pipe flow, geometrical parameters of a channel, continuity equation.</p> <p>Uniform Flow: Chezy's and Manning's Equations for uniform flow in open channel, velocity distribution, most efficient channel section.</p>					
Unit-II	Energy and Momentum Principles				08 Hrs
<p>Energy and Momentum Principles: Critical depth, concept of specific energy and specific force, application of specific energy principle for interpretation of open channel phenomenon, flow through vertical and horizontal contractions.</p>					
Unit-III	Non-uniform Flow in Open Channel				08 Hrs
<p>Non-uniform flow in open channel: Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods, flow in curved channel.</p>					
Unit-IV	Hydraulic Jump & Hydraulic Pumps				08 Hrs
<p>Hydraulic Jump, Surges, Water Waves: Classical hydraulic Jump, evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, equation of motion for unsteady flow, open channel surge, celerity of the gravity wave, deep and shallow water waves.</p> <p>Hydraulic Pumps: Rotodynamic pumps, basic equations, axial and mixed flow pumps, cavitation in pumps, characteristic curves.</p>					
Unit-V	Hydraulic Turbines				08 Hrs
<p>Hydraulic Turbines: Introduction, rotodynamic machines, Pelton turbine, equation for jet and roter size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, head on reaction turbine, basic equation for type, head on reaction turbine, basic equation for rotodynamic machines, similarity law and specified speed, cavitations, characteristic curves.</p>					
<p>References:</p> <ol style="list-style-type: none"> 1. K. Subramanya: Flow in Open Channels, Tata McGraw Hills, 2014. 2. V.T. Chow: Open Channel Hydraulics, Blackburn Press, 2009. 3. K. Rang Araju: Open Channel Flow, McGraw Hill Education, 2001. 4. Madan Mohan Das: Open Channel Flow, PHI Learning Private Limited, 2008. 5. Grade, R.J and A.G Mirajgaoker, 'Engineering Fluid Mechanics (including Hydraulic Machines), Second Edition, Nem Chand and Bros., Roorkee, 1983. 6. R. K. Bansal, 'Fluid Mechanics and Hydraulic Machines', Laxmi Publication, New Delhi 2007. 7. R.K. Rajput, 'Fluid Mechanics and Hydraulic Machines', S.Chand Publication, New Delhi 2002. <p>Web links to e-learning:</p> <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105106114/ 2. https://nptel.ac.in/courses/105107059/6 3. https://nptel.ac.in/courses/105103021/ 4. https://nptel.ac.in/courses/105103096/2 					

CE210/CEE210	ADVANCE SURVEYING				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE202/CEE202	NIL	3	1	0	4
Objectives	1. To learn about the principles involved in the advanced surveying instruments. 2. To learn about the process of establishment of horizontal control points necessary for carrying out survey of the area and also learn about theory of error. 3. To learn about the techniques of layout: (a) curves in transportation and irrigation engineering (b) building, culvert etc.				
Unit-I	Plane Table Surveys				08 Hrs
Plane Table Surveys: Principles, advantages and disadvantages, plane table equipment, Use of Telescopic Alidade and Indian Patterns Tangent Clinometer, different methods of plane table surveying, resection- two and three point problems, Field work in plane table surveying and contouring.					
Unit-II	Trilateration and Triangulation				08 Hrs
Trilateration and Triangulation: Principle of Trilateration, EDM instrument and their uses, reduction of observation, principle and classification of Triangulation system, Triangulation chains, strength of figures, station marks and signals, satellite station, intersected and resected points, Field work- Reconnaissance, intervisibility of station, angular measurement, base line measurement and its extension, adjustment of field observation and computation of coordinates.					
Unit-III	Theory of Errors				08 Hrs
Adjustment Computations: Weighting of observations, treatment of random errors, probability equation, normal law of errors, most probable value and measures of precision, propagation of errors and variances, most probable value, principle of least square, observations and correlative normal equations, adjustment of triangulation figures and level nets.					
Unit-IV	Curves				08 Hrs
Curves: Classification of curves, elements of circular, transition and vertical curves, theory and methods of setting out simple, transition and vertical curves, special field problem.					
Unit-V	Project Surveys				08 Hrs
Project Surveys: General requirements and specifications for engineering project surveys, Reconnaissance's, preliminary and locations surveys for highways, railways and canals. Correlation of surface and underground surveys in case of culverts, bridges and tunnels. Principles and practice of hydrographic surveys, Layout of culverts, canals, bridges and buildings. Field Astronomy: Astronomical terms, coordinate systems, spherical trigonometry, Astronomical Triangle, relationship between coordinates.					
References: <ol style="list-style-type: none"> 1. Agor, R., "Surveying", vol. II & III Khanna Publications, Delhi, 1995. 2. Arora, K. R., "Surveying", vol. II & III Standard Publishing House, Delhi, 1993. 3. Bannister, A. and Baker, R., "Solving Problems in surveying". Longman Scientific Technical, U.K, 1994. 4. Kennie, T.J.M. and Petrie,G., "Engineering Surveying Technology", Blackie & Sons Ltd., London, 1990. 5. Punmia, B.C., "Surveying", vol. II & III , Laxmi Publications, New Delhi, 1996 					
Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105107158/ 					

CE211/CEE211	CONCRETE TECHNOLOGY				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	1. To understand concepts related to Concrete technology which involves types and property of concrete. 2. To know the procedure & significance of test on concrete and mix design				
Unit-I	Introduction of Cement Concrete				08 Hrs
Concrete as a Building Material and its Gradients Cement: Manufacture of Portland cement, its composition. Hydration of cement, physical and chemical properties, concept of strength development, Gel space ratio, power's Law, Gel structure [4] Testing of cement for general physical and chemical properties as per BIS specifications.					
Unit-II	Types of Cement				08 Hrs
Different types of cement such as Slag cement, Portland Pozzolana cement and high Alumina cement, their characteristics, composition, use and properties, aggregates and testing of aggregates, classification source, physical and mechanical properties. Testing of aggregates for physical and mechanical properties					
Unit-III	Tests on Fresh Concrete and Hardened Concrete				08 Hrs
Proportioning of concrete, operation involved in concrete production. Workability, factors affecting workability, measurement of workability, problem of segregation, bleeding and Laitance, NDT(Rebound hammer, PUNDIT) methods [8]					
Unit-IV	Mix Design				08 Hrs
Concrete Mix Design: Principle and methods, Statistical quality control, concrete rheology, maturity concept, IS code method, ACI code method [6] Admixture in concrete: Introduction, functions, classification, and IS specification.					
Unit-V	Special Concrete				08 Hrs
Special Concrete: Light weight concrete. High density concrete. Sulphar Impregnated concrete, polymer concrete, lime concrete, constituents and uses. High Strength Concrete, Fibre Reinforced Concrete					
References: <ol style="list-style-type: none"> Rai Mohan and Jai Singh M.P. "Advances in Building Materials and Construction", CBRI, Roorkee. Civil Engineering Materials, "Technical Teachers" Training Institute, Chandigarh, Tata McGraw Hill Publishing Company Ltd., New Delhi. Spence RJS and Cook DJ- "Building Materials in Developing Countries", John Willey and Sons. Shetty M.S, "Concrete Technology, Theory and practices", S. Chand & Company Ltd., New Delhi. Neville A.M., Properties of Concrete, Pitman Publishing Company. Gambhir M.L., "Concrete Technology", - Tata McGraw Hill Publishing Company Ltd., New Delhi. Gambhir M.L, "Concrete Manual ", Dhanpal Rai & Sons, Delhi. 8. SP: 23, BIS Publication. 					
Web links to e-learning: <ol style="list-style-type: none"> https://nptel.ac.in/courses/105102012/ https://nptel.ac.in/courses/105104030/ 					

CE212/CEE212	STRUCTURAL ANALYSIS - I				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE204/CEE204	NIL	3	1	0	4
Objectives	1. To make aware student about the classification structure. 2. To develop understanding of basic principles and methods of analysis for rolling loads, arches, unsymmetrical bending for determinate structure etc. 3. To apply energy methods for analyzing simple beams and frames for given load and support condition.				
Unit-I	Classification of Structures				08 Hrs
Classification of Structures, Types of structural framework, stress resultants, degrees of freedom per node, Static and Kinematic determinacy for beam trusses and building frames, Type of supports. Classification of Pin jointed determinate trusses, Analysis of determinate plane and space trusses, method of Tension co-efficient.					
Unit-II	Rolling Loads				08 Hrs
Rolling loads, influence lines for determinate beams and trusses, Absolute maximum bending moment and shear force, Muller-Breslau's principal & its applications for determinate structures					
Unit-III	Arches				08 Hrs
Arches, Types of Arches, Analysis of Arches, Linear arch, Eddy's theorem, Analysis of three hinged arch, spandrel braced arch, moving load & influence lines diagram for three hinged arches.					
Unit-IV	Strain Energy				08 Hrs
Strain Energy of deformable systems, Maxwell's reciprocal & Betti's theorem, Castigliano's first theorem, unit load methods for determinate structures.					
Unit-V	Unsymmetrical Bending				08 Hrs
Unsymmetrical bending, location of neutral axis, computation of stresses and deflection, Shear Centre and its location for common structural section. Bending of curved bars in plane of bending, stresses in bars of small & large initial curvatures.					
References: <ol style="list-style-type: none"> 1. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill. 2. Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill. 3. Jain, O.P. and Jain, B.K., "Theory & Analysis of Structures". Vol. I & II Nem Chand. 4. Coates, R.C., Coutie, M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson, 1980. 5. Jain, A.K., "Advanced Structural Analysis", Nem Chand & Bors, Roorkee, India 1996. 6. Jain O.P & Arya A.S., "Theory of Structures" Vol. II. New Chand Bors., Roorkee 1976. 7. Kinney, J.S., "Indeterminate Structural Analysis" McGraw Hill Book Company, 1957. 8. Theory of structures Vol. II Vazirani and Ratwani 					
Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/downloads/105101085/ 2. https://nptel.ac.in/downloads/105105109/ 3. https://nptel.ac.in/youtube.com/watch?v=qhEton-EEOW 4. https://nptel.ac.in/courses/105105166/ 					

CE213/CEE213	HYDRAULIC & HUDRAULIC MACHINES LAB				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	CE209/CEE209	0	0	2	1
Objectives	1. Students are expected to hand on experience different hydraulic machine. 2. Also understand characteristics of flow and hydraulic machines.				
<ol style="list-style-type: none"> 1. To determine the Manning's coefficient of roughness 'n' for the bed of a given flume. 2. To study the velocity distribution in an open channel and to determine the energy and momentum correction factors. 3. To study the flow characteristics over a hump placed in an open channel. 4. To study the flow through a horizontal contraction in a rectangular channel. 5. To calibrate a sharp-crested rectangular and triangular weirs. 6. To calibrate a broad-crested weir and study the pressure distribution on the upstream face of the weir. 7. To calibrate a Venturiflume. 8. To study the characteristics of free hydraulic jump. 9. To study the flow over a free overfall in an open channel and to determine the end depth. 10. To study rotodynamic pumps and their characteristics. 11. To study rotodynamic turbines and their characteristics. 					
References: <ol style="list-style-type: none"> 1. Lab manual provided by the department 2. Streeter, V.L. "Fluid Mechanics", Mc Graw-Hill, N.Y, USA. 3. Garde, R.J. "Fluid Mechanics" RPH, Roorkee. 4. Jain, A.K. "Mechanics of fluids", Khanna Publisher., Delhi. Additional Learning Source. 5. Shames, "Mechanics of fluids" Mc Graw-Hill (Int. St. ed.) Auckland, NZ. 					

CE214/CEE214	ADVANCE SURVEY FIELD WORK				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	CE210/CEE210	0	0	2	1
Objectives	<ol style="list-style-type: none"> 1. To apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying. 2. to make student competent enough to, carry out triangulation, topographic mapping, layout of building plans & curves on ground 3. To use techniques, skills, and modern engineering tools necessary for engineering practice. 4. To function as a member of a team. 				
<ol style="list-style-type: none"> 1. Setting up the plane table and plotting the given area by radiation method. 2. Setting up the plane table and plotting the given area by intersection method. 3. Traversing of the given area by plane table. 4. To solve three point problem by mechanical method. 5. To solve three point problem by graphical method. 6. To solve two point problem. 7. To carry out Triangulation and Trilateration of a given area 8. Layout a simple circular curve on the ground using tape by perpendicular offset method. 9. Layout a simple circular curve on the ground using tape by radial offset method. 10. Layout a simple circular curve on the ground using two theodolite method. 11. Layout a building on the ground. 12. To plot the details as well as contours (topographic mapping) of area. 13. Demonstration and working of Electronic Total Survey Station. 					
<p>References:</p> <ol style="list-style-type: none"> 1. Lab Manual Provided by the Department. 2. Kanetkar, T. P., "Surveying and Levelling" Vol I and II, Pune Vidyarthi Griha Prakashan, Pune, India. 3. Punmia, B. C., "Surveying Vol I and II" Laxmi Publications, Delhi, India. 					

CE215/CEE215	CONCRETE TECHNOLOGY LAB				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	0	0	2	1
Objectives	1. To understand the properties of ingredients of concrete. 2. To study the behavior of concrete at its fresh and hardened state.				
<p>CEMENT:</p> <ol style="list-style-type: none"> 1. Normal Consistency of cement. 2. Initial & final setting time of cement. 3. Compressive strength of cement. 4. Fineness of cement by air permeability method. 5. Tensile strength. <p>COARSE AGGREGATE:</p> <ol style="list-style-type: none"> 6. Water absorption of aggregate. 7. Sieve Analysis of Aggregate 8. Specific gravity & bulk density. 8. Grading of aggregates. <p>FINE AGGREGATE:</p> <ol style="list-style-type: none"> 9. Sieve analysis of sand. 10. Silt content of sand. 11. Bulking of sand. <p>TEST ON FRESH CONCRETE:</p> <ol style="list-style-type: none"> 12. Slump Test. 13. Compaction factor test. 14. Vee Bee Consistometer test. <p>TESTS ON HARDENED CONCRETE:</p> <ol style="list-style-type: none"> 15. Compressive Strength test. 16. Flexural Strength test. 17. Non-Destructive Test (Rebound Hammer and PUNDIT) 					
<p>References:</p> <ol style="list-style-type: none"> 1. Lab Manual Provided by the Department. 2. Neville, A.M. and Brooks J.J. "Concrete Technology", Longman, India. 3. Shetty, M.S., "Concrete Technology", SCC Ltd., New Delhi Additional Learning Source. 4. Gambhir, M.L., "Concrete Technology", TMH, New Delhi, India. 					

SYLLABUS

OF

B. TECH

OF

III YEAR

B. TECH. (CBCS)

**DEPARTMENT OF CIVIL
ENGINEERING**

**INTEGRAL UNIVERSITY
LUCKNOW**

STUDY AND EVALUATION SCHEME

Branch: Civil Engineering

Year – III, Semester – V

S. No.	Course Category	Code No	Name of Subject	Periods			Credits C	Evaluation Scheme			Subject Total	
				L	T	P		Sessional Exam				Exam ESE
							CT	TA	Total			
1	DC	CE301	Structural Analysis-II	3	1	0	4	25	15	40	60	100
2	DC	CE302	Design of Reinforced Concrete Structure-I	3	1	0	4	25	15	40	60	100
3	DC	CE303	Transportation Engineering	3	1	0	4	25	15	40	60	100
4	DC	CE304	Geotechnical Engineering-I	3	1	0	4	25	15	40	60	100
5	DC	CE305	Engineering Geology	3	1	0	4	25	15	40	60	100
6	DC	CE306	Water Resources Engineering	3	1	0	4	25	15	40	60	100
PRACTICAL / DRAWING / DESIGN												
7	DC	CE307	Structural Analysis Lab	0	0	2	1	30	30	60	40	100
8	DC	CE308	Transportation Engineering Lab	0	0	2	1	30	30	60	40	100
9	DC	CE309	Quantity Surveying & Estimation	0	0	2	1	30	30	60	40	100
Total				18	6	6	27					900

L – Lecture; **T** – Tutorial; **P** – Practical; **C** – Credits; **CT** – Class Test; **TA** – Teacher Assessment

Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

DC – Departmental Core

DE – Departmental Elective

OE – Open Elective

STUDY AND EVALUATION SCHEME

Branch: Civil Engineering

Year – III, Semester – VI

S. No.	Course Category	Code No	Name of Subject	Periods			Credits C	Evaluation Scheme			Subject Total	
				L	T	P		Sessional Exam		Exam ESE		
							CT	TA	Total			
THEORY SUBJECT												
1	DC	CE310	Environmental Engineering-I	3	1	0	4	25	15	40	60	100
2	DC	CE311	Design of Reinforced Concrete Structure-II	3	1	0	4	25	15	40	60	100
3	DC	CE312	Geotechnical Engineering-II	3	1	0	4	25	15	40	60	100
4	DE	CE313-CE317	Departmental Elective-I	3	1	0	4	25	15	40	60	100
5	DE	CE320-CE324	Departmental Elective-II	3	1	0	4	25	15	40	60	100
6	OE	-	Open Elective	3	1	0	4	25	15	40	60	100
PRACTICAL / DRAWING / DESIGN												
8	DC	CE327	Environmental Engineering Lab-I	0	0	2	1	30	30	60	40	100
9	DC	CE328	Geotechnical Engineering Lab	0	0	2	1	30	30	60	40	100
10	DC	CE329	Survey Camp	0	0	0	1	0	0	100	0	100
Total				18	6	4	27					900

L – Lecture; T – Tutorial; P – Practical; C – Credits; CT – Class Test; TA – Teacher Assessment

Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

DC – Departmental Core

DE – Departmental Elective

OE – Open Elective

List of Departmental Electives (I & II)

Departmental Elective - I

CE313/CEE313	Traffic Engineering
CE314/CEE314	Open Channel Flow
CE315/CEE315	Matrix Methods of Structural Analysis
CE316/CEE316	Sustainable Construction Techniques
CE317/CEE317	Ground Improvement Techniques

Departmental Elective - II

CE320/CEE320	Dock Harbor Tunnel Engineering
CE321/CEE321	Design of Hydraulic Structures
CE322/CEE322	Maintenance & Rehabilitation of Structures
CE323/CEE323	Occupational Health and Safety Engineering
CE324/CEE324	Principles of Town Planning and Architecture

CE301/CEE301	STRUCTURAL ANALYSIS – II				
Pre-requisite	Co-Requisite	L	T	P	C
CE212/ CEE212 Recommended	NIL	3	1	0	4
Objectives	To develop an understanding of theory and application of the various advanced methods of structural analysis. To develop the skill to deals with the problems of moving loads in the structures and their analysis techniques.				
Unit-I	Analysis of Linear and Two dimensional Structures				08 Hrs
Analysis of fixed beam, continuous beam and simple frames with or without translation of joints. Slope deflection method, Moment distribution method, strain energy method.					
Unit-II	Two Hinged Arches & Influence Line Diagram for Indeterminate Structures				08 Hrs
Muller-Breslau's principle and its application for drawing influence line for Indeterminate beams. Analysis of two hinge arches, Influence line diagram for maximum bending moment, shear force and thrust.					
Unit-III	Analysis of Suspension Cable & Bridge Girders				08 Hrs
Suspension bridges, Analysis of cable with concentrated and continuous loadings, Analysis of two and three hinge stiffening girder, Influence line diagram for maximum bending moment and shear force in the stiffening girders.					
Unit-IV	Matrix Methods of Structure Analysis				08 Hrs
Basics of force and displacement matrix, matrix method for the analysis of beams and frames.					
Unit-V	Plastic Analysis of Structures				08 Hrs
Basics of plastic analysis, Application of static and kinematics theorem, Plastic analysis of beams and frames.					
References:					
<ol style="list-style-type: none"> 1. Theory of Structures by Pundit and Gupta, Vol. I & II, McGraw Hill Publication, New Delhi, First Edition, 2000 2. Basic structural analysis by CS Reddy, TMH publishing Company Ltd. New Delhi, 3rd Edition, 2010 3. Theory of Structures by S. Ramamrutham and R. Narayan, Dhanpat Rai Publishing Company, Delhi, 2nd Edition 2015 4. Analysis of statically indeterminate structures P. Dayaratnam. Affiliated East-West press Pvt. Ltd. 5. Indeterminate structural Analysis C.K.Wang, McGraw Hill Publications, 5th Edition 2014 6. Structural Analysis (Matrix Approach) by Pundit and Gupta, McGraw Hill Publication, New Delhi. 2nd edition, 2008. 7. Theory of structures Vol. II Vazirani and Ratwani, Sixteenth edition (2017) 8. Fundamentals of Structural Mechanics and Analysis by M.L Gambhir, PHI Learning Private Limited, New Delhi. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105104102/ 					

CE302/CEE302	DESIGN OF REINFORCED CONCRETE STRUCTURE-I				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE204/ CEE204	NIL	3	1	0	4
Objectives	To understand the Basic concept and procedure of Designing Reinforced Concrete Structural Components.				
Unit-I	Attributes of Structural Design				08 Hrs
Material properties of RCC Making materials, Basic design approach, Working stress & Limit state method of design. Assumptions, Analysis and Design of a rectangular singly and doubly reinforced section by Working stress design method.					
Unit-II	Limit State Design of Beams				08 Hrs
Assumption in Limit state design method, Codal recommendations, Design of a rectangular singly & doubly reinforced section, T & L sections by limit state method.					
Unit-III	Behavior of RC Beams in Shear				08 Hrs
Shear strength of beam with and without shear reinforcement, Minimum & maximum shear reinforcement, Design of beam in shear using Limit state method. Nature of bond between steel and concrete, Concept of development length and anchorage, Calculation of development length using Limit state methods.					
Unit-IV	Limit State Design of Slab & Stair				08 Hrs
One way solid slabs, Simply supported and continuous. Two way slabs: Simply supported and continuous. Types of RCC stairs, loads and load effects on stairs, design of doglegged stairs. Introduction to Short term, long term deflections & Cracks in RCC.					
Unit-V	Limit State Design of Compression Members				08 Hrs
Classification of compression members, Codal provisions relating to design of RC columns, Effective length of RC column, Minimum eccentricity, Design of Axially loaded (tied and helically reinforced) short columns by Limit state method.					
References:					
<ol style="list-style-type: none"> 1. A.K. Jain “Reinforced concrete design, limit state Method”, Nem Chand & Bros.; 7th Edition 2012 2. S.Unnikrishna. and Devdas Menon, “Reinforced concrete design”, McGraw Hill Education; 3rd Edition 2009 3. B.C. Punmia and A.K. Jain “Limit State Design of Reinforced Concrete”, Laxmi Publications, 1st Edition Reprint 2007 4. Sayal I.C and Goel A.K., “Reinforced Concrete Structures” S Chand & Company; 4th Edition 2007 5. IS 456-2000 Indian Standard “Plain & Reinforced Concrete-code of practice”, BIS, New Delhi. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. http://nptel.ac.in/courses/105105105/ 2. http://nptel.ac.in/downloads/105105104/ 					

CE303/CEE303	TRANSPORTATION ENGINEERING				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	To provide knowledge of design and construction of roads, railways, airports and harbours.				
Unit-I	Introduction and Geometric Design of Highways				08 Hrs
Modes of Transportation, History of road development road types and patterns. Introduction to highway alignment and engineering surveys; Geometric design of highways –cross-sectional elements, sight distances, horizontal and vertical alignments.					
Unit-II	Pavement Design and Highway Materials				08 Hrs
Design factors for flexible and rigid pavements; Design of flexible pavement by CBR method; Design of rigid pavement: Westergaard's theory, load and temperature stresses, critical combination of stresses, joints.Highway materials - desirable properties and quality control tests; Design of bituminous paving mixes.					
Unit-III	Traffic Engineering				08 Hrs
Traffic flow studies, speed studies, travel time: delay study and O-D study, PCU, peak hour factor, Microscopic and macroscopic parameters of Traffic flow, Fundamental relationships, Traffic Simulation: An introduction to microsimulation; Control devices, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service.					
Unit-IV	Railway Engineering				08 Hrs
Introduction to Railways:Permanent way, capacity of railway track, cross-section of subgrade. Track geometry, gradient, horizontal curves, vertical curves, super elevation and safe speed on curve, widening of tracks, cant deficiency, negative super elevation and compensation for curvature on gradients, tractive resistant and tractive power. Point and crossing: Element of a turnout, detail of a switch and crossing numbers and angles of crossings, design of a turnout.					
Unit-V	Airport and Harbour				08 Hrs
Aircraft characteristics affecting airport planning, Site selection and design, airport layout, runway orientation, wind rose diagram.Airport runway length and corrections, taxiway and exit taxiway design. Harbours, layout and port facilities, Break waters, Jetties, wharves, navigation aids. .					
References:					
<ol style="list-style-type: none"> 1. Dr. S.K. Khanna, M.G Arora and S.S Jain, Airport Planning & Design, Nem Chand & Bros., Roorkee, 5th Edition 2012 2. SK Khanna & CG Justo, Highway Engineering, Nem Chand and Brothers, Roorkee, 4th Reprint 2015 3. L.R. Kadiyali, Highway Engg., Kanna Tech Publications, Delhi 6th Edition, 2014 4. Specification for Roads & Bridges by Ministry of Road Transport & Highways and Indian Road Congress, 2014 5. Satish Chandra and M.M Agarwal, Railway Engineering, Oxford University Press, Delhi, 4th Edition 2014. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. http://nptel.ac.in/downloads/105101008/ 2. http://nptel.ac.in/courses/105105107/ 3. http://nptel.ac.in/courses/105107123/ 					

CE304/CEE304	GEOTECHNICAL ENGINEERING- I				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	To introduce students to soil mechanics, understand soil behavior with loading and time.				
Unit-I	Introduction to Soil and Index Properties				08 Hrs
Engineering Geology of Soil and its formation, Preliminary definitions of Soil Properties, phase diagram, inter-relationship, Index properties of Soil. Classification of Soils: Classification of soil systems – Particle size classification, Textural classification, AASHTO classification, Unified soil classification and Indian soil classification.					
Unit-II	Permeability in Soil				08 Hrs
Soil Water: Types of soil water, Capillarity in soils, Permeability of soils, Darcy's law, Determination of permeability of soils, Permeability of stratified soils, Seepage velocity, flow net, Absolute coefficient of permeability, Factors affecting permeability, Effective stress principle- Effective stress under different field conditions- Seepage pressure-Quick sand condition.					
Unit-III	Stresses in Soil				08 Hrs
Stresses in soils: Normal and shear Stresses on a plane, Stresses due to applied loads, Boussinesq's solution for a point load, line load, strip load, uniformly loaded circular and rectangular areas, Isobar and pressure bulb concept, stress distribution on horizontal and vertical planes, Newmark's chart and its application, contact pressure.					
Unit-IV	Compaction and Consolidation				08 Hrs
Soil structure. Compaction of soil – Theory of compaction, laboratory compaction tests, optimum moisture content and zero air void line, Field methods and compaction control. Compressibility and Consolidation: Virgin compression curve, Normal and Over Consolidated soils, Over Consolidation Ratio, Terzaghi's one dimensional consolidation theory, Laboratory consolidation test. Determination of coefficient of consolidation by log of time fitting and square root of time fitting methods, Consolidation settlement.					
Unit-V	Shear Strength				08 Hrs
Introduction of Shear Strength of Soil: State of stress at a point, Mohr's stress circle. Shear strength of soil. Mohr-Coulomb failures envelop. Direct, Triaxial, Unconfined and Vane shear tests, principles of drained and undrained tests, Strength of loose and dense sands, pore pressures.					
References:					
<ol style="list-style-type: none"> 1. Gopal Ranjan and A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age International (P) Ltd, 2nd Edition (2005), New Delhi 2. K R Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Dist., 2nd Edition 2009. 3. V.N.S.Murty, "Soil Mechanics and Foundation Engineering", Sai Kripa Technical Consultants, 1st edition 2009. 4. By B. C. Punmia, Ashok Kumar Jain, "Soil Mechanics and Foundations", Laxmi Publications Ltd., 16th edition (2017), New Delhi. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105105168/ 2. https://nptel.ac.in/courses/105101201/ 					

CE305/CEE305	ENGINEERING GEOLOGY				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	To provide knowledge of rocks ,minerals, internal structure of earth, ground water condition, soil formation and tunneling				
Unit-I	General Geology				08 Hrs
Introduction to the Earth Sciences. Elementary idea about the internal structure of the earth. The elementary knowledge and demonstration of the physical properties of the common rock forming minerals. Introduction and demonstration to the major group of rocks, mode of origin classification and properties.					
Unit-II	Structural Geology, Earthquake and Landslides				08 Hrs
Theory and demonstration of Strike and Dip, Out crops, volcanoes, overlaps, inliers and outliers types and classification of folds, faults, joints, unconformities Classifications, causes and effects of Earthquakes and Landslides, seismic curve, seismograph, seismogram, seismic problems of India, seismic zones of India, case histories.					
Unit-III	Geological Investigation, Geology of Dams and Reservoirs				08 Hrs
Interpretation of geological maps, use of aerial maps in geological surveying, Topographic maps, Geological Cross-section, outcrop patterns. Geophysical methods as applied to civil engineering for subsurface analysis. Types of dams, preliminary and detailed geological investigation for a dam site, important International and Indian examples of failure of dams and their causes, factors affecting the seepage and leakage of the reservoirs and the remedial measures.					
Unit-IV	Ground Water Geology				08 Hrs
Ground water, zones of ground water, water table and perched water table, ground water provinces of India, water bearing properties of rocks, springs, selection of a site for well sinking and groundwater investigations. Concept of water shed management, Ground water Pollution, Impact of mining activity on ground water.					
Unit-V	Soil formation, Rock Mechanics and Tunnelling				08 Hrs
Soil profile and classification, engineering properties of soil. Purposes of tunnelling and geological problems connected with tunnelling, geological consideration in road alignment, roads in complicated regions, problems after road construction, geology of bridge sites					
References: <ol style="list-style-type: none"> 1. Subinoy Gangopadhyay “Engineering Geology” Oxford University Press (2013). 2. Parbin Singh. “Engineering and General Geology”, Katson Publishing House (2008). 3. P.K.Mukerjee, “A text book of Geology”, Calcutta, Word Publisher (14 January 2013). 4. K.M.Bangar “Principle of Engineering Geology”, Standard publishers Distributors (2009). Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105105106/ 2. https://web.viu.ca/earle/geol111/lecture-notes.htm 					

CE306/CEE306	WATER RESOURCES ENGINEERING				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE201/ CEE201	NIL	3	1	0	4
Objectives	Students are expected to realize the importance of water resources and its application in Civil engineering.				
Unit-I	Hydrology				08 Hrs
Hydrologic cycle, Precipitation types and forms, rainfall and its measurement, rain gauges, rain gauge network, presentation of rainfall data, computation of mean rainfall using arithmetic mean, Thiessen polygon and Isohyetal methods , estimation of missing rainfall Infiltration – process, infiltration indices and Horton’s equation; Evaporation and Evapotranspiration – Pan evaporation, empirical equations for estimating evaporation and evapotranspiration.					
Unit-II	Runoff and Hydrographs				08 Hrs
Runoff- definition, types, catchment characteristics, factors affecting runoff, methods of runoff estimation, flow duration curve and flow mass curve, stage-discharge relationship and rating curve Hydrograph Analysis: Flood hydrograph, Components of hydrograph, base flow separation, direct runoff hydrograph, Unit hydrograph theory, derivation of unit hydrograph and its duration, S-hydrograph and instantaneous unit hydrograph, Derivation of unit hydrograph for ungauged catchments using Snyder’s method.					
Unit-III	Analysis of Floods				08 Hrs
Peak discharge estimation methods, Concepts of return period, flood frequency analysis, Gumbel’s and Log-Pearson Type-III distributions, Flood Routing: Concepts of flow routing, hydraulic and hydrologic routing, Reservoir routing, Channel routing, Muskingum method of channel routing and flood forecasting. Flood control management.					
Unit-IV	Ground Water Hydrology				08 Hrs
Zones of ground water ,types of aquifers, aquiclude, aquifuge, aquitard, confined and unconfined aquifers, perched aquifer, aquifer properties-specific storage, specific capacity, transmissivity, Theims and Dupit theory for yield calculation in Confined and unconfined aquifers, Darcy’s law, types of wells,interference of wells, well losses, recuperation test for yield determination from an open well.					
Unit-V	Irrigation Engineering				08 Hrs
Irrigation: necessity, Types of irrigation , advantages and disadvantages of irrigation, irrigation efficiencies, Consumptive use and its determination, water requirement of various crops, Duty, Delta, Base period and crop period, relationship between base period, duty and delta. Soil moisture: Hygroscopic water, capillary water, gravity water, saturation capacity, field capacity, permanent wilting point.					
References:					
<ol style="list-style-type: none"> 1. Subramanya K., Engineering Hydrology, Tata McGraw Hill (2016) 2. S.K Garg, Irrigation Engineering and Hydraulic structures, Khanna publishers(2016) 3. P. Jaya Rami Reddy , A Textbook of Hydrology, Laxmi Publications; Third edition (2016) 4. Punmia B.C. & Lal P.B., Irrigation and Water Power, Laxmi Publications(2016) 5. Dr. Modi P.N. Seth, Irrigation Water Resources & Water Power, Standard publishers(2016) 6. G.L.Asawa, Irrigation Engineering, Wiley Eastern(2016) 7. N N Basak ,Irrigation Engineering, McGraw Hill Education; 1st edition (1 July 2017). 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. https://gradeup.co/well-hydraulics-and-aquifers-i-ed587c01-975d-11e6-bf75-9c0e0d13dead 2. https://www.youtube.com/watch?v=fx1uUek3Iqg 3. http://nptel.ac.in/courses/105104103/1 					

CE307/CEE307	STRUCTURAL ANALYSIS LAB				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	Structural Analysis-II (CE-301)	0	0	2	1
<ol style="list-style-type: none"> 1. To determine flexural Rigidity (EI) of a given beam. 2. To verify Maxwell's Reciprocal Theorem. 3. To find horizontal thrust in a three hinged arch and to draw influence line diagrams for Horizontal Thrust and Bending Moment. 4. To find horizontal thrust in a two hinged arch and to draw influence line diagrams for Horizontal Thrust and Bending Moment. 5. To find carry over factor for the beam with far end fixed. 6. To find deflection of curved members 7. To find bar forces in a three member structural frames with pin jointed bar. 8. To find Critical loads in Struts with different end conditions. 9. To find forces in elastically Coupled Beam. 10. To find deflections in beam having unsymmetrical bending. 11. To determine the fatigue strength of mild steel specimen. 					
<p>References:</p> <ol style="list-style-type: none"> 1. Theory of Structures by Pundit and Gupta, Vol. I & II, McGraw Hill Publication, New Delhi, First Edition, 2000 2. Basic structural analysis by CS Reddy, TMH publishing Company Ltd. New Delhi, 3rd Edition, 2010 3. Theory of Structures by S. Ramamrutham and R. Narayan, Dhanpat Rai Publishing Company, Delhi, 2nd Edition 2015 4. Analysis of statically indeterminate structures P. Dayaratnam. Affiliated East-West press Pvt. Ltd. 5. Indeterminate structural Analysis C.K.Wang, McGraw Hill Publications, 5th Edition 2014 6. Structural Analysis (Matrix Approach) by Pundit and Gupta, McGraw Hill Publication, New Delhi. 2nd edition, 2008. 7. Theory of structures Vol. II Vazirani and Ratwani, Sixteenth edition (2017) 8. Fundamentals of Structural Mechanics and Analysis by M.L Gambhir, PHI Learning Private Limited, New Delhi. 					

CE308/CEE308	TRANSPORTATION ENGINEERING LABORATORY				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	Transportation Engineering (CE-303)	0	0	2	1
<ol style="list-style-type: none"> 1. To determine Crushing strength of a given Aggregate sample. 2. To determine Aggregate Impact Value of a given Aggregate sample. 3. To determine Abrasion Value of a given Aggregate sample. 4. To determine Angularity of a given Aggregate sample. 5. To determine Penetration Point of a given Bituminous sample. 6. To determine Softening Point of a given Bituminous sample. 7. To determine Flash and Fire Point of a given Bituminous sample. 8. To determine Stripping Value of a given Bituminous sample. 9. To determine Ductility of a given Bituminous sample. 10. To Perform Traffic Volume Study at a given Stretch of Road. 11. To Perform Traffic speed study given point of Road. 					
<p>References:</p> <ol style="list-style-type: none"> 1. Dr. S.K. Khanna, M.G Arora and S.S Jain, Airport Planning & Design, Nem Chand & Bros., Roorkee, 5th Edition 2012. 2. SK Khanna & CG Justo, Highway Engineering, Nem Chand and Brothers, Roorkee, 4th Reprint 2015. 3. L.R. Kadiyali, Highway Engg., Kanna Tech Publications, Delhi 6th Edition, 2014. 4. Specification for Roads & Bridges by Ministry of Road Transport & Highways and Indian Road Congress, 2014. 5. Satish Chandra and M.M Agarwal, Railway Engineering, Oxford University Press, Delhi, 4th Edition 2014. 					

CE309/CEE309	QUANTITY SURVEYING & ESTIMATION				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	0	0	2	1
<ol style="list-style-type: none"> 1. Importance of estimation, different types of estimates specifications general and detailed. 2. Methods of Estimation: General items of work for estimates units and measurement, method of accounting for the deduction of openings etc. 3. Detailed estimates of a single roomed and a two roomed residential building. 4. Analysis of rates: Definition of analysis of rates, Prime cost, Work charged establishment. 5. Quantity of materials per unit of work for major civil engineering items Resource planning through analysis of rates, market rates, P.W.D. Scheduled and cost indices for building material and labour. Public works Organization, M.E.S. Organization, India Railway Organization and concept of organizational set up for Public Work Execution. 					
<p>References:</p> <ol style="list-style-type: none"> 1. Dr. Rang Wala, Estimation, Costing & Valuation, Charator Publishing House Pvt. Ltd., 17th Edition 2015. 2. S.V Deodhar, Estimation, Costing & Valuation, Khanna Publishing, 6th Edition 2015. 					

CE310/CEE310	ENVIRONMENTAL ENGINEERING -I				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	To educate the students about the basic principles of water treatment processes and air pollution engineering.				
Unit-I	Water Quality Assessment				08 Hrs
Importance and necessity for planned water supplies, various types of Water demands, Per capita demand, Variations in demand, Design Periods & Population Forecast, Sources of water, Intakes for collecting surface water. Guideline Specification For Drinking Water Quality- IS-10500:2012, Indicator Organism.					
Unit-II	Sedimentation and Coagulation				08 Hrs
Water Treatment Concept, Screening, Settling operation, Plain Sedimentation. Coagulation and its Mechanism, Coagulants, Flocculation, Mechanism of Flocculation. Sedimentation aided with coagulation.					
Unit-III	Water Filtration and Softening				08 Hrs
Filtration: Theory, Types Of Filter, Mechanism and Operation Of Slow Sand, Rapid Sand And Pressure Filter. Disinfection: Methods of Disinfection, Kinetics of disinfection, Chlorination and Practices of Chlorination. Softening and its Methods, Calculation of Doses.					
Unit-IV	Storage and Distribution of Water				08 Hrs
Distribution System, Methods Of Distribution, Layouts Of Distribution Networks, Detection of Leakage in the Distribution Pipes, Pipe Network Analysis- Hardy-Cross Method, Equivalent Pipe Method. Appurtenances in The Distribution System. Plumbing System, House Water Connection, Different Cocks and Pipe Fittings.					
Unit-V	Air Pollution Engineering				08 Hrs
Air Pollution: Natural And Man-Made Air Pollution, Causes And Effect Of Air Pollution, Air Pollution Control Methods, Control Of Particulate Pollutants, Control Of Gaseous Pollutants.					
References:					
<ol style="list-style-type: none"> 1. S. K. Garg, Water Supply Engineering: Environmental Engineering v. 1, 29th Edition, Khanna Publication, 2013 2. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, Environmental Engineering, 1st Edition, McGraw Hill Education; 2013. 3. Gilbert M. Masters, Wendell P. Ela, Introduction to Environmental Engineering and Science, 3rd Edition, Publisher: Prentice Hall, ISBN-13: 978-0-13-148193-0, ISBN-10: 0-13-148193-2 4. K.V.S.G. Murali Krishna, Air Pollution and Control, Laxmi Publications, 1st Edition, 2017. 5. Standard Methods for the Examination of water and wastewater: AWWA, APHA, WPCF 2012. 6. I.S. 10500: 2012, Drinking Water Standards, 2012. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. http://envirocomp.org 2. https://www.hindawi.com/journals/tswj/2013/231768/ 					

CE311/CEE311	DESIGN OF REINFORCED CONCRETE STRUCTURE - II				
Pre-requisite	Co-Requisite	L	T	P	C
Compulsory CE302/CEE302	NIL	3	1	0	4
Objectives	To bring about an exposure to advanced topics in structural design comprising of Torsional Effect on Beams, Footings, Flat and Circular Slabs ,water tanks, RC retaining walls and prestressed concrete.				
Unit-I	Torsional Effect on Beams and Design of Footing				08 Hrs
Effect of torsion on beam, concept of equivalent shear and moments. Design of beam under torsion. Structural behavior of footings, Design of wall, isolated and combined footing.					
Unit-II	Flat and Circular Slabs				08 Hrs
Nature of stresses in flat slabs. Design of flat slab with and without drops by direct method, reinforcement in flat slab. Design of Circular slab with various edges and loading condition..					
Unit-III	Water Tanks				08 Hrs
Design criteria, material specifications and permissible stress for tanks, design of circular and rectangular tanks situated on the ground under hoop stresses, Introduction of underground and overhead tanks.					
Unit-IV	Retaining Walls				08 Hrs
Structural behavior of retaining wall, stability of retaining wall against overturning, sliding and pressure developed under the base design of T- shaped retaining wall, design of shear key concept of counter fort retaining wall.					
Unit-V	Prestressed Concrete				08 Hrs
Introduction of pre-stressed concrete, advantages of pre-stressed concrete, types of pre-stressing, methods of pre-stressing, losses in pre-stress, analysis of simple pre-stressed rectangular and T-sections.					
References:					
<ol style="list-style-type: none"> 1. Ramamurtham S., “Design of Reinforced Concrete Structures”, Dhanpatrai Publishing Company, 18th Edition 2015, Reprint 2016. 2. Bhawikatty S. S. “ Advanced Concrete Design”, New Age International, 3rd Edition (2016) 3. Sinha S.N. “Reinforced Concrete Design”, Tata McGraw-Hill Education, 2nd Edition (2002) 4. Punmia B.C Jain A.K, “Limit State Design of Reinforced Concrete”, Laxmi Publications 1st Edition (2007) 5. Jain A.K., “Reinforced concrete design, limit state Method”, Nem Chand & Bros.; 7th Edition (2012) 6. IS 456-2000 Indian Standard “Plain & Reinforced Concrete-code of practice”, BIS, New Delhi. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. http://nptel.ac.in/courses/105105105/ 2. http://nptel.ac.in/courses/105105104/ 					

CE312/CEE312	GEOTECHNICAL ENGINEERING - II				
Pre-requisite	Co-Requisite	L	T	P	C
CE304	NIL	3	1	0	4
Objectives	<ol style="list-style-type: none"> To develop an understanding to perform site investigations and to determine the soil parameters needed to carry out foundation design. To apply the principles of soil mechanics to design of shallow and deep foundations including bearing capacity, stability analysis of slopes and settlement calculations. To compute the lateral earth pressure, select size of retaining walls and ensure safety against external forces and moments. 				
Unit-I	Soil Exploration and Site Investigation				08 Hrs
<p>Introduction, Planning and stages in sub-surface exploration, depth and spacing of exploration, Disturbed and undisturbed soil samples, Area ratio, External and internal clearance, Methods of exploration, Geophysical methods: Seismic refraction and Electrical resistivity method.</p> <p>Boring: Auger boring, Wash boring and Rotary drilling. Types of soil sample: Disturbed and undisturbed soil samples, Features of sampler affecting soil disturbance.</p> <p>Characterization of ground, site investigations, Standard Penetration Test, Static and Dynamic cone penetration test, ground water level etc. Preparation of Bore log report</p>					
Unit-II	Shallow Foundation and Bearing Capacity				08 Hrs
<p>Introduction- contact pressure distributions, Bearing capacity of footing, types of shear failure, correction for size, shape, depth, compressibility, etc., ultimate and allowable stresses, Terzaghi's, Meyerhof's, Hansen, Skempton's and BIS methods, Effect of rising and lowering of water table on bearing capacity, Plate load test, Standard and Cone penetration tests for determining allowable bearing pressure, Total and Differential settlements as per IS Code, causes and methods of minimizing settlement, Introduction to Floating foundation</p>					
Unit-III	Deep Foundations				08 Hrs
<p>Pile foundations: Introduction to pile foundation, factors influencing the selection of pile, Load carrying capacity of Single Pile by static formula and dynamic formulae (Engineering News and Hileys), Feld's rule, Capacity from in-situ penetration tests, piles load test; Negative skin friction; under reamed pile foundations; Pile groups – Necessity, Efficiency, Group capacity and settlements.</p> <p>Well Foundation: Types of casissons and their construction; Different shapes of wells, component parts and forces, sinking of wells and remedial measures for tilts and shifts.</p>					
Unit-IV	Stability of Slopes				08 Hrs
<p>Types of slopes, Types of slope failures, limit equilibrium methods of slices and simplified Bishop Method, factor of safety, friction circle method, Taylor stability number method, Stabilization of soil slopes.</p>					
Unit-V	Earth Pressures and Retaining Structures				08 Hrs
<p>Earth pressure theories, Plastic equilibrium, Coulomb's and Rankine's approaches, pressure distribution diagram for lateral earth pressures against retaining walls for different conditions in cohesion less and cohesive soils, smooth and rough walls, inclined backfills, depth of tension cracks, retaining structures, gravity cantilever, counter fort, reinforced earth, etc., design and check for stability, Rebhann's and Culmann's graphical constructions of active pressure for cohesionless soil.</p>					
<p>References:</p> <ol style="list-style-type: none"> Bowles .J.E, "Foundation analysis and design", McGraw Hill, 5th Edition, 2001. Murthy .V.N.S, "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors, New Delhi, 1st Edition, 2009. Garg, S.K., "Soil Mechanics and Foundation Engineering", Khanna Publishers, New Delhi, India. Khanna (2003) Khan I. H., "A Text Book of Geotechnical Engineering", Prentice –Hall of India Pvt. Ltd., Delhi, India. 2nd Revised edition edition (30 March 2005) Arora, K. R., "Soil Mechanics and Foundation Engineering", Standard Publishers, New Delhi, India. STANDARD PUBLISHER DIST. (2009) Punmia, B.C., "Soil Mechanics and Foundation Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 1995. Prentice Hall India Learning Private Limited (2011) <p>Web links to e-learning:</p> <ol style="list-style-type: none"> https://nptel.ac.in/courses/105105185/ 					

CE313/CEE313	TRAFFIC ENGINEERING				
Pre-requisite	Co-Requisite	L	T	P	C
CE303	NIL	3	1	0	4
Objectives	To familiarize about the fundamentals of Traffic Engineering, its surveys and methods to analyse and controls its operations.				
Unit-I	Traffic Engineering Principles				08 Hrs
Traffic on road, mixed traffic, concept of PCU, Traffic Engineering- scope and objectives, road user and vehicle characteristics, Traffic characteristics, Hierarchy of Roads, Typical road cross sections, fundamental definitions, traffic flow parameters, time-space diagram, speed-flow-density relationship, capacity and level of service, factors effecting level of service.					
Unit-II	Traffic Flow Theory and Regulation				08 Hrs
Traffic stream and its components, stream parameters, Interrupted and un-interrupted traffic flow, trajectory diagrams, shock wave theory and it application, queuing theory and its application. Regulation of speed, regulation of vehicles, regulation concerning drivers, regulation concerning traffic, parking regulations, general rules, enforcement of regulations.					
Unit-III	Traffic Survey and Studies				08 Hrs
Traffic Volume study-need, methods, format preparation, analysis and presentation; Origin Destination studyneed, methods, format preparation, zoning, analysis and presentation; Speed and Delay Study- need, methods, format preparation, analysis and presentation; Parking Study- need, type of surveys, format preparation, demand estimation, type of parking facilities; Road Network Inventory Survey- need, format preparation and data collection.					
Unit-IV	Traffic Operation and Control				08 Hrs
Traffic control devices, Traffic Signs - principles, types and design considerations; Road Markings-principles, type and design; Traffic Signals - types, optimal cycle length and signal settings, warrants, designing of traffic signals by Webster's method and IRC method, signal approach dimensions; Street Lighting; Street Furniture.					
Unit-V	Traffic Management, Road Safety and Intersections:				08 Hrs
Traffic management measures, Intersections-at grade and grade separated intersections, rotary intersections and channelization. Accident situation in India, collection of accident data, collision and condition diagram, road and its effect on accidents, vehicles and its effect on accidents, drivers, pedestrian safety, cyclist safety, legislations, enforcement, educations and awareness, road safety audit.					
References:					
<ol style="list-style-type: none"> 1. Traffic Engineering & Transport Planning by LR Kadyali, Khanna Publisher, Delhi, 2010. 2. Transportation Engineering and Planning, C.S.Papacostas, P.D.Prevedouros, Prentice –Hall India, Delhi, 2005. 3. Highway Engineering-S.K.Khanna & C.EG. Justo, Nem Chand & Bros, Roorkee, 2014. 4. Transportation Engineering, an Introduction, C Jotin Khisty,B.Kent Lall, Prentice-Hall India, Delhi 5. Transportation Planning, Principles, Practice and Policies,P.K. Sarkar, Vinay Maitri, G.J. Joshi, Prentice-Hall, India, Delhi 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105101008/ 2. https://nptel.ac.in/courses/105105107/ 					

CE314/CEE314	OPEN CHANNEL FLOW				
Pre-requisite	Co-Requisite	L	T	P	C
CE209	NIL	3	1	0	4
Objectives	To understand and apply the fundamental principles governing open channel hydraulics to the design of engineering systems.				
Unit-I	Introduction to Open Channel Flow				08 Hrs
Classifications, description, types energy and momentum equation for prismatic and non-prismatic channels. Uniform flow, critical flow, critical depth, specific energy. Use of Design charts and Semi empirical relations.					
Unit-II	Gradually Varied Flow				08 Hrs
Gradually varied flow, dynamic equation, flow profiles, computation, analytical and graphical methods, and transitions of sub critical and supercritical flow.					
Unit-III	Analytical and Numerical Methods of Gradually Varied Flow				08 Hrs
Basic principles and assumptions in analysis of flow profile, methods of numerical integration. Compound channel, Equivalent Roughness.					
Unit-IV	Rapidly Varied Flow				08 Hrs
Characteristics of the rapidly varied flow, classification of hydraulic jump, hydraulic jump in horizontal, and sloping channels, submerged hydraulic jump, jump in gradually and suddenly expanding channels, empirical solutions.					
Unit-V	Analysis of Flow in Channels of Nonlinear Alignment				08 Hrs
Flow in channel of non-linear alignment and non-prismatic channel sections, design considerations for sub critical and super critical flows. Hydraulic design of culvert. .					
References:					
<ol style="list-style-type: none"> 1. K.Subramanya : Flow in open channels, Tata Mcgraw Hills, 2014. 2. V.T.Chow : Open Channel Hydraulics,Blackburn Press, 2009. 3. K.RangAraju:Open channel flow,Mcgrawhill Education, 2001. 4. Madan Mohan Das: Open Channel Flow,PHI learning private limited, 2008. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105107059/ 					

CE315/CEE315	MATRIX METHODS OF STRUCTURAL ANALYSIS				
Pre-requisite	Co-Requisite	L	T	P	C
CE301	NIL	3	1	0	4
Objectives	To understand the Basic concept and analysis Structural Components by matrix methods.				
Unit-I	Classification of Structures				08 Hrs
Classification of structure, equation of static equilibrium, degree of static and kinematic determinacy. Basic methods of structure analysis.					
Unit-II	Introduction of Matrix Method and Analysis of Beam				08 Hrs
Introduction of Flexibility and stiffness method. Formulation analysis of continuous beams.					
Unit-III	Analysis of Pin Joined Structure				08 Hrs
Formulation analysis of two-dimensional pin jointed frames and space frame by matrix approach.					
Unit-IV	Analysis Two Dimensional Rigid Structure				08 Hrs
Formulation analysis of two-dimensional rigid frames by flexibility and stiffness methods.					
Unit-V	Analysis Three Dimensional Structure				08 Hrs
Analysis of three dimension structure by displacement method.					
References: <ol style="list-style-type: none"> Weaver & Gere, Matrix Analysis of Framed structures. CBS Publication & Distributors Pvt. Ltd., Edition: 2nd edition (2004). H.C. Matrix, "Introduction to Matrix Methods of structural Analysis", McGraw Hill (2012). Pandit, G.S & Gupta., "Structural Analysis: A Matrix Approach" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (2008). 					
Web links to e-learning: <ol style="list-style-type: none"> https://nptel.ac.in/courses/105106050/ 					

CE316/CEE316	SUSTAINABLE CONSTRUCTION TECHNIQUES				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	To provide knowledge of design and construction of roads, railways and airports.				
Unit-I	Introduction to Sustainability				08 Hrs
Sustainability, challenges in sustainable construction, design construction and equipment, materials and systems, maintenance and conservation, waste materials, site waste management, re-use and recycling of materials.					
Unit-II	Energy Efficient Buildings				08 Hrs
Energy efficient buildings, concepts of green and sustainable buildings, natural lighting, rainwater harvesting.					
Unit-III	Alternative Building Materials				08 Hrs
Alternative Building Material for Low Cost Housing: Introduction, Substitute, for scarce materials, timber substitution, industrial waste, Agricultural waste, Strategies of Promotion of Alternative Building Materials.					
Unit-IV	Modern Housing Scenario				08 Hrs
Housing scenario, status of urban and rural housing and construction land use and physical planning for housing, building bye laws, housing finance: approaches and strategies, housing for urban poor					
Unit-V	Precast and Prefabricated Systems				08 Hrs
Adoption of innovative cost effective construction technology, prefabrication, precast roofing/ flooring systems, walls.					
References: <ol style="list-style-type: none"> 1. A.K Lal, Handbook of low cost housing, New Age Publishers, 4th Edition, 2010. 2. India Green Building Congress Recommendations, 3rd Revision, 2011. 3. Ajla Aksamija, "Sustainable Facades: Design Methods for High-Performance Building Envelopes", Jhon Wiley & Sons Inc, 2nd Edition, 2011. 4. Kibert J.Charles, "Sustainable Construction: Green Building Design and Delivery", Jhon Wiley & Sons Inc, 6th Edition, 2014. 5. Phillip F. Ostwald, "Construction Cost Analysis and Estimating", Prentice Hall Press, Delhi, 3rd Reprint, 2015. Web links to e-learning: <ol style="list-style-type: none"> 1. https://www.youtube.com/watch?v=WPRgRBxfbss 2. https://www.youtube.com/watch?v=SJOH6kheN_c 					

CE317/CEE317	GROUND IMPROVEMENT TECHNIQUES				
Pre-requisite	Co-Requisite	L	T	P	C
CE-304/CEE-304	CE312/CEE312	3	1	0	4
Objectives	Introduce the student to fundamentals of design of hydraulic structures in civil engineering.				
Unit-I	Dewatering				08 Hrs
Introduction - Scope and necessity of ground improvement in Geotechnical engineering- basic concepts and philosophy. Drainage - Ground Water lowering by well points deep wells- vacuum and electro-osmotic methods. Stabilization by thermal and freezing techniques.					
Unit-II	Compaction and Sand Drains				08 Hrs
Insitu compaction of granular and cohesive soils, Shallow and Deep compaction sand piles – concept, factors influencing compaction, Blasting and dynamic consolidation – Preloading with sand drains, fabric drains, wick drains – theories of sand drain – design and relative merits.					
Unit-III	Geo-synthetics & Applications of Geo-synthetics				08 Hrs
Development – Types of Geosynthetics – Geotextiles – Geogrids- Geonets – Geomembranes – Geocomposites – Functions – Reinforcement – Use of geosynthetics for filtration and drainage – Use of geosynthetics in roads – Use of reinforced soil in Retaining walls – Improvement of bearing capacity – Geosynthetics in land fills.					
Unit-IV	Stone Column, Lime Piles and Earth Reinforcement				08 Hrs
Stone column, lime piles – Functions – Methods of installation – Earth reinforcement – Principles and basis mechanism of reinforced earth-reinforced soil retaining structures.					
Unit-V	Grouting				08 Hrs
Grouting techniques – Types of grout – Suspension and solution grouts – Basic requirements of grout. Grouting equipment – principle of injection-injection methods – properties of treated ground-application of jet grouting-grout monitoring – Electro – chemical stabilization – Stabilization with cement, lime etc. – Stabilization of expansive clays.					
References:					
<ol style="list-style-type: none"> 1. Koerner, R.M., “Designing with Geo-synthetics”, Xlibris Publication, 6th Edition (2012). 2. Rowe, R.K., “Geotechnical and Geo-environmental Engineering Handbook”, Springer 1st edition (2012). 3. P. Purushothama Raj, “Ground Improvement Techniques Paperback”, Laxmi Publications; Second edition (2016). 4. Sivakumar Babu, “An Introduction to Soil Reinforcement & Geosynthetics”, Universities Press; 1st edition (2005). 5. Satyendra Mittal, An Introduction to Ground Improvement Engineering, Medtech, 1st edition (2013). 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105108075/ 					

CE320/CEE320	DOCK HARBOR AND TUNNEL ENGINEERING				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	To provide knowledge of design Tunnels and Harbors.				
Unit-I	Introduction: Harbor Planning and Natural				08 Hrs
Harbor Planning: Harbor components, characteristics of good harbor, principles of harbor planning, site selection criteria and layout of harbors. Natural Phenomena: tides and currents phenomena, generation characteristics and effects on marine structures, silting, erosion and littoral drift.					
Unit-II	Marine Structures				08 Hrs
Marine Structures: General design aspects, breakwaters - function, types general design principles, wharves, quays, jetties, piers, pier heads, dolphin fenders, mooring accessories function, types, suitability, design and construction features.					
Unit-III	Dock and Repair Facilities				08 Hrs
Docks and Locks: Tidal basin, wet docks-purpose, design consideration, operation of lock gates and passage, repair docks - graving docks, floating docks, marine railway.					
Unit-IV	Tunnels: Introduction and Construction Methods				08 Hrs
Site investigations, Geotechnical Considerations of tunneling, Construction & Excavation methods, soft ground tunnels, Rock tunnels.					
Unit-V	Micro Tunneling and Tunnel Utilities				08 Hrs
Micro tunneling techniques, Tunnel support design, Ventilation of tunnels, tunnel utilities, safety aspects.					
References: <ol style="list-style-type: none"> 1. R. Srinivasan and S. C. Rangwala, Harbour, Dock and Tunnel Engineering, 2012, Charotar Pub. House. 2. S. P. Bindra, A Course in Docks and Harbour Engineering, 2015, Dhanpat Rai & Sons, New Delhi. Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/114106025/ 2. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/114106025/lec3.pdf 					

CE321/CEE321	DESIGN OF HYDRAULIC STRUCTURES				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE201/CEE201	CE306	3	1	0	4
Objectives	Introduce the Student to Fundamentals of Design of Hydraulic Structures in Civil Engineering				
Unit-I	Hydraulic Structures General				08 Hrs
Failure of hydraulic structures founded on permeable soils, Bligh's creep theory, Khosla's theory of independent variables for design of impervious floors, Types of canal falls, Design of sharda type fall.					
Unit-II	Head Works and Cross Drainage Works				08 Hrs
Function, location and layout of head works, cross drainage works: necessity and types, design of siphon aqueduct.					
Unit-III	Dams and Reservoirs				08 Hrs
Investigation and planning of dams and reservoirs, zones of storage, reservoir sedimentation and its control, classification of dams.					
Unit-IV	Gravity Dams				08 Hrs
Elementary profile of a gravity dam, Low and high gravity dams, Modes of failure and factor of safety, Galleries in dams, Temperature control in mass concrete.					
Unit-V	Earth Dams and Spillways				08 Hrs
Earth Dam their component and functions, causes of failure. Types of spillways, energy dissipation below spillways, spillways gates.					
References: <ol style="list-style-type: none"> 1. Subramanya K., Engineering Hydrology, Tata McGraw Hill, 2014. 2. Punmia B.C. & Lal P.B., Irrigation and Water Power Engineering, Laxmi Publications, 2015 3. Asawa, Irrigation Engineering, Wiley Eastern Edition, 2013. 4. S.K Garg, Irrigation Engineering and Hydraulic structures, Khanna publishers, 2016. Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105105040/ 					

CE322/CEE322	MAINTENANCE & REHABILITATION OF STRUCTURES				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	To provide knowledge practices adopted for maintenance of structures.				
Unit-I	Introduction				08 Hrs
Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.					
Unit-II	Quality Assurance for Concrete				08 Hrs
Strength, Durability and Thermal properties, of concrete Cracks, different types, causes– Effects due to climate, temperature, Sustained elevated temperature, Corrosion -Effects of cover thickness and cracking.					
Unit-III	Advanced Materials				08 Hrs
Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, Sulphur infiltrated concrete, Ferrocement, Fiber reinforced concrete.					
Unit-IV	Rehabilitation Techniques				08 Hrs
Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning. Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings and cathodic protection. Engineered demolition techniques for dilapidated structures–case studies					
Unit-V	Repairing of Structures				08 Hrs
Repairs to overcome low member strength. Deflection, Cracking, Chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.					
References:					
<ol style="list-style-type: none"> Shetty M.S., "Concrete Technology-Theory and Practice", S. Chand and Company, 2008. Dov Kominetzky.M.S., "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001. Ravishankar .K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008. Gambhir .M.L., "Concrete Technology", McGraw Hill, 2013. 					
Web links to e-learning:					
<ol style="list-style-type: none"> https://nptel.ac.in/courses/105/106/105106202/ https://nptel.ac.in/courses/105104030/ 					

CE323/CEE323	OCCUPATIONAL HEALTH AND SAFETY ENGINEERING				
Pre-requisite	Co-Requisite	L	T	P	C
CE310 & CE401	NIL	3	1	0	4
Objectives	To educate the students on the basic principles, development and application of occupational health and safety engineering				
Unit-I	Introduction to Occupational Health and Safety				08 Hrs
Introduction to occupational health and safety: Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety. Importance of Industrial safety, role of safety department, OHSAS 18001.					
Unit-II	Construction Safety				08 Hrs
Hazards in Construction Industry :Introduction of Construction industry, Scaffolding and Working plat form, Welding and Cutting, Excavation Work, Concreting and Cementing work, Transportation of men and material, Handling and Storage of compressed gas.					
Unit-III	Electrical Safety				08 Hrs
Electrical Hazards: Safe limits of amperages, voltages, distance from lines, etc., Joints and connections, Effects of Electrical Hazards, Effects of Current on Human Body, Control of hazards due to static electricity.					
Unit-IV	Fire Safety				08 Hrs
Fire Hazards: Fire Types, Fire Hazard Analysis and Prevention of Fire, Fire Risk, Fire Protection and its Prevention, hazards and control in mines, Portable Fire Extinguishers, Firefighting.					
Unit-V	Safety Guidelines and Recommendations				08 Hrs
Construction hazards and safety guidelines; Prevention techniques for construction accidents; Site management with regard to safety recommendations; Training for safety awareness and implementation.					
References: <ol style="list-style-type: none"> 1. B. G. Dale, Managing quality, 5 th ed., Blackwell Publishing, Oxford, 2007. 2. D. Reese and J. V. Eidson, Handbook of OSHA construction safety and health, 2 n d ed., CRC Press, Boca aton, 2006. 3. F. Harris, R. McCaffer and F. Edum-Fotwe, Modern construction management, 6 t h ed., Blackwell Publishing, Oxford, 2006 4. K. Knutson, C. J. Schexnayder, C. M. Fiori and R. Mayo, Construction management fundamentals, 2nd ed., McGraw Hill, New York, 2008. . 5. S. J. Holt, Principles of construction safety, Blackwell Publishing, Oxford, 2008. 6. R.K.Jain and Sunil S.Rao , Industrial Safety , Health and Environment Management Systems, Khanna publishers , New Delhi, 2006. 7. Journal of Occupational Safety and Health, ISSN 1675-5456 PP13199/12/2012 (032005) 					
Web links to e-learning: <ol style="list-style-type: none"> 1. https://www.osha.gov/SLTC/generalshreferences/journals.html 2. https://www.osha.gov/ 					

CE324/CEE324	PRINCIPLES OF TOWN PLANNING AND ARCHITECTURE				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	To educate the students on the basic principles, concept and development of planning town, city, smart city etc.				
Unit-I	Introduction				08 Hrs
Principles and history of town planning, Comprehensive planning of towns: Contemporary planning concepts, Problems of urban growth. Land use classification and patterns, Housing demographic and social surveys, economic and environmental aspects. Concept of master plan, Zoning and Density.					
Unit-II	History of Town Planning				08 Hrs
An overview of ancient human settlements, Evolution of towns: Garden city movement, Linear city and concentric city concepts, Neighborhood and Radburn, Lacite industrielle, Radiant city to present day planning, Satellite town concepts. Concept of habitat, Neighborhood planning, problems of metropolis.					
Unit-III	Development of Town Planning				08 Hrs
Factors influencing architectural development. Impact of development of materials and techniques through ages. Evolution of architectural forms. Brief history of architecture.					
Unit-IV	Architectural Design				08 Hrs
Elements of Architectural Design: Line, Form, Shape, Space, texture, value and colour. Principles of Architectural Design: Balance, Rhythm, Emphasis, Proportion and Scale, Movement, Contrast, Unity, Harmony, Repetition, Hierarchy. Role of architects.					
Unit-V	Planning of Buildings				08 Hrs
Functional planning of buildings: Classification of buildings, General requirements of site and building. Building codes, Acts and Bye-laws, Licensing of building works. Functional planning of building such as residential, institutional, public, commercial, industrial buildings, checking for circulation, ventilation, structural, preparing sketch plan, working drawing etc.					
References:					
<ol style="list-style-type: none"> 1. Sir Banister Fletcher's, A History of Architecture, CBS Publisher. 2002. 2. S.C. Rangwala, Town Planning, Charotar Publishing House, 2009. 3. G.K. Hiraskar, Fundamentals of Town Planning, Dhanpat Rai Publications, 2012. 4. S.C. Agarwala, Architecture and Town Planning, Dhanpat Rai & Co. 2013. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. https://nptel.ac.in/content/storage2/courses/109104047/pdf/lecture35.pdf 					

CE327/CEE327	ENVIRONMENTAL ENGINEERING LAB - I				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	CE310	0	0	2	1
<ol style="list-style-type: none"> 1. Determination of Turbidity, colour and conductivity. 2. Determination of pH, Alkalinity and acidity. 3. Determination of Hardness and chlorides. 4. Determination of Residual chlorine and chlorine demand. 5. Determination of dissolved oxygen. 6. Determination of most probable number of coliforms. 					
<p>References:</p> <ol style="list-style-type: none"> 1. S. K. Garg, Water Supply Engineering: Environmental Engineering v. 1, 29th Edition, Khanna Publication, 2013 2. Howard S. Peavy, Donald R. Rowe, George Tchobanoglous, Environmental Engineering, 1st Edition, McGraw Hill Education; 2013. 3. Gilbert M. Masters, Wendell P. Ela, Introduction to Environmental Engineering and Science, 3rd Edition, Publisher: Prentice Hall, ISBN-13: 978-0-13-148193-0, ISBN-10: 0-13-148193-2 4. K.V.S.G. Murali Krishna, Air Pollution and Control, Laxmi Publications, 1st Edition, 2017. 5. Standard Methods for the Examination of water and wastewater: AWWA, APHA, WPCF 2012. 6. I.S. 10500: 2012, Drinking Water Standards, 2012. 					

CE328/CEE328	GEOTECHNICAL ENGINEERING LAB				
Pre-requisite	Co-Requisite	L	T	P	C
CE304	CE312	0	0	2	1
<ol style="list-style-type: none"> 1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method. 2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method. 3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method. 4. Determination of relative density and grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis. 5. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (grain-size analysis). 6. Determination of compaction characteristics (OMC & MDD) of a given soil sample. 7. Determination of permeability of a remolded soil sample by constant head &/or falling head method. 8. Determination of consolidation characteristics of a remolded soil sample by an oedometer test. 9. Determination of shear strength characteristics of a given soil sample from Tri-axial Shear Test. 10. Determination of shear strength characteristics of a given soil sample from Direct Shear Test. 					
<p>References:</p> <ol style="list-style-type: none"> 1. Bowles, Joseph E., "Engineering Properties of Soil and Their Measurement" Fourth Edition, Indian Edition, McGraw Hill Education (India) Pvt. Ltd, New Delhi-110032. 					

SYLLABUS

OF

B. TECH

OF

IV YEAR

B. TECH. (CBCS)

**DEPARTMENT OF CIVIL
ENGINEERING**

**INTEGRAL UNIVERSITY
LUCKNOW**

STUDY AND EVALUATION SCHEME

Branch: Civil Engineering

Year – IV, Semester – VII

S. No.	Course Category	Code No	Name of Subject	Periods			Credits C	Evaluation Scheme			Subject Total	
				L	T	P		Sessional Exam				Exam ESE
							CT	TA	Total			
1	DC	CE401	Environmental Engineering-II	3	1	0	4	25	15	40	60	100
2	DC	CE402	Construction Technology and Management	3	1	0	4	25	15	40	60	100
3	DC	CE403	Steel Structure	3	1	0	4	25	15	40	60	100
4	DE	CE404-CE407	Department Elective-III	3	1	0	4	25	15	40	60	100
5	DE	CE410-CE413	Department Elective-IV	3	1	0	4	25	15	40	60	100
PRACTICAL / DRAWING / DESIGN												
6	DC	CE418	Environmental Engineering Lab-II	0	0	2	1	30	30	60	40	100
7	DC	CE419	Structural Detailing Lab	0	0	2	1	30	30	60	40	100
8	DC	CE420	Minor Project	-	-	2	1	-	-	60	40	100
9	DC	CE300*	Industrial Training	-	-	-	0	-	-	-	50	50
Total				15	5	6	23					800

*Note: Industrial Training (CE300/CEE300) is a zero credit course. Student must clear this paper with 50% marks and marks will not be included in result

L – Lecture; **T** – Tutorial; **P** – Practical; **C** – Credits; **CT** – Class Test; **TA** – Teacher Assessment
Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

DC – Departmental Core
DE – Departmental Elective
OE – Open Elective

STUDY AND EVALUATION SCHEME

Branch: Civil Engineering

Year – IV, Semester – VIII

S. No.	Course Category	Code No	Name of Subject	PERIODS			Credits	EVALUATION SCHEME			Subject Total	
				L	T	P		C	SESSIONAL EXAM			EXAM ESE
							CT		TA	Total		
THEORY SUBJECT												
1	OE	-	Open Elective - II	3	1	0	4	25	15	40	60	100
PRACTICAL / DRAWING / DESIGN												
2	DC	CE499	B.Tech Project	-	-	-	4	-	-	60	40	100
3	DC	CE499	B.Tech Project	-	-	-	4	-	-	60	40	100
4	DC	CE499	B.Tech Project	-	-	-	4	-	-	60	40	100
5	DC	CE451	Seminar	-	-	-	3	-	-	60	40	100
6	DC	CE452	Comprehensive Assessment	-	-	-	2	-	-	100	-	100
Total				3	1	0	21					600

L – Lecture; **T** – Tutorial; **P** – Practical; **C** – Credits; **CT** – Class Test; **TA** – Teacher Assessment

Sessional Total (CA) = Class Test + Teacher Assessment

Subject Total = Sessional Total (CA) + End Semester Examination (ESE)

DC – Departmental Core

DE – Departmental Elective

OE – Open Elective

List of Departmental Electives (III & IV)

Departmental Elective - III

CE404/CEE404	Transportation System & Planning
CE405/CEE405	Advanced Concrete Design
CE406 /CEE406	Environmental Pollution Control
CE407/CEE407	Design of Waste Water System

Departmental Elective - IV

CE410/CEE410	Earthquake Resistant Design
CE411/CEE411	Advanced Foundation Design
CE412/CEE412	Impact of Climate Change for Civil Engineering Projects
CE413/CEE413	Plastic Design of Steel Structures

CE401/CEE401	ENVIRONMENTAL ENGINEERING II				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE310	Nil	3	1	0	4
Objectives	Students will be familiar with current and emerging environmental engineering and global issues, and have an understanding of ethical and societal responsibilities. Students will have the necessary qualifications for employment in environmental engineering and related professions, for entry into advanced studies.				
Unit-I	Wastewater Quality and Quantity Estimation				08 Hrs
Introduction to wastewater engineering, wastewater management, Wastewater Quantity Estimation, Fluctuations in Dry Weather Flow, Population Equivalent, Wastewater Characterization.					
Unit-II	Wastewater Collection and Conveyance				08 Hrs
Conservancy system, Waste water carriage system, wastewater flow rates, storm water flow, Hydraulic design of Sewers, construction of sewers, Sewer Appurtenances.					
Unit-III	Wastewater Treatment				08 Hrs
Unit operations and unit processes for wastewater treatment, Preliminary and Primary treatment: Screening, grit chamber, Sedimentation and chemical clarification. Secondary treatment: Types of biological treatment systems, theory and design of trickling filter; theory and design of Activated sludge process.					
Unit-IV	Miscellaneous Method				08 Hrs
Oxidation ditch, aerated lagoons, waste stabilization pond, Rotating biological contactors, Up flow anaerobic sludge blanket reactor, Introduction to Duckweed pond, Vermiculture and Root zone technology.					
Unit-V	Waste Management				08 Hrs
Sludge characteristics, Sludge Treatment process, disposal of sludge, septic tank, solid waste disposal, composting, incineration, Introduction to sanitary landfill.					
References: <ol style="list-style-type: none"> 1. Birdie G.S and Birdie J.S, Water Supply and Sanitary Engineering, Dhanpat Rai & Sons, 2010. 2. Duggal K N, Elements of Environmental Engineering, S Chand & Co Ltd. 3. Garg S K, Environmental Engineering Vol II, Khanna Publishers, 2010 4. Fair, Gayer and Okun, Water and Waste water Engineering Vol. II, John Wiley. 3rd Edition 2011. 5. Metcalf and Eddy, Waste Water Engineering, Treatment, Disposal & Reuse, Tata McGraw Hill. 2002. Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105106119/ 2. https://nptel.ac.in/courses/105105048/ 					

CE402/CEE402	CONSTRUCTION TECHNOLOGY AND MANAGEMENT				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	NIL	3	1	0	4
Objectives	To understand the basics of construction management methods, techniques along with the knowledge of their applications in Construction Industry				
Unit-I	Fundamentals of Construction Management				08 Hrs
Introduction, Problems in Construction Industry, History of Construction Management. Construction Projects & its Classifications .Project Cycle, Project Parameters, Organizations in Construction Industry, Planning, Scheduling, Monitoring and Management Information System.					
Unit-II	Network Techniques & Analysis				08 Hrs
Basic Concepts , Application of PERT, CPM, GERT, AOA & AON Networks and its applications , Critical Path, Bar Charts, Milestone Chart, Time Estimates, Preparation of Network Diagrams, Crashing, Cost Planning, Resource Allocation, Resource Planning, Line of Balance Techniques.					
Unit-III	Construction Safety & Engineering Economics				08 Hrs
Introduction, Hazards in Construction Projects, Cause of Accidents, Classifications of Construction Accidents, General Safety Programme, and Accident Report, Safety Precautions at Construction Site. Engineering Economics- Time Value of Money, Cash Flow Diagrams, Payback Period, Replacement Analysis, Concept of Depreciation and its methods, Break even chart Analysis.					
Unit-IV	Contract Management				08 Hrs
Introduction, Indian Contract Act, Labour Laws, Prequalification of Contracts, Selection of Contractor, Classification of Contracts, Conditions of Contract, Prerequisites of Tendering, Tender Document, Tender Notice, Security Deposit , Earnest Money Deposit, Evaluation of Tenders, Contract Negotiation, Award of Contract, Termination of Contract, Settlements of Disputes, Arbitration and Conciliation Act, Commissioning and Closure of Project.					
Unit-V	Construction Equipment Management				08 Hrs
Introduction, Procurement of Equipment, Selection of Equipment, Productivity, Operational Cost, Owning and Hiring Cost, Work motion Study, Equipment Maintenance, Time Concepts for use, Depreciation, earth moving Equipments, Hauling and Hoisting Equipments, Concrete Production Equipments, Operational Use of equipments.					
References: <ol style="list-style-type: none"> 1. Dr. U.K.Shrivastava “Construction Planning and Management”,Galgotia Publications.; 3rd Edition 2005. 2. Kumar Neeraj Jha, “ Construction Project Management ”, Pearson New Delhi; 1st Edition 2005. 3. A.K.Gupta “Construction Technology and Management”, Shubham Publications,1st Edition Reprint 2013. 4. K.G.Krishnamurthy and S.V.Ravindra “Construction and Project Management” CBS Publishers and Distributers Pvt.ltd.; 2ndEdition 2017. 5. IS 456-2000 Indian Standard “Construction Planning, Equipment and Methods”, Mc Graw Hill; 7th Edition 2006. Web links to e-learning: <ol style="list-style-type: none"> 1. http://nptel.ac.in/courses/105103093/ 					

CE403/CEE403	STEEL STRUCTURES				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE204/ CEE204	NIL	3	1	0	4
Objectives	To understand the basic concept and procedure of designing steel structural components.				
Unit-I	Attributes of Steel Structural Design				08 Hrs
Basis for design, design philosophies, Introduction to Limit State Design, Limit state for steel design, limit state of strength, limit state of serviceability, probabilistic basis for design, design criteria, material, structural steel. Stress - Strain Curve for Mild Steel. Introduction to rolled steel sections, Loads. Riveted, Bolted, Pinned and Welded connections, Strength, Efficiency and Design of joints.					
Unit-II	Design of Steel Compression Members				08 Hrs
Compression members- Effective length, Slenderness ratio, Strength of Compression members, Design of Struts, Columns, Built-up Columns, Design of eccentrically loaded columns.					
Unit-III	Design of Steel Tension Members				08 Hrs
Tension members – Net and Gross sectional areas, Strength of members and their design. Design of slab and Gusset bases, Design of Grillage footing.					
Unit-IV	Design of Steel Beams				08 Hrs
Beams – web crippling and web buckling, design of laterally supported beam, design of laterally unsupported beam.					
Unit-V	Design of Industrial Building				08 Hrs
Design of Industrial Buildings –Elements of an industrial building, Design of elements of roof trusses, i.e purlin and plate girder.					
References: <ol style="list-style-type: none"> 1. Subramanian, “Steel Structures- “Design and Practice”, Oxford, University Press. 2. M.R. Shriyekar, “Limit State Design in Structural Steel”, PHI, New Delhi. 3. Duggal S.K. “Limit State Design of Steel Structures”, McGraw-Hill Education (India) Private Limited, New Delhi. 4. Kazmi, S.M.A and Jindal R.S “Design of Steel Structures” PHI, New Delhi, India. 5. I.S: 800-2007- Code of Practice for General Construction in Steel, BIS, New Delhi, India 6. I.S: 808-1989- Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections, BIS, New Delhi. 					
Web links to e-learning: <ol style="list-style-type: none"> 1. http://nptel.ac.in/courses/105106112/ 2. https://youtu.be/CNE4hk_SGTo 3. https://youtu.be/ruuKvu5QtKI 4. https://youtu.be/utgnv9NIFQc 					

CE404/CEE404	TRANSPORTATION SYSTEMS AND PLANNING				
Pre-requisite	Co-Requisite	L	T	P	C
CE303/CEE303	NIL	3	1	0	4
Objectives	Introduce the student to fundamentals of design of hydraulic structures in civil engineering.				
Unit-I	Transport System and Its Development				08 Hrs
Transport System and its Development: Transportation system, classification of transport system, urbanization and transport demand, motorization trends, urban transport problems, role of transportation: social, economic, political, and environmental; transportation today, organizations involved in transportation development in India. Hierarchy of Roads and Capacity: Hierarchy of Roads, Concept of PCU, capacity and level of service, factors affecting capacity and level of service; capacity of rural and urban roads-					
Unit-II	Transport Facility Design				08 Hrs
Public Transportation and Transport Facility Design: Technology in transportation, public transport systems, design of parking facilities, design of pedestrian facilities, design of cycle tracks, design of bus facilities, terminal and its functions, transit planning, transit demand, transit route network.					
Unit-III	Transportation Cost, Demand and Supply				08 Hrs
Transportation Cost, Demand and Supply: Transport costs: capital cost, operation and maintenance cost, vehicle operating cost (VOC), value of time (VOT), accident cost; transportation demand, supply in transportation, transportation networks and environmental impact.					
Unit-IV	Transport Planning				08 Hrs
Transport Planning: Transportation planning surveys, transport planning process: trip generation, trip distribution, modal split and trip assignment; economic evaluation of transport plans.					
Unit-V	Modern Transportation Techniques				08 Hrs
System Operations and ITS: System operation and management, Intelligent Transport System (ITS), Benefits of ITS, ITS services: advanced traffic management system (ATMS), advanced traveler information system (ATIS), advanced vehicle control system (AVCS), commercial vehicle operation (CVO), advanced public transport system (APTS), emergency management system (EMS), electronic payment (EP), safety, working of ITS, application of ITS.					
References:					
<ol style="list-style-type: none"> 1. Traffic Engineering & Transport Planning by LR Kadyali, Khanna Publisher, Delhi, 2010. 2. Theory and Applications of Economics in Highway and Transport Planning, Vinay Maitri, P.K.Sarkar, Standard Publishers Distributors, Delhi, 2008. 3. Transportation Planning, Principles, Practice and Policies, P.K.Sarkar, Vinay Maitri, G.J. Joshi, Prentice-Hall India, Delhi, 2002. 4. Transportation Engineering and Planning, C.S.Papacostas, P.D.Prevedouros, Prentice –Hall India, Delhi, 2005. 5. Highway Engineering-S.K.Khanna & C.EG. Justo, Nem Chand & Bros, Roorkee, 2014. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105106058/ 2. http://www.civil.iitb.ac.in/~dhingra/ce751.htm 					

CE405/CEE405	ADVANCED CONCRETE DESIGN				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE311/ CEE311	NIL	3	1	0	4
Objectives	Students are expected to realize the importance of design of heavy RCC structure and their application in civil engineering				
Unit-I	RC Domes and Curved Beams				08 Hrs
Natures of stresses in spherical domes, Analysis of spherical domes, Design of reinforced concrete domes under uniformly distributed load and point load at crown, using IS:456-2000 guide lines. Nature of stresses in Curved beams, Design philosophy, Design of reinforced concrete curved beam using IS:456-2000 guide lines.					
Unit-II	RC Overhead Tank				08 Hrs
Nature of stresses in reinforced concrete overhead tank, Design philosophy, IS Code guide lines, Design of rectangular and cylindrical water tank using IS-3370 design charts.					
Unit-III	Intze Tank				08 Hrs
Elements of Intze tank, Effect of continuity, Design of top dome, Top ring beam, Cylindrical wall, Bottom ring beam, Conical dome, Bottom dome , Bottom circular beam at junction of tank and supporting columns, Design of supporting columns with bracings and raft foundation, Reinforcement detailing of different elements of Intze tank.					
Unit-IV	Building Frames				08 Hrs
Dead load, Live load, Wind load and Earthquake loads, Analysis of building frames by substitute frames ,portal and cantilever methods, Design of building frames.					
Unit-V	RC Bridges and Composite members				08 Hrs
Types of bridges, Economic span, Load, forces and permissible stresses, General design requirements, Design of deck slab using effective width concept, Introduction to Pigeaud's and Courban's theory, Design concept of encased columns, Guide lines as per IS-800, Design of encased columns.					
References: <ol style="list-style-type: none"> 1. N .Krishna Raju "Advance concrete design", CBS Publishers, 3rd edition,2015 2. D.J. Victor "Essential of Bridge Engineering" , Oxford & IBH Publishing company, 6th edition 2017. 3. B.C. Punmia and A.K.Jain "Limit State Design of Reinforced Concrete", Laxmi Publications, 1st Reprint2017. 4. IS:3370(Part-1,2,3,4) -1965-Code of practice for concrete structures for the storage of liquids. 5. IS 456-2000 Indian Standard "Plain & Reinforced Concrete-code of practice", BIS, New Delhi. 6. IS:11682-1985-Criteria for design of RCC staging for overhead water tank. 					
Web links to e-learning: <ol style="list-style-type: none"> 1. http://nptel.ac.in/courses/105105105/ 2. http://nptel.ac.in/downloads/105105104/ 3. http://onlinecourses.nptel.ac.in 4. channel">http://m.youtube.com>channel 					

CE406/CEE406	ENVIRONMENTAL POLLUTION CONTROL				
Pre-requisite	Co-Requisite	L	T	P	C
CE310, CE401	NIL	3	1	0	4
Objectives	The objective of this course is: <ul style="list-style-type: none"> • Impart knowledge on fundamental aspects of air pollution & control, solid waste management and noise pollution. • Introduces some basics of sanitation methods essential for protection of community health. 				
Unit-I	Impact on man of environment				08 Hrs
Environment and its Components, Biosphere, Hydrologic Cycle, Nutrient Cycles, Anthropogenic Activities, Consequences of Population Growth, Energy Problem, Pollution of Air, Water and Land. Environmental Protection Act.					
Unit-II	Air Pollution				08 Hrs
Sources and Effects, Meteorological Aspects, Air Pollution Sampling and Measurement, Control Methods and Equipment, Control of Specific Air Pollutants, Air (Prevention and Control of Pollution) Act. National Ambient Air Quality Standards.					
Unit-III	Water Pollution				08 Hrs
Sources and Classification of Water Pollutants, Wastewater Sampling and Analysis. Water (Prevention and Control of Pollution) Act, Water Quality Criteria, WHO Drinking Water Specifications, BIS Drinking Water Specification (IS 10500: 2012)					
Unit-IV	Land Pollution				08 Hrs
Definition, Major Types of Land Pollution, Solutions for Land Pollution, Solid Waste Management, Generation, Storage, Collection, Transport, Processing and Disposal. Land Filling with Solid Waste, Solid Waste Management Rules, 2016.					
Unit-V	Noise Pollution				08 Hrs
Definition, Human Diseases Caused by Noise Pollution, Effects of Noise Pollution on Wildlife and Marine Life, Preventive Measures, The Noise Pollution (Regulation And Control) Rules 2000, Noise Level Calculations.					
References: <ol style="list-style-type: none"> 1. Birdie G.S and Birdie J.S, Water Supply and Sanitary Engineering, Dhanpat Rai & Sons, 2010. 2. Duggal K N, Elements of Environmental Engineering, S Chand & Co Ltd. 3. Garg S K, Environmental Engineering Vol II, Khanna Publishers, 2010. 4. Fair, Gayer and Okun, Water and Waste water Engineering Vol. II, John Wiley. 3rd Edition 2011. 5. Metcalf and Eddy, Waste Water Engineering, Treatment, Disposal & Reuse, Tata McGraw Hill. 2002. Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105102089/ 2. https://nptel.ac.in/content/syllabus_pdf/105104099.pdf 					

CE407/CEE407	DESIGN OF WASTEWATER SYSTEM				
Pre-requisite	Co-Requisite	L	T	P	C
CE310	NIL	3	1	0	4
Objectives	To understand the basic concept and procedure of designing of various wastewater treatment processes.				
Unit-I	Wastewater Characteristics				08 Hrs
Wastewater Characteristics: Physical, Chemical and Biological characteristics, Composition and Microbiology of Wastewater, BOD kinetics and COD.					
Unit-II	Wastewater Treatment				08 Hrs
Primary Treatment: Theory and design of Screens, Grit chamber, Sedimentation Tank, Unit operation and processes, Process flow sheets of wastewater treatment plant.					
Unit-III	Activated Sludge Process				08 Hrs
Secondary Treatment: Theory, Design and Construction of Biological Treatment Processes, Activated Sludge Process, Design of different Units and Modifications, Extended Aeration Systems.					
Unit-IV	Trickling Filter				08 Hrs
Secondary Treatment: Theory, Design and Construction of Trickling Filter, Types of Trickling Filter, Efficiency Calculation of Trickling Filter, Recirculation of Treated Sewage. SBR Technology: Methodology and Operation.					
Unit-V	Miscellaneous Method				08 Hrs
Waste Stabilization Ponds, Aerated Lagoon, Oxidation Ditches, and Rotating Biological Contactors (RBC).					
References: <ol style="list-style-type: none"> 1. Birdie G.S. and Birdie J.S, "Water Supply and Sanitary Engineering", Dhanpat Rai & Sons, 2010. 2. Duggal K. N, "Elements of Environmental Engineering", S Chand & Co Ltd.. 3. Garg S. K, "Environmental Engineering Vol II", Khanna Publishers, 2010 4. Fair, Gayer and Okun, "Water and Waste water Engineering Vol. II", John Wiley. 3rd Edition 2011. 5. Metcalf and Eddy, "Waste Water Engineering, Treatment, Disposal & Reuse", Tata McGraw Hill. 2002. 6. B.C. Punmia, "Water supply Engineering", Arihant Publications. Web links to e-learning: <ol style="list-style-type: none"> 1. http://nptel.ac.in/courses/105105048/ 					

CE410/CEE410	EARTHQUAKE RESISTANT DESIGN				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE302	NIL	3	1	0	4
Objectives	To introduce the students the basics of structural dynamics and to design Earthquake Resistant Structures. The students are familiarized with the codal provisions as well as aseismic design methodology.				
Unit-I	Basics of Structural Dynamics				08 Hrs
Wind and earthquake loading on structures, structural idealization for dynamic analysis. Free and forced vibration of single degree freedom system.					
Unit-II	Base Shear Determination				08 Hrs
Two degree and multi degree freedom system, seismic response of the buildings, calculation of time period, base shear, seismic coefficient method and response spectrum method.					
Unit-III	Earthquake Resistant Design of Structures				08 Hrs
Effect of structural irregularities on the performance of RC building. Earthquake Resistant Design of Masonry building.					
Unit-IV	Design of Shear Wall				08 Hrs
Design of shear wall. Ductility requirement of RCC frame. Modern techniques in a seismic design.					
Unit-V	Design of Machine Foundation				08 Hrs
Structural design of machine foundation. Dynamics of soil–structure interaction. Earthquake induced liquefaction of soil.					
References: <ol style="list-style-type: none"> 1. Earthquake- Resistant Design of Structures-S.K. Duggal. 2. Basics of Structural Dynamics and Aseismic Design.- S.R. Damodarasamy and S. Kavitha. 3. Structural Dynamics-Theory and Computation- Mario Paz. 4. Introduction to Structural Dynamics- J.M.Biggs 5. IS-13920-1993- Ductile detailing of Reinforced Concrete Structures subjected to a Seismic Forces. 6. IS-4326-1993. 7. IS-1893-(Part I)-2016 Criterion for Earthquake Resistant Design. Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105105104/40 2. https://www.nicee.org/EQTips.php 					

CE411/CEE411	ADVANCED FOUNDATION DESIGN				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE312/ CEE312	NIL	3	1	0	4
Objectives	To develop and apply the principles of soil mechanics to design of shallow and deep foundations including bearing capacity, analysis & design.				
Unit-I	Introduction				08 Hrs
Introduction, Basic definitions, Gross & Net footing pressure, Rankines analysis, Terzaghis analysis, Prandtl's analysis, Terzaghis bearing capacity theory.					
Unit-II	Shallow Foundations				08 Hrs
Bearing capacity of foundation, types of shear Failure, Terzaghis, Meyerhof's, Hansen, Skempton's & IS methods, Effect of water Table, Plate Load Test.					
Unit-III	Pile Foundations				08 Hrs
Load capacity of pile foundations Various factors affecting load carrying capacity of piles, Static and Kinematics analysis of pile groups in sand & clays, Settlement of pile groups, Efficiency, Pile load tests Laterally loaded and battered piles.					
Unit-IV	Well Foundation				08 Hrs
Elements of well foundation, shapes, depth of scour, well sinking, tilts, shift and their prevention, Cofferdams and its types.					
Unit-V	Machine Foundation and its Design				08 Hrs
Machine foundation and its types, basic terms and definitions, general design criteria of machine foundation, natural frequency of natural soil system, vibration isolation and control.					
References:					
<ol style="list-style-type: none"> 1. Dr. K K Arora -"Soil Mechanics & Foundation Engineering", Standard Publisher Distributors.7th Edition Reprint 2015. 2. Dr Alam Singh -"Soil engineering in Theory & Practices", Volume-2, CBS Publishers & Distributors 2nd Edition Reprint 2009. 3. Gopal Ranjan & A S Rao -"Basics & Applied Mechanics 2nd Edition, New Age International (P) Ltd Publishers,2nd edition Reprint 2012. 4. P C Verghese – "Foundation Engineering", Phi Learning Ltd, 9th Printing 1st edition. 5. Dowlous H S & E H - "Pile Foundation Analysis & Design", John Willey & sons, New York 1980. 					
Web links to e-learning:					
<ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105108069/ 2. https://nptel.ac.in/content/syllabus_pdf/105108069.pdf 3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/105105039/lec5.pdf 					

CE412/CEE412	IMPACT OF CLIMATE CHANGE FOR CIVIL ENGINEERING PROJECTS				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE201/CE306	NIL	3	1	0	4
Objectives	To identify the factors influencing the global and regional climate systems and develop strategies for adaptation and mitigation measures for sustainable development.				
Unit-I	Introduction to Weather and Climate				08 Hrs
Basic meteorology, measurement of meteorological parameters, Earth's Climate System, Climate Classification , The general circulation ,Trade Winds and the Hadley Cell , The Westerlies , Cloud Formation and Monsoon Rains(focus on Indian Monsoon) , Storms and Hurricanes , The Hydro-logical Cycle , El Nino and its Effect , Solar Radiation ,The Earth's Natural Green House Effect , Green House Gases and Global Warming ,Carbon Cycle.					
Unit-II	Climate Change Impacts on Water Resources				08 Hrs
Impact on hydrological cycle ,floods, droughts, coupling of hydroclimate variability with human systems, impact on water quality and quantity ,Climate change projections, Water management approaches to climate change adaptation and mitigation.					
Unit-III	Incorporating Climate Science in Engineering Practice				08 Hrs
Climate change dilemma for engineering, Uncertainty and statistical methods for risk assessment, Risk management, Engineering standards and regulations, Guiding principles.					
Unit-IV	Climate Change Impacts in Civil Engineering				08 Hrs
The Montreal Protocol – UNFCCC – IPCC –Evidences of Changes in Climate and Environment – on a Global Scale and in India, Impacts on buildings and other structures, impacts on transportation, impacts on urban water systems, coastal management, air quality and energy supply ,adaptation and mitigation strategies for sustainable development of infrastructure.					
Unit-V	Climate Change Mitigation Strategies				08 Hrs
Climate Change Adaptation And Mitigation Measures in various sectors - Water – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Carbon sequestration – Carbon capture and storage (CCS)- –Carbon Trading examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind –Hydroelectric Power ,green concrete.					
References:					
1. John M Wallace,Peter V Hobbs “Atmospheric science-, An introductory survey”, Academic press., 2nd Edition 2006.					
2. J.Rolf Olsen, “Adopting infrastructure and civil engineering practice to a changing climate”, American Society of Civil Engineers(ASCE) ,ASCE book series , 2015					
3. Dash Sushil Kumar, “Climate Change – An Indian Perspective”, Cambridge University Press India Pvt. Ltd, 2007					
Web links to e-learning:					
1. https://ascelibrary.org/doi/pdf/10.1061/9780784479193					

CE413/CEE413	PLASTIC DESIGN OF STEEL STRUCTURES				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE301/CEE-301	NIL	3	1	0	4
Objectives	To understand the basic concept and procedure of plastic design of steel structures. To develop the skill to deals with the problem of various beams and frame structures.				
Unit-I	Plastic Behavior of Structural Steel				08 Hrs
General Introduction, basic hypothesis, stress-strain relation for mild steel, scope of plastic analysis, redistribution of moments, concept of shape factor and load factor, scope of plastic collapse- basic theorems.					
Unit-II	Plastic Analysis Methods				08 Hrs
Procedure of plastic analysis: Introduction, Static and Kinematic methods, Plastic hinge concept, Plastic collapse load, method of combining mechanisms: Analysis of beams and frames, plastic moment distribution method.					
Unit-III	Plastic Moment's Factors				08 Hrs
Factors affecting fully plastic moments: Introduction, variations of lower yield stress, effect of shear force, effect of normal force, interaction formula.					
Unit-IV	Plastic Design of Beam/Frame				08 Hrs
Plastic Design: Introduction, design consideration, Design of simple, fixed and continuous beams, analysis and design of portal and Gable frames, design of two bay and two story frames.					
Unit-V	Miscellaneous Methods				08 Hrs
Minimum Weight Design: Assumptions, Geometrical analogue and Minimum weight theorem, applications, Methods of solution.					
References: <ol style="list-style-type: none"> 1. S.K. Duggal, Design of Steel Structures, Tata Mc Graw Hill publishing co. India. 2. Arya Ajmani, Design of Steel Structures, Wiley Eastern, New York. 3. Vazirani & Ratwani Steel Structures, Khanna Publishers Delhi. 4. B. G. Neal, Plastic Methods of Structural Analysis, Chapman and Hall Ltd. Great Britain 5. L.S. Negi, Design of Steel Structures, Tata Mc Graw Hill publishing co. India. 					
Web links to e-learning: <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/105106113/7 					

CE418/CEE418	ENVIRONMENTAL ENGINEERING LAB- II				
Pre-requisite	Co-Requisite	L	T	P	C
Recommended CE310	CE401	0	0	2	1
<ol style="list-style-type: none"> 1. Determination of total suspended and dissolved solids. 2. Determination of BOD of sample. 3. Determination of COD of sample. 4. Determination of Kjeldahl nitrogen. 5. Determination of fluorides. 6. Determination of rate kinetics constant of aerobic reactions. 7. Field visit of water / wastewater treatment plant. 					
<p>References:</p> <ol style="list-style-type: none"> 1. Birdie G.S and Birdie J.S, Water Supply and Sanitary Engineering, Dhanpat Rai & Sons, 2010. 2. Duggal K N, Elements of Environmental Engineering, S Chand & Co Ltd.. 3. Garg S K, Environmental Engineering Vol II, Khanna Publishers, 2010 4. Fair, Gayer and Okun, Water and Waste water Engineering Vol. II, John Wiley. 3rd Edition 2011. 5. Metcalf and Eddy, Waste Water Engineering, Treatment, Disposal & Reuse, Tata McGraw Hill. 2002. 					

CE419/CEE419	STRUCTURAL DETAILING LAB				
Pre-requisite	Co-Requisite	L	T	P	C
NIL	CE403	0	0	2	1
Preparation of Plan, Elevation and Sectional Elevation for the following:					
<ol style="list-style-type: none"> 1. Rolled sections and connections (welded and bolted). 2. Built-up columns and beams. 3. Gusset bases. 4. Grillage footing 5. Roof trusses 6. RC retaining walls 7. RC water tanks 					
References:					
<ol style="list-style-type: none"> 1. Subramanian, “Steel Structures- “Design and Practice”, Oxford, University Press 2. M.R. Shriyekar, “Limit State Design in Structural Steel”, PHI, New Delhi 3. Duggal S.K. “Limit State Design of Steel Structures”, McGraw-Hill Education (India) Private Limited, New Delhi 4. Kazmi, S.M.A and Jindal R.S “Design of Steel Structures” PHI, New Delhi, India 5. I.S: 800-2007- Code of Practice for General Construction in Steel, BIS, New Delhi, India 6. I.S: 808-1989- Dimensions for Hot Rolled Steel Beam, Column, Channel and Angle Sections, BIS, New Delhi, India 7. A.K..Jain “Reinforced concrete design, limit state Method”, Nem Chand & Bros.; 7th Edition 2012 8. S.Unnikrishna. and Devdas Menon, “Reinforced concrete design”, McGraw Hill Education; 3rd Edition 2009. 					