EVALUATION SCHEME

OF

B. TECH

OF

II YEAR

(As per NEP-2020)

DEPARTMENT OF CIVIL ENGINEERING

INTEGRAL UNIVERSITY LUCKNOW

EVALUATION SCHEME

Branch: B. Tech Civil Engineering Program as per NEP-2020

w.e.f Batch 2024-25

Year – II, Semester – III

S. No.	Course Category	Code No	Name of Subject	Periods				Continuous Assessment (CA)			Exam ESE			Course Total
				L	T	P	Credits	CT	TA	Total	TE	PE	Total	
1	PCC	CE201	Fluid Mechanics	3	-	2	4	65	35	100	75	25	100	200
2	PCC	CE202	Basic Surveying	3	-	2	4	65	35	100	75	25	100	200
3	PCC	CE203	Building Material and Construction	3	-	2	4	65	35	100	75	25	100	200
4	PCC	CE204	Strength of Material	3	1	-	4	50	25	75	75	-	75	150
5	PCC	CE231	Geotechnical Engineering	3	-	2	4	65	35	100	75	25	100	200
6	HSSM	ES203	Disaster Management and Mitigation	3	-	-	3	50	25	75	75	-	75	150
7	MC	BM226	Human Values & Ethics	2	-	-	0	-	-	-	100	-	100	100
Total				**20**	**1**	**8**	**23**			**550**			**650**	**1200**

L – Lecture; **T –** Tutorial; **P –** Practical; **C** – Credits; **CT** – Class Test; **TA** – Teacher's Assessment,
TE- Theory Exam, **PE**- Practical Exam
Continuous Assessment (CA) = Class Test + Teacher Assessment
End Semester Exam (ESE) = Theory Exam + Practical Exam
Course Total = CA + ESE

PCC- Professional Core Courses **MC-** Mandatory Course
HSSM- Humanities, Social Sciences & Management Courses

EVALUATION SCHEME

Branch: B. Tech Civil Engineering Program as per NEP-2020

w.e.f Batch 2024-25

Year – II, Semester – IV

S. No.	Course Category	Code No	Name of Subject	Periods				Continuous Assessment (CA)			Exam ESE			Course Total
				L	T	P	Credits	CT	TA	Total	TE	PE	Total	
1	PCC	CE210	Advance Surveying	3	-	2	4	65	35	100	75	25	100	200
2	PCC	CE211	Concrete Technology	3		2	4	65	35	100	75	25	100	200
3	PCC	CE212	Structural Analysis-I	3	-	2	4	65	35	100	75	25	100	200
4	PCC	CE234	Design of Reinforced Concrete Elements	3	1	-	4	50	25	75	75	-	75	150
5	PCC	CE335	Advance Geotechnical Engineering	3	-	-	3	50	25	75	75	-	75	150
6	OEC	As per Annexure	Open Elective -1	3	-	-	3	50	25	75	75	-	75	150
7	PCC	CE252	Comprehensive Assessment - I	-	-	2	1	-	-	50	-	-	-	50
8	IPC	CE255	Internship/Mini Project/Training	-	-	2	1	-	-	50	-	-	-	50
9		As per Annexure	Minor-1*	3	-	-	3	50	25	75	75	-	75	150
Total				**18**	**1**	**10**	**24**			**625**			**525**	**1150**

L – Lecture; **T –** Tutorial; **P –** Practical; **C** – Credits; **CT** – Class Test; **TA** – Teacher's Assessment,
TE- Theory Exam, **PE**- Practical Exam
Continuous Assessment (CA) = Class Test + Teacher Assessment
End Semester Exam (ESE) = Theory Exam + Practical Exam
Course Total = CA + ESE

PCC- Professional Core Courses **OEC-** Open Elective Courses **IPC-** Internship/Project Courses

*** Minor offered by Department of Civil Engineering**
CE271- Air and Noise Pollution Control

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE201	**Title of the Course**	Fluid Mechanics	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	3rd	3	0	2	4
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	To provide students with a fundamental understanding of fluid mechanics by introducing key concepts of fluid properties, fluid statics, kinematics, and dynamics, and by enabling the analysis of laminar and turbulent flows, boundary layers, and flow over submerged bodies for solving real-world engineering problems.						

Course Outcomes	
CO1	Given fundamental fluid properties and definitions, students will be able to distinguish between fluids and solids and apply concepts such as viscosity, surface tension, and compressibility and explain the behavior of fluids under various physical conditions.
CO2	Given static fluid systems and pressure measuring devices, students will be able to compute pressure distribution and hydrostatic forces on submerged surfaces and to analyze fluid statics problems and determine buoyancy and stability of floating bodies.
CO3	Given various flow scenarios and velocity fields, students will able to classify flow types and apply continuity equations to analyze fluid behavior using kinematic descriptions.
CO4	Given fluid flow systems and pipe networks, students will analyze and apply fluid mechanics principles including Bernoulli's and momentum equations, vortex flow, and dimensional analysis to determine forces, pressure changes, flow rates, and energy losses using appropriate models and formulas.
CO5	Given internal and external fluid flow scenarios, students will apply boundary layer theory, laminar and turbulent flow principles, and flow past submerged bodies to analyze velocity distribution, drag, lift, shear stress, and related flow characteristics using appropriate equations and measurement techniques.
CO6	Students will experimentally validate fluid mechanics principles, analyze flow regimes and losses, assess flow meter performance, and model 2D flow patterns.

Unit No.	Title of the Unit	Content of Unit (Theory)	Contact Hrs.	Mapped CO
1	Basic Concepts and Definitions	Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.	8	CO1
2	Fluid Statics	Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometers. Pressure gauges, Hydro-static pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.	8	CO2
3	Fluid Kinematics	Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and in-compressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates	8	CO3
4	Fluid Dynamics	Surface and body forces; Equations of motion - Euler's Equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber *Number and Euler Number; Buckingham's* π-Theorem. **Compressibility Effects in Pipe Flow**: Transmission of pressure waves in rigid and elastic pipes; Water hammer.	8	CO4

5	Laminar Flow and Compressibility Effects in Pipe Flow	**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. **Turbulent Flow**: Transition from laminar to turbulent flow, equation for turbulent flow, eddy viscosity, mixing length concept and velocity distribution in turbulent flow **Boundary Layer Analysis:** Boundary layer thicknesses, boundary layer over a flat plate, laminar boundary layer, turbulent boundary layer, laminar sub-layer, smooth and rough boundaries, local and average friction coefficient, separation of boundary layer and its control, measurement of shear **Flow Past Submerged Bodies:** Drag and lift, drag on sphere, Cylinder and disc, lift, Magnus effect and circulation.	8	CO5
List of Experiments				
1	Determine metacentric height and stability conditions for floating objects		2	CO6
2	Plot flow net using the Hele-Shaw apparatus.		2	CO6
3	Validate Bernoulli's equation using a Venturi meter and analyze energy losses.		2	CO6
4	Verify the Impulse Momentum equation experimentally.		2	CO6
5	Quantify major (friction) / minor (bend/fitting) losses in piping systems		2	CO6
6	Study the variation of friction factor 'f', for turbulent flow in commercial pipes.		2	CO6
7	Compare discharge coefficients of Orifice/Venturi meters and assess accuracy under varying flow rates.		2	CO6
8	Determine critical Reynolds number and visualize flow regimes in a transparent pipe.		2	CO6

Reference Books:

R. K. Bansal, 'Fluid Mechanics and Hydraulic Machines' Laxmi Publication, New Delhi 2007

Hunter Rouse," Elementary Mechanics of Fluid", John Wiley & Sons. Omc/.1946

Grade, R.J 'Fluid Mechanics through Problems.', Wiley Eastern Limited, New Delhi, 1989

Grade,R.J and A.G Mirajgaoker, 'Engineering Fluid Mechanics (including Hydraulic Machines), Second Edition, Nem Chand and Bros., Roorkee, 1983

R.K. Rajput, 'Fluid Mechanics and Hydraulic Machines', S.Chand Publication, New Delhi, 2002

e-Learning Source:

https://archive.nptel.ac.in/courses/105/103/105103095/

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	0	0	0	0	0	0	0	0	0	3	3
CO2	0	3	0	0	0	0	0	0	0	0	0	3	3
CO3	0	3	0	0	0	0	0	0	0	0	0	3	3
CO4	0	3	3	0	0	0	0	0	0	0	0	3	3
CO5	0	3	0	0	2	0	0	0	0	0	2	3	3
CO6	2	2	0	0	0	0	0	2	2	0	0	0	0

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE202	**Title of the Course**	Basic Surveying	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	3rd	3	0	2	4
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• To learn the different techniques of measurements of distances, directions and elevations by means ofadvanced surveying instruments. • To learn about the process of establishment of horizontal control points necessary for carrying outsurvey of the area. • To learn about the procedures of preparations of topographical maps of the areas.						

Course Outcomes	
CO1	Given conventional instruments and Total Station, students will apply surveying principles to measure distances accurately, correcting for errors and ensuring precision in linear measurement.
CO2	Using compass and theodolite, students will measure angles and bearings, perform necessary adjustments, and analyze magnetic declination to ensure directional accuracy.
CO3	With data and instruments, students will perform traversing and tachometric surveys, compute coordinates, and minimize errors in angular and distance measurements.
CO4	Using leveling instruments and elevation data, students will apply various leveling methods to determine elevations and produce accurate profiles while correcting for curvature and refraction.
CO5	Given contour data and topographic maps, students will generate contour maps, determine storage capacities, and apply CIM/I&A.C series for map numbering.
CO6	Given site plan, benchmark and standard survey instrument learners will be able to apply surveying techniques to perform field measurements and set out building layouts accurately with error adjustments.

Unit No.	Title of the Unit	Content of Unit (Theory)	Contact Hrs.	Mapped CO
1	Introduction to Basic Surveying	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	8	CO1
2	Measurement of Angles and Bearings	**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.	8	CO2
3	Traversing and Tachometry	**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.	8	CO3
4	Levelling	**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.	8	CO4

5	Contouring and Sheet numbering system	**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 & A.C series, Scales and Numbering of Indian Topographic maps.	8	CO5
List of Experiments				
1	To perform linear measurement, ranging, and taking offsets along a given survey line.		02	CO6
2	To measure the bearings of a closed traverse using a Prismatic/Surveyor's compass.		02	CO6
3	To determine the reduced levels of given points using an Auto Level or Dumpy Level.		02	CO6
4	To draw the longitudinal and cross-sectional profiles along a given route using a Dumpy/Auto Level.		02	CO6
5	To study the parts of a Vernier/Electronic Theodolite and measure horizontal and vertical angles.		02	CO6
6	To determine the height of a structure using trigonometrical leveling by taking observations in a single vertical plane.		02	CO6
7	To lay out a building plan on the ground according to the given drawings.		02	CO6
8	To lay out a column footing on the ground as per the given layout drawings.		02	CO6
9	To measure distances, horizontal and vertical angles, coordinates, and the area of given land using a Total Station (Demonstration).		02	CO6
10	To perform traversing of a given area using a Theodolite/Total Station.		02	CO6
11	To determine the reduced levels of intermediate points by conducting fly leveling.		02	CO6
Reference Books:				
Agor, R, "Surveying", Vol. I & II, Khanna Publications, Delhi, 1995.				
Arora, K, R., "Surveying ", Vol. I & II, Standard Book House, Delhi, 1993.				
Bannister, A. and Baker, R., "Solving Problems in Surveying "Longman Scientific Technical, U.K., 1994.				
Kennie, T.J.M. and Petrie, G., "Engineering Surveying Technology", Blackie & Sons Ltd., London, 1990.				
e-Learning Source:				
https://nptel.ac.in/courses/105107122/				

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	0	1	1	0	0	0	0	0	2	3	3
CO2	3	2	0	1	1	0	0	0	0	0	0	3	3
CO3	3	3	0	2	1	0	0	0	0	0	0	3	3
CO4	3	2	0	1	1	0	0	0	0	0	0	3	3
CO5	3	2	2	1	1	1	0	0	0	0	0	2	3
CO6	3	3	0	1	3	2	0	2	2	0	0	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE203	**Title of the Course**	Building Material and Construction	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	3rd	3	0	2	4
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• To equip students with the ability to analyze functional requirements of buildings, interpret structural loads as per IS codes (IS 875, IS 1893, NBC), and select appropriate construction materials (bricks, stones, metals, timber, modern composites) while adhering to safety, sustainability, and cost-effectiveness criteria. To teach students how to select appropriate construction materials. • To develop proficiency in designing and testing construction materials (aggregates, fly ash, pavements) through standardized protocols (IS 2386, IS codes) and evaluate their compliance with Indian standards for strength, durability, and quality. • To foster skills in proposing energy-efficient and sustainable construction solutions using modern materials (AAC, PVC panels, aerocon systems) and techniques, aligning with NBC guidelines and addressing real-world environmental and structural challenges.						

Course Outcomes	
CO1	Given real-world building scenarios, the student will be able to analyze the functional requirements of buildings and interpret loads as per IS 875, IS 1893, and NBC, ensuring compliance with safety and sustainability standards.
CO2	When provided with samples of bricks, stones, metals, and plastics, students will classify materials based on structural properties and justify their selection for construction scenarios with 90% accuracy in alignment with IS specifications.
CO3	Using aggregates, bitumen, and fly ash samples, students will evaluate the suitability of WBM and WMM for pavement construction and design bituminous mixes that meet technical specifications for durability and load-bearing capacity.
CO4	Considering environmental challenges and preservation requirements, students will assess timber preservation techniques and recommend modern materials for sustainable construction, adhering to IS guidelines for timber quality
CO5	Using architectural plans for residential buildings and NBC guidelines, students will design foundations, masonry walls, and waterproofing systems with modern techniques to ensure compliance with structural safety and efficiency norms.
CO6	Given samples of bricks, aggregates (fine/coarse), sand, concrete blocks (interlocking/AAC), and as per relevant Indian Standard codes (IS 1077, IS 3495, IS 2386, IS 15658, IS 2185), the student will be able to perform standardized tests to determine physical, mechanical, and durability properties and interpret the results within experimental tolerances specified in the standards.

Unit No.	Title of the Unit	Content of Unit (Theory)	Contact Hrs.	Mapped CO
1	Introduction	Functions of buildings and structures in general. Loads on buildings as per IS 875, IS 1893 and NBC. Functional requirements of buildings and the necessity of byelaws. Role of materials in construction	8	CO1
2	Bricks and Stones, Glass, metal and paints	Introduction and properties of construction materials. Structure and properties of materials. Introduction to brick and its types, Properties and classification. Selection of stones and their uses. Classification, properties and selection criteria: Glass, plastics, Steel, aluminium and Copper.	8	CO2
3	Aggregates and fly ash	Introduction to Aggregates, properties of aggregates and their types. Basic pavement materials such as WBM and WMM; structure and properties of bitumen and tar. Fly ash: uses and classification.	8	CO3
4	Timber and Wood-based materials. Modern Materials	Source of good timber, properties and classification of timber, preservation of timber. Wood products: properties, classification and applications. Modern materials: Autoclave Aerated Concrete, Polyvinyl Chloride Panels and Unplasticized Polyvinyl Chloride Panels, Aerocon Panels	8	CO4
5	Building Construction	Foundations, typical roof construction, masonry, door windows, plastering, pointing, water proofing materials and techniques. Stairs: Terminology, requirements and classification. Introduction to modern construction techniques.	8	CO5

List of Experiments				
1	Brick	1. Water absorption test on Brick samples as per IS 1077:1992 2. Dimension tolerance test on Brick samples as per IS 1077:1992 3. Determination of Compressive strength of brick samples as per IS 3495 (Part 1) 4. Efflorescence Test on Brick samples as per IS 3495 (Part 3)	06	CO6
2	Aggregate	1. Determination of Bulking of sand sample as per IS 2386 (Part 3) 2. Determination of Silt content of sand sample as per IS 2386	04	CO6
3	Steel and Modern Materials	1. Determination of impact resistance of mild steel as per IS 1598:1977 2. Determination of the indentation hardness of steel as per IS 1500: 2005 3. To study the mechanical properties of mild steel under torsion as per IS 1717 (2012) 4. Determination of Compressive strength of Interlocking Pavement Block sample as per IS 15658:2021 5. Determination of Compressive strength of Autoclaved Aerated Concrete as per IS 2185 (Part 3): 1984	10	CO6

Reference Books:

Sharma, SK; and Mathur, GC; "Engineering Materials;" Delhi-Jalandhar, S. Chand and Co.

TTTI, Chandigarh "Civil Engineering Materials:" New Delhi Tata McGraw Hill Publication

SC Rangawala, "Construction Materials", Charotar Publishers

S K Duggal; Building Materials, New Age Techno Press.

e-Learning Source:

https://nptel.ac.in/courses/105102088/

https://eerc01-iiith.vlabs.ac.in/List%20of%20experiments.html

https://onlinecourses.nptel.ac.in/noc21_ce10/preview

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	0	0	0	0	0	0	0	0	0	3	1	2
CO2	3	0	0	0	0	0	0	0	0	0	0	1	2
CO3	3	0	0	0	0	1	0	0	0	0	0	1	2
CO4	2	0	0	0	0	0	2	0	0	0	0	2	0
CO5	3	0	0	0	0	2	0	0	0	0	0	2	1
CO6	3	0	0	0	0	2	0	0	2	0	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE204	**Title of the Course**	Strength of Materials	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	3rd	3	1	0	4
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• To understand the stress-strain developed in structural members including their materials properties. • To form bending moment equations, shear force equations and bending stress diagram for a determinant beams. • To familiarize with strain energy and the theories of failure. • To introduce methods in order to calculate the deflections and rotations of a determinant beams and buckling load of long columns. • To impart knowledge in order to access the stress and strain developed in cylindrical and spherical vessels.						

Course Outcomes	
CO1	Learners will be able to apply the fundamental concepts of stress and strain under axial and thermal loading and analyze principal stresses using Mohr's circle for engineering components.
CO2	Learner will be able to analyze shear forces and bending moments in beams and calculate bending stresses for various beam cross-sections under static loads.
CO3	Learners will be able to compute strain energy and stresses under impact and torsional loading and evaluate shaft strength under loading conditions.
CO4	Learner will be able to determine slope and deflection in beams using standard analytical methods, including double integration, Macaulay's method, moment area, and conjugate beam methods under given loading condition.
CO5	Learners will be able to analyze axial load-carrying capacity of columns and struts using Euler's and Rankine's theories, and compute stresses in thin and thick-walled pressure vessels.

Unit No.	Title of the Unit	Content of Unit (Theor)	Contact Hrs.	Mapped CO
1	Stress-Strain	**Stress and Strain:** Concept of stress and strain relationship, Ductility, Toughness, Elastic constants, Hardness, Brittleness, Tension, Compression, Shear, and Elongation, Concept of thermal stresses **Principal stresses:** Stress transformation, Application of Mohr's circle in stress analysis	8	CO1
2	Bending & Torsion Theory	**Bending of Beams:** Review of bending of beams, shear forces & bending moment diagrams for statically determinate beams, bending stresses in the beam section.	8	CO2
3	Strain Energy and Theories of Failure	**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. **Torsion of Shafts:** Torsion of circular shaft, power transmitted by shaft, combined bending and torsion in shafts.	8	CO3
4	Slope & Deflection and Compression Members	**Deflection of Beams:** Deflection of beams, Integration method, Macaulay's method, Area Moment method, Conjugate Beam method.	8	CO4
5	Thin and Thick Cylinder	**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. **Thin & Thick Cylinders:** Theory of thin and thick cylinders subjected to pressure, expression for hoop stress and longitudinal stress, Thin walled pressure vessels and uniform torsion. Thick walled pressure vessels and uniform torsion.	8	CO5

Reference Books:
Kazmi, S. M. A., ‘Solid Mechanics’ TMH, Delhi, India.
R. K. Rajput, ‘Strength of Materials’, S. Chand & Company Ltd., New Delhi.
Norris, C.H. and Wilber, J. B. ‘Elementary Structural Analysis’ McGraw Hill.
Timoshenko, S. and Young, D. H., ‘Elements of Strength of Materials’, New York.
Surendra Singh, ‘Strength of Materials’, Vikas Publishing House Pvt. Ltd., New Delhi.
e-Learning Source:
https://nptel.ac.in/Aeronautical/Strength%20of%20Materials/course_strength%20of%20materials.pdf
https://nptel.ac.in/courses/105105108/
https://nptel.ac.in/downloads/105105108/

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	0	3	0	0	0	0	0	0	0	3	2
CO2	3	3	0	3	0	0	0	0	0	0	0	3	2
CO3	3	3	0	3	0	0	0	0	0	0	0	3	2
CO4	3	3	0	3	0	0	0	0	0	0	0	3	2
CO5	3	3	0	3	0	0	0	0	0	0	0	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE231	**Title of the Course**	Geotechnical Engineering	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	3rd	3	0	2	4
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• To build a strong foundation in soil mechanics by understanding the origin, physical and index properties of soils, and classifying them accurately using the Indian Standard soil classification system. • To develop analytical skills related to soil behavior, including permeability, effective stress, stress distribution under various loading conditions, and the phenomena of compaction and consolidation, with a focus on their implications for settlement and structural stability. • To enable students to evaluate the shear strength characteristics of soils using Mohr-Coulomb theory and laboratory testing, and to apply fundamental soil mechanics principles to practical geotechnical engineering problems such as slope stability, retaining walls, pavements, and foundations.						

Course Outcomes	
CO1	Given standard laboratory or field data for soil samples, the student will be able to describe the physical and index properties and classify soils as per IS classification system with accuracy as per IS:1498-1970.
CO2	Given details of soil strata and boundary conditions, the student will be able to compute permeability and formulate effective stress under static and dynamic conditions as per IS:2720 standards and Terzaghi's effective stress principle.
CO3	When subjected to different loading scenarios such as point load, strip load, or foundation loads, the student will be able to compute vertical and lateral stress distribution in soil using Boussinesq's or Westergaard's equations with acceptable precision.
CO4	Provided experimental data or lab results on compaction and consolidation, the student will be able to interpret soil behavior under loading and relate it to field applications such as embankments or foundations as per IS:2720 (Part 7 & 15).
CO5	Given laboratory test data from direct shear, triaxial, or unconfined compression tests, the student will be able to evaluate the shear strength parameters (cohesion and angle of internal friction) in line with Mohr-Coulomb failure theory.
CO6	Students will understand soil properties and apply them to geotechnical works like slopes, foundations, and retaining structures, using lab tests and data analysis as per IRC, IS:2720, and MoRTH guidelines.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction to Soil and Index Properties	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.	8	CO1
2	Permeability in Soil	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.	8	CO2
3	Stresses in Soil	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	8	CO3
4	Compaction and Consolidation	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.	8	CO4

5	Shear Strength	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	8	CO5
List of Experiments				
1	Determination of Basic Soil Properties	1. Determination of water content of a soil sample using (i) oven drying method and (ii) pycnometer method as per IS 2720 Part 2 2. Determination of specific gravity of soil using (i) density bottle and (ii) pycnometer method IS as per 2720 Part 3 3. Determination of grain size distribution using sieve and hydrometer analysis, and evaluation of relative density as per IS 2720 Part 4	8	CO6
2	Determination of Soil Compaction, Permeability & Compressibility Characteristics	1. Determination of in-situ dry density by (i) core-cutter method and (ii) sand replacement method IS 2720 Part 28 & 29 2. Determination of compaction characteristics (Optimum Moisture Content and Maximum Dry Density) as per IS 2720 Part 7&8 3. Determination of permeability of remolded soil using constant head and/or falling head method as per IS 2720 Part 17 4. Determination of consolidation characteristics using oedometer test as per IS 2720 Part 15	8	CO6
3	Determination of Soil Shear Strength Parameters	1. Determination of shear strength characteristics from Tri-axial Shear Test as per IS 2720 Part 11 2. Determination of shear strength characteristics from Direct Shear Test as per IS 2720 Part 13	4	CO6

Reference Books:

Gopal Ranjan and A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age International (P) Ltd, 2nd Edition (2005), New Delhi

K R Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Dist., 2nd Edition 2009.

V.N.S.Murty, "Soil Mechanics and Foundation Engineering", Sai Kripa Technical Consultants, 1st edition 2009

IS 2720. Indian Standard codes for Soil testing

e-Learning Source:

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https://gte-nitk.vlabs.ac.in/List%20of%20experiments.html

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	0	0	0	3	0	0	2	0	0	0	2	1	1
CO2	0	0	3	0	0	2	2	0	0	0	0	1	2
CO3	0	0	0	3	2	0	0	0	0	0	2	2	1
CO4	0	0	0	3	0	0	2	0	0	0	0	1	1
CO5	0	0	0	3	0	0	2	0	0	0	0	2	2
CO6	0	0	0	3	0	0	3	0	0	0	0	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	ES203	**Title of the Course**	Disaster Management and Mitigation	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	3rd	3	0	0	3
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• **Understand** the various types of disasters and analyze their profiles in the Indian context. • **Explain** the causes and **evaluate** the impacts of different disasters through case studies of national and global events. • **Apply** risk reduction approaches in disaster management and **analyze** safety measures for mitigating industrial disasters. • **Comprehend** the fundamental concepts of the Disaster Management Cycle and **implement** appropriate risk reduction strategies. • **Examine** national disaster mitigation acts and policies and **assess** the roles of key stakeholders such as the Army, Police, Community, Corporate sector, and Media in post-disaster management from both national and global perspectives.						

Course Outcomes	
CO1	Students will be able to learn types of disasters and its profile in India.
CO2	Students will be able to understand the causes and impacts of disasters on environment.
CO3	Students will be able to learn about risk reduction approaches of disasters with safety issues in mitigating industrial disasters.
CO4	To understand the concept of Disaster Management Cycle and its Risk Reduction.
CO5	Students will be able to learn the role of Acts, Policies, National and International Organizations in Disaster Management.
CO6	Students will be able to learn about Global Perspectives of Disasters.

Unit No.	Title of the Unit	Content of Unit (Theory)	Contact Hrs.	Mapped CO
1	Introduction to Disaster	Introduction to Disasters, Concepts, Definition and types (Natural and Man-made), Disaster profile of India.	6	CO1
2	Impact of Disaster	Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem., Case studies from Disasters, Large Hydro projects and its risks for Disasters.	8	CO2
3	Disaster Risk Reduction	Approaches to Disaster risk Reduction, Risk Assessments and Vulnerability Analysis Techniques, Safety issues in mitigating, Case studies, EHS.	7	CO3
4	Disaster Management	Disaster Management Cycle. Reconstruction and Rehabilitation. Early warning Systems Pre-Disaster Management, Post Disaster Management.	6	CO4
5	Disaster Act and Policies	National Acts and policies for mitigating Disasters (Disaster Management Act 2005, NDRF, National Policy for Disaster Management 2009, Role of Army and Police Force in Disaster, Role of International/National Humanitarian aid/ Relief Organizations for Disaster management, Role of Community, Corporate, Media etc. for post Disaster Management.	9	CO5
6	Global Perspective (Natural and Manmade Disasters)	Case Studies of disasters induced by Human Activities and climate change such as earthquake, forest fire, flood, drought, landslides, Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.	9	CO6

Reference Books:

Gupta Harsh K., Disaster Management, Hyderabad University Press, Publications-Meerut.

Sethi, V.K., Disaster Management, New Delhi Maxford Books.

Bhattacharya, Tushar, Disaster Science and Management, New Delhi Tata Mc Graw Hill.

Nidhi Gauba, Dhawan/ Ambrina Sardar Khan, Disaster Management and Preparedness, CBS.

e-Learning Source:

https://www.youtube.com/watch?v=9WIwlljva_s

https://www.youtube.com/watch?v=uA_OLKfQpYA

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	1	1	2	3		2	2	1	1	2
CO2	2	2	2	1	2	2	3		2	2	2	1	2
CO3	3	2	2	1	2	2	3		2	2	1	1	2
CO4	2	2	3	1	2	2	3		2	1	1	1	2
CO5	1	1	2	2	1	1	3		2	2	1	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	ES203	**Title of the Course**	Human Values & Professional Ethics	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	3rd	2	0	0	0
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• To help students understand the importance of human values and ethics in professional and personal life. • To develop a sense of social and environmental responsibility. • To enhance decision-making capabilities based on moral values and professional ethics. • To create awareness about the ethical responsibilities of engineers towards society. • To equip students with tools to handle ethical dilemmas in the workplace effectively.						

Course Outcomes	
CO1	Develop an understanding of human values, morals, and ethics for professional and personal growth.
CO2	Analyze and apply ethical reasoning in decision-making for professional and social well-being.
CO3	Demonstrate awareness of environmental, social, and sustainability responsibilities in engineering practices.
CO4	Identify ethical dilemmas and implement professional ethics in engineering projects.
CO5	Develop skills for effective communication, teamwork, and leadership while adhering to ethical values.

Unit No.	Title of the Unit	Content of Unit (Theory)	Contact Hrs.	Mapped CO
1	Introduction to Human Values	Definition, Types of Values, Morals, Ethics, and Character, Need for Ethics in Engineering. Value Education, Self-Exploration. Natural Acceptance and Experiential Validation, Continuous Happiness and Prosperity, Right understanding, Understanding Happiness and Prosperity correctly.	6	CO1
2	Introduction to Ethical Concept	Definition of industrial ethics and values, Ethical rules of industrial worker. Values and Value Judgments. Moral Rights and Moral rules, Moral character and responsibilities. Privacy, Confidentiality, Intellectual Property and the Law. Ethics as Law.	6	CO2
3	Corporate Social Responsibility & Sustainability	The basis and scope of Professional Responsibility, Professions and Norms of Professional Conduct, Ethical Standards versus Profession, Culpable mistakes, the Autonomy of professions and codes of ethics. Employee status and Professionalism. Central Professional Role of Engineers in Society, Ethical Theories, Decision Making Frameworks, Conflicts of Interest Environmental and Social Responsibilities, Sustainability, Safety, and Risk Assessment.	6	CO3
4	Ethical Dilemmas and Case Studies	Senses of 'Engineering Ethics', variety of moral issues, types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, Gilligan's theory, Valuing Time, Case Studies on Professional Ethics, Corporate Misconduct, Whistleblowing.	6	CO4
5	Communication and A Glimpse of Life Stories on Leadership with Ethics	Effective Communication, Teamwork, Leadership, and Ethical Conduct. Environmental ethics, computer ethics, weapons development, engineers as managers consulting engineers, engineers as expert witnesses and advisors, moral leadership. Life story of Prophet Mohammad, Mahatma Gandhi, Swami Vivekanand, Marie Curie and Steve Jobs.	6	CO5

Reference Books:

R. R. Gaur, R. Sangal, G. P. Bagaria, "A Foundation Course in Human Values and Professional Ethics," Excel Books, 2010.

Govindarajan M., Natarajan S., Senthil Kumar V. S., "Engineering Ethics (Includes Human Values)," PHI Learning, 2013.

Charles D. Fleddermann, "Engineering Ethics," Pearson Education, 4th Edition, 2012.

Mike W. Martin, Roland Schinzinger, "Ethics in Engineering," McGraw Hill, 4th Edition, 2013.

R.S. Naagarazan, "Professional Ethics and Human Values," New Age International, 2006.

e-Learning Source:
https://www.youtube.com/watch?v=XiN8iqJGb48&list=PLFW6lRTa1g83uYgRiZEy_F4pzedPNWpew
https://www.youtube.com/watch?v=vS31O3XfH_0&list=PLyVhmjhvTvDYR2K4FgFYuK2gfUibZG8YA
https://www.youtube.com/watch?v=8gpzLafYPcA
https://www.youtube.com/watch?v=xXyatU-l07w

PO-PSO-CO	PO											PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	3	3	2	2	1	3	2	2	1
CO2	2	2	2	1	1	3	3	2	2	1	3	2	3	2
CO3	2	2	2	2	1	3	3	2	2	1	3	2	3	2
CO4	1	2	2	2	1	3	3	2	2	1	3	2	2	2
CO5	1	1	2	2	2	3	3	3	3	2	3	2	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE210	**Title of the Course**	Advance Surveying	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	4th	3	0	2	4
Pre-Requisite	CE202	**Co-requisite**	NA				
Course Objectives	• To learn about the principles involved in the advanced surveying instruments. • 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. • To learn about the techniques of layout of curves in transportation • To learn about modern survey instruments like Total station, DGPS etc.						

Course Outcomes	
CO1	Given plane table instruments and alidades, students will perform plane table surveying using various methods and solve resection problems to locate points accurately on the field.
CO2	Using triangulation principles, students will classify systems, assess intervisibility, and compute baseline extension and center reduction for accurate station positioning.
CO3	With field observation data, students will apply error theory and least squares methods to determine most probable values and distribute errors based on weighting laws.
CO4	Using design data and project alignment constraints, students will set out simple circular, transition, and vertical curves applying geometric parameters and safety criteria for road and rail projects
CO5	Given engineering and hydrographic project needs, students will apply setting out and sounding methods, and operate EDM, Total Station, and DGPS for precise positioning and distance measurement
CO6	Given site plan, benchmark and standard survey instrument learners will be able to perform advanced field surveys involving topographic mapping, building and curve layout, and coordinate-based land measurements using modern instruments, to support engineering design and planning.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Plane Table Survey	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 problem.	8	CO1
2	Triangulation and Trilateration	Introduction, classification of triangulation system, triangulation figures, station marks and signals, intervisibility and height of stations, satellite station, problems on reduction to center, base line measurement and its extension.	8	CO2
3	Theory of Errors	Types of errors, treatment of random errors, Basic terms, laws of weights with examples, Theory of least squares, Rules for giving weights and distribution of errors to the field observations, Determination of the most probable values of quantities by normal equation method & method of differences.	8	CO3
4	Curves	Classification of curves, Elements of simple circular curve, Designation of curve by radius and degree of curves. Method of Setting out simple circular curve by offset from long chord method and Rankine's method of deflection angles. Simple Numerical problems on above topics. Transition curve, introduction and advantages superelevation, length of transition curve. Vertical curve and its types, sight distance.	8	CO4
5	Project Surveys	General requirements for engineering project surveys, Setting out of building. Hydrographic surveying: Introduction to Hydrographic surveying, Sounding, methods of locating soundings. Special Survey Instruments: Introduction and uses of Electromagnetic Distance Measurement (EDM), Total station, Differential Global Positioning System (DGPS).	8	CO5

List of Experiments			
1	To perform traversing of the given area using a plane table.	2	CO6
2	To lay out a building plan on the ground using a Theodolite/Total Station	2	CO6
3	To set out a simple circular curve by the Offset method.	2	CO6
4	To set out a simple circular curve by Rankine's method.	2	CO6
5	To determine the coordinates and area of a land parcel using DGPS	2	CO6
6	To determine the coordinates and area of a land parcel using a Total Station.	2	CO6
7	To draw the longitudinal and cross-sectional profiles along a given route using a Total Station/DGPS	2	CO6
8	To plot the details as well as contours (topographic mapping) of an area using a Total Station/DGPS.	2	CO6
9	To set out a building foundation using centerline marking techniques/coordinates.	2	CO6
10	To perform traversing of the given area using a plane table.	2	CO6
11	To lay out a building plan on the ground using a Theodolite/Total Station	2	CO6

Reference Books:

Agor, R., "Surveying", vol. II & III Khanna Publications, Delhi, 1995.

Arora, K. R., "Surveying", vol. II & III Standard Publishing House, Delhi, 1993.

Bannister, A. and Baker, R., "Solving Problems in surveying". Longman Scientific Technical, U.K, 1994.

Kennie, T.J.M. and Petrie,G., "Engineering Surveying Technology", Blackie & Sons Ltd., London, 1990.

e-Learning Source:

https://nptel.ac.in/courses/105107158/

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	0	0	1	0	0	0	0	2	3	3
CO2	3	3	3	0	1	2	0	0	0	0	2	3	3
CO3	3	3	1	2	0	0	0	0	0	0	1	3	3
CO4	3	3	3	2	1	2	0	0	0	0	1	3	3
CO5	3	3	2	2	2	2	0	0	0	0	1	3	3
CO6	2	3	3	2	3	3	0	2	2	0	2	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE211	**Title of the Course**	Concrete Technology	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	4th	3	0	2	4
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• Understand the composition, properties, and testing of cement, aggregates, and special concretes (e.g., lightweight, polymer) as per BIS standards. • Design and optimize concrete mixes using IS/ACI methods, addressing workability, quality control, and production challenges. • Conduct standardized tests (physical, mechanical, NDT) on cement, aggregates, and concrete as per IS codes (4031, 2386, 516, 13311).						

Course Outcomes	
CO1	Given raw materials and experimental hydration data, students will be able to analyze the composition of Portland cement, its hydration process, and strength development mechanisms to predict compressive strength under varying curing conditions, aligned with theoretical models.
CO2	Given construction scenarios, cement types, and aggregate samples with BIS specifications, students will analyze the composition, properties, and suitability of cement and aggregates through comparative evaluation and standardized testing to select materials compliant with technical, environmental, and code requirements.
CO3	Given concrete materials and field scenarios, students will be able to design proportioned concrete mixes, analyze factors affecting workability (e.g., water-cement ratio, aggregate grading), evaluate segregation/bleeding/laitance risks, and assess concrete quality using NDT methods to ensure compliance with IS 456 and technical feasibility.
CO4	Given raw materials, admixtures, and code specifications, students will be able to design concrete mixes using statistical, IS, and ACI methods, analyze rheological behavior and maturity effects, select appropriate admixtures based on functional classification, and evaluate compliance with strength, durability, and workability requirements as per IS 9103 and project specifications.
CO5	Given construction scenarios or material constraints, students will be able to evaluate the constituents, properties, and applications of special concretes to select and justify their use based on structural, environmental, and economic requirements, complying with industry standards.
CO6	Given cement, fine/coarse aggregates, and fresh/hardened concrete samples with relevant Indian Standard codes (IS 4031, IS 2386, IS 1199, IS 516, and IS 13311), the student will be able to perform standardized tests to determine physical, mechanical, and workability properties and interpret the results within acceptable experimental tolerances as specified in the standards.

Unit No.	Title of the Unit	Content of Unit (Theory)	Contact Hrs.	Mapped CO
1	Introduction of Cement Concrete	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. Testing of cement for general physical and chemical properties as per BIS specifications.	8	CO1
2	Types of Cement	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.	8	CO2
3	Tests on Fresh Concrete and Hardened Concrete	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	CO3
4	Mix Design	Concrete Mix Design: Principle and methods, Statistical quality control, concrete rheology, maturity concept, IS code method, ACI code method. Admixture in concrete: Introduction, functions, classification, and IS specification.	8	CO4

5	Special Concrete	Special Concrete: Light weight concrete. High density concrete. Sulphar Impregnated concrete, polymer concrete, lime concrete, constituents and uses. High Strength Concrete, Fibre Reinforced Concrete.	8	CO5
List of Experiments				
1	Cement	1. Determination of consistency of cement as per IS 4031 (Part4) 2. Determination of initial & final setting time of cement as per IS 4031 (Part 5) 3. Determination of compressive strength of cement as per IS 4031 (Part 6) 4. Determination of Fineness of cement of cement as per IS 4031 (Part 1)	06	CO6
2	Coarse Aggregate Fine Aggregate	1. Determination of Specific gravity & Water absorption of fine aggregate as per IS 2386 (Part III) 2. Determination of Specific gravity & Water absorption of coarse aggregate as per IS 2386 (Part III) 3. Perform Sieve Analysis of Coarse Aggregates as per IS 2386 (Part 1) 4. Perform Sieve Analysis of Fine Aggregates as per IS 2386 (Part 1)	06	CO6
3	Test on Fresh Concrete Tests on Hardened Concrete	1. Determination of workability of fresh concrete as per IS: 1199 (Part 2) 2. Determination of Compressive Strength as per IS: 516 (Part 1: Section 1) 3. Determination of Flexural Strength as per IS 516 (Part 1: Section 1) 4. Perform Non-Destructive Test as per IS 13311-2 (Rebound Hammer and Ultra Sonic Pulse Velocity test) IS 516 (Part 5: Section 1)	06	CO6

Reference Books:

Gambhir M.L., "Concrete Technology", - Tata McGraw Hill Publishing Company Ltd., New Delhi.

Shetty M.S, "Concrete Technology, Theory and practices", S. Chand & 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.

e-Learning Source:

https://nptel.ac.in/courses/105102012/

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PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	0	0	2	1	0	0	0	0	0	0	1	0
CO2	3	0	0	2	1	0	0	0	0	0	0	2	0
CO3	3	0	2	2	1	0	0	0	0	0	0	1	1
CO4	3	0	2	2	3	0	2	2	1	0	3	1	3
CO5	3	0	2	2	1	0	0	0	0	0	0	1	0
CO6	3	0	1	3	3	1	3	1	3	0	3	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE212	**Title of the Course**	Structural Analysis - I	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	4th	3	0	2	4
Pre-Requisite	Recommended CE204	**Co-requisite**	NA				
Course Objectives	• To develop the ability to classify and analyze determinate structures—including beams, trusses, and arches—by understanding their form, support conditions, and responses to loads. • To equip learners with the concepts of strain energy and unsymmetrical bending for accurate deflection analysis and structural assessment under complex loading.						

Course Outcomes	
CO1	Learners should be able to classify structure in terms of stability and determinacy. Also able to analyze determinate truss for given load & support conditions.
CO2	Learners should be able to analyze beams/girders subjected to moving load as well as draw the influence lines for reactions, shears, and bending moments by knowing loading conditions.
CO3	Learner should able to analyze and draw the influence lines for reactions, radial shears, normal thrust and bending moments for three hinged arches by knowing its shapes and loading conditions
CO4	Learner should know the principle and significance of strain energy methods as well as able to calculate deflections in statically determinate structures by applying strain energy methods for given loading conditions.
CO5	Learners should understand the behavior of unsymmetrical and curved beams under loading, and be able to compute stresses, deflections, and locate the shear center for common structural sections.
CO6	Learners will be able to analyze and evaluate the behavior of beams, frames, and arches under various loading conditions, and determine deflection, internal forces, and flexural response using analytical and experimental methods.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Classification of Structures	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.	8	CO1
2	Rolling Loads	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	8	CO2
3	Arches	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.	8	CO3
4	Strain Energy	Strain Energy of deformable systems, Maxwell's reciprocal & Betti's theorem, Castigliano's first theorem, unit load methods for determinate structures.	8	CO4
5	Unsymmetrical Bending	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.	8	CO5
List of Experiments				
1	To determine flexural Rigidity (EI) of a given beam.		2	CO6
2	To verify Maxwell's Reciprocal Theorem		2	CO6
3	To find horizontal thrust in a three hinged arch and to draw influence line diagrams for Horizontal Thrust and Bending Moment.		2	CO6
4	To find horizontal thrust in a two hinged arch and to draw influence line diagrams for Horizontal Thrust and Bending Moment.		2	CO6
5	To find carry over factor for the beam with far end fixed.		2	CO6
6	To find deflection of curved members		2	CO6
7	To find bar forces in a three member structural frames with pin jointed bar.		2	CO6

8	To find forces in elastically Coupled Beam.	2	CO6
9	To find deflections in beam having unsymmetrical bending.	2	CO6
10	To determine the fatigue strength of mild steel specimen	2	CO6

Reference Books:
Wilbur and Norris, “Elementary Structural Analysis”, Tata McGraw Hill.
Reddy, C.S., “Basic Structural Analysis”, Tata McGraw Hill.
Jain, O.P. and Jain, B.K., “Theory & Analysis of Structures”. Vol. I & II Nem Chand.
Jain, A.K., “Advanced Structural Analysis”, Nem Chand & Bors, Roorkee, India 1996.
e-Learning Source:
https://nptel.ac.in/downloads/105101085/
https://nptel.ac.in/downloads/105105109/
https://nptel.ac.in/youtube.com/watch?v=qhEton-EEOw
https://nptel.ac.in/courses/105105166/

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	0	0	0	0	0	0	0	0	0	3	2
CO2	3	2	0	1	0	0	0	0	0	0	0	3	2
CO3	3	2	0	1	0	0	0	0	0	0	0	3	2
CO4	3	2	0	2	0	0	0	0	0	0	0	3	2
CO5	3	2	0	2	0	0	0	0	0	0	0	3	2
CO6	3	1	0	0	2	0	0	2	2	0	0	3	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE234	**Title of the Course**	Design of Reinforced Concrete Elements	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	3rd	3	1	0	4
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• To understand the Basic concept and procedure of Designing Reinforced Concrete Structural Components.						

Course Outcomes	
CO1	Learners will be able to apply the appropriate load, load combination and use working stress method as per the design requirement under Indian Standard Codes.
CO2	Learner will be able to design RC beam under given loading as per the design requirement under Indian Standard Codes.
CO3	Learner will be able to design RC slab under given loading and check serviceability criteria as per the design requirement & guidelines under Indian Standard Codes.
CO4	Learner will be able to design RC short column under given loading as per the design requirement under Indian Standard Codes.
CO5	Learner will be able to design RC isolated and combined footing under given loading as per the design requirement under Indian Standard Codes.

Unit No.	Title of the Unit	Content of Unit (Theory)	Contact Hrs.	Mapped CO
1	Attributes of Structural Design	Loads and Load Combination as per IS875 and IS 456. Material properties of RCC Making materials, Basic design approach, design methodologies. Working stress method of design. Assumptions, Analysis and Design of a rectangular singly reinforced section by Working stress design method. Introduction to limit state design.	8	CO1
2	Limit State Design of Beams	Codal recommendations, Design of a rectangular singly & doubly reinforced section by limit state method as per IS456. Effect of torsion on beam, concept of equivalent shear and moments. Design of beam under torsion.	8	CO2
3	Limit State Design of Slab & Serviceability	One-way solid slabs, Simply supported and continuous. Two-way slabs: Simply supported and continuous. Introduction to serviceability, short term, long term deflections & cracks in RCC. Calculation of deflection and cracks as per IS456.	8	CO3
4	Limit State Design of Compression Members	Classification of compression members, Codal provisions relating to design of RC columns, Effective length of RC column, Minimum eccentricity, Design of axially loaded, uniaxial and biaxial columns by Limit state method as per IS456 and SP16.	8	CO4
5	Limit State Design of footing	Structural behavior of footings, Codal provisions relating to design of RC foundations, types of foundations. Design of isolated footing and combined footing by Limit state method as per IS456.	8	CO5

Reference Books:

Kazmi, S. M. A., 'Solid Mechanics' TMH, Delhi, India.

R. K. Rajput, 'Strength of Materials', S. Chand & Company Ltd., New Delhi.

Norris, C.H. and Wilber, J. B. 'Elementary Structural Analysis' McGraw Hill.

Timoshenko, S. and Young, D. H., 'Elements of Strength of Materials', New York.

Surendra Singh, 'Strength of Materials', Vikas Publishing House Pvt. Ltd., New Delhi.

e-Learning Source:

https://nptel.ac.in/Aeronautical/Strength%20of%20Materials/course_strength%20of%20materials.pdf

https://nptel.ac.in/courses/105105108/

https://nptel.ac.in/downloads/105105108/

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	0	3	0	0	0	0	0	0	0	3	3
CO2	3	3	0	3	0	0	0	0	0	0	0	3	3
CO3	3	3	0	3	0	0	0	0	0	0	0	3	3
CO4	3	3	0	3	0	0	0	0	0	0	0	3	3
CO5	3	3	0	3	0	0	0	0	0	0	0	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE335	**Title of the Course**	Advance Geotechnical Engineering	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	4th	3	0	0	3
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• 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.						

Course Outcomes	
CO1	Given site conditions and structural requirements, students will be able to differentiate and explain various types of foundations (shallow and deep) based on suitability, function, and load characteristics as per IS 1080 and IS 2911 with correct classification in 90% of cases.
CO2	When provided with geotechnical field data and site constraints, students will be able to describe and interpret various in-situ soil investigation methods such as Standard Penetration Test (SPT), Cone Penetration Test (CPT), and Plate Load Test with clarity and compliance to IS: 2131 and IS: 4968 standards.
CO3	Given the soil parameters and structural load data, students will be able to analyze and design suitable foundation systems (isolated, combined, raft, pile) using relevant theories and IS code provisions with safe bearing capacity and permissible settlement criteria.
CO4	When presented with case histories or field failure reports, students will be able to identify and explain causes of foundation and structural failures and recommend preventive measures as per standard practices.
CO5	Provided geometrical and loading configurations of earth-retaining systems, students will be able to evaluate and describe the behavior of retaining structures (gravity, cantilever, anchored walls) under active, passive, and at-rest conditions with theoretical validation and acceptable factor of safety as per IS: 14458.

Unit No.	Title of the Unit	Content of Unit (Theory)	Contact Hrs.	Mapped CO
1	Soil Exploration and Site Investigation	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. Boring: Auger boring, Wash boring and Rotary drilling. Types of soil sample: Disturbed and undisturbed soil samples, Features of sampler affecting soil disturbance. Characterization of ground, site investigations, Standard Penetration Test, Static and Dynamic cone penetration test, ground water level etc. Preparation of Bore log report.	8	CO1
2	Shallow Foundation and Bearing Capacity	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.	8	CO2
3	Deep Foundations	Pile foundations: Introduction to pile foundation, factors influencing the selection of pile, Load carrying capacity of Single Pile by static formula and dynamic formula (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. 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.	8	CO3
4	Stability of Slopes	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.	8	CO4

5	Earth Pressures and Retaining Structures	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.	8	CO5

Reference Books:

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).

IS 2720. Indian Standard codes for Soil testing

e-Learning Source:

https://nptel.ac.in/courses/105105185/

https://nptel.ac.in/courses/105101201

https://gte-nitk.vlabs.ac.in/List%20of%20experiments.html

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	0	0	0	3	0	0	2	0	0	0	2	1	1
CO2	0	0	0	3	0	0	2	0	0	0	2	1	2
CO3	0	0	0	3	0	0	2	0	0	0	2	2	1
CO4	0	0	0	3	0	0	2	0	0	0	2	1	1
CO5	0	0	0	3	0	0	2	0	0	0	2	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Integral University, Lucknow

Effective from Session: 2025-26							
Course Code	CE271	**Title of the Course**	Air and Noise Pollution Control	**L**	**T**	**P**	**C**
Year	2nd	**Semester**	4th	3	0	0	3
Pre-Requisite	NA	**Co-requisite**	NA				
Course Objectives	• To classify air pollutants, identify their sources, and interpret air quality indices. • To apply air sampling methods and analyse meteorological data for pollution assessment • To design and evaluate particulate pollution control devices. • To select suitable gaseous pollutant control methods based on performance and cost. • To assess noise pollution and recommend appropriate control measures as per regulations.						

Course Outcomes	
CO1	After analyzing major pollution sources and their effects, students will be able to classify air pollutants and interpret air quality indices as per CPCB standards.
CO2	Given a pollution monitoring scenario, students will accurately select and apply ambient and stack sampling techniques and interpret meteorological data.
CO3	When tasked with particulate pollution scenarios, students will design and evaluate appropriate control equipment achieving ≥80% removal efficiency.
CO4	For a given gaseous pollutant case, students will choose suitable control methods and justify their selection based on pollutant characteristics and cost-efficiency.
CO5	Under urban or industrial settings, students will assess noise levels using standard tools and recommend control measures compliant with national noise regulations.

Unit No.	Title of the Unit	Content of Unit (Theory)	Contact Hrs.	Mapped CO
1	Introduction to Air Pollution	Definition and classification of air pollutants, Sources: natural and anthropogenic, Effects on human health, vegetation, animals, and materials, Global impacts: climate change, ozone depletion, Air quality standards and indices.	8	CO1
2	Air Pollution Monitoring and Meteorology	Ambient and stack sampling techniques, Measurement of particulate and gaseous pollutants, Meteorological parameters: wind patterns, temperature inversions, plume behaviour, Dispersion modelling and air quality forecasting.	8	CO2
3	Control of Particulate Pollutants	Design and operation of control equipment: Gravity settlers, Cyclones, Fabric filters, Electrostatic precipitators, Wet scrubbers. Selection criteria and efficiency considerations.	8	CO3
4	Control of Gaseous Pollutants	Control methods: Absorption, Adsorption, Condensation, Combustion, Biofiltration. Application to pollutants like SO_2, NO_x, CO, VOCs. Process integration and cost analysis.	8	CO4
5	Noise Pollution and Its Control	Sources: industrial, transportation, construction, and urban activities, Measurement units and instrumentation, Effects on human health and environment, Control strategies: Source reduction, Path control, Personal protection. Regulations and standards.	8	CO5

Reference Books:

C. S. Rao, Environmental Pollution Control Engineering, Wiley Eastern Ltd.

M. N. Rao & H. V. N. Rao, Air Pollution, Tata McGraw-Hill.

Noel de Nevers, Air Pollution Control Engineering, McGraw-Hill.

e-Learning Source:

https://archive.nptel.ac.in/courses/105/107/105107213/

https://archive.nptel.ac.in/courses/112/104/112104227/

PO-PSO-CO	PO											PSO	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	0	0	0	0	3	0	0	0	0	0	1	1
CO2	3	2	0	0	0	3	0	0	0	0	0	1	1
CO3	3	0	0	0	0	3	0	0	0	0	0	1	1
CO4	3	0	0	0	0	3	0	0	0	0	0	1	1
CO5	3	2	0	0	0	3	0	0	0	0	0	1	1

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