# SYLLABUS

# OF

## *B. TECH*

***OF***

## *II YEAR*

## B. TECH. (CBCS)

### DEPARTMENT OF CIVIL ENGINEERING

## INTEGRAL UNIVERSITY LUCKNOW

# SYLLABUS AND EVALUATION SCHEME

## Branch: Civil Engineering (w.e.f. 2022-23)

## Year – II, Semester – III

| S. No. | Course Category | Code No | Name of Subject | Periods | | | Credits | Evaluation Scheme | | | | Subject Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Sessional Exam | | | Exam | |
| | | | | L | T | P | C | CT | TA | Total | ESE | |
| 1 | DC | CE201 | Fluid Mechanics | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 2 | DC | CE202 | Basic Surveying | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 3 | DC | CE204 | Strength of Material | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 4 | DC | CE231 | Geotechnical Engineering | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 5 | DC | CE101 | Construction Materials | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 6 | DC | As per Annexure | Departmental Elective II | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| **PRACTICAL / DRAWING / DESIGN** | | | | | | | | | | | | |
| 7 | DC | CE205 | Fluid Mechanics Lab | 0 | 0 | 2 | 1 | 40 | 20 | 60 | 40 | 100 |
| 8 | DC | CE206 | Basic Surveying Field Work | 0 | 0 | 2 | 1 | 40 | 20 | 60 | 40 | 100 |
| 9 | DC | CE238 | Geotechnical Engineering Lab | 0 | 0 | 2 | 1 | 40 | 20 | 60 | 40 | 100 |
| 10 | DC | CE208 | Material Testing Lab | 0 | 0 | 2 | 1 | 40 | 20 | 60 | 40 | 100 |
| **Total** | | | | **18** | **6** | **8** | **28** | | | | | **1000** |

**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)

**BS** – Basic Sciences
**HM** – Humanities
**DE** – Departmental Elective
**DC** – Departmental Core
**OE** – Open Elective
**ESA** – Engineering Science & Art (Foundation Course & Engineering Courses)

# SYLLABUS AND EVALUATION SCHEME

## Branch: Civil Engineering (w.e.f. 2022-23)

## Year – II, Semester – IV

| S. No. | Course Category | Code No | Name of Subject | Periods | | | Credits | Evaluation Scheme | | | | Subject Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Sessional Exam | | | Exam | |
| | | | | L | T | P | C | CT | TA | Total | ESE | |
| **THEORY SUBJECT** | | | | | | | | | | | | |
| 1 | DC | CE209 | Hydraulic & Hydraulic Machines | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 2 | DC | CE210 | Advance Surveying | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 3 | DC | CE212 | Structural Analysis-I | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 4 | DC | CE234 | Design of Reinforced Concrete Elements | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 5 | DC | As per Annexure | Open Elective I | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| 6 | ESA | ES202 | Disaster Management | 2 | 1 | - | 3 | 40 | 20 | 60 | 40 | 100 |
| 7 | DC | CE106 | Introduction to Civil Engineering Profession | 3 | 1 | - | 4 | 40 | 20 | 60 | 40 | 100 |
| **PRACTICAL / DRAWING / DESIGN** | | | | | | | | | | | | |
| 8 | DC | CE213 | Hydraulic & Hydraulic Machines Lab | 0 | 0 | 2 | 1 | 40 | 20 | 60 | 40 | 100 |
| 9 | DC | CE214 | Advance Surveying Field Work | 0 | 0 | 2 | 1 | 40 | 20 | 60 | 40 | 100 |
| 10 | DC | CE215 | Concrete Technology Lab | 0 | 0 | 2 | 1 | 40 | 20 | 60 | 40 | 100 |
| 11 | DC | CE252 | Comprehensive Annual Assessment-I | - | - | - | 1 | 40 | 20 | 60 | 40 | 100 |
| **Total** | | | | **20** | **6** | **8** | **31** | | | | | **1100** |

**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)

**BS** – Basic Sciences
**HM** – Humanities
**DE** – Departmental Elective
**DC** – Departmental Core
**OE** – Open Elective
**ESA** – Engineering Science & Art (Foundation Course & Engineering Courses)

# Integral University, Lucknow

| **Effective from Session:** 2015-16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE201 | **Title of the Course** | Fluid Mechanics | **L** | **T** | **P** | **C** |
| Year | 2ND | **Semester** | 3RD | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | NIL | **Co-requisite** | NIL | | | | |
| **Course Objectives** | The main objective of this course is to understand the basics of the fluid mechanics such as fluid and flow properties, fluid behavior at rest and in motion and fundamental equations like mass, energy and momentum conservation of the fluid flow. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Students are able to understand basic concept of properties of fluid and its properties. |
| **CO2** | Students are able to understand the Kinematics and Dynamics of Fluid and its application. |
| **CO3** | To understand the concept of fluid measurement, types of flows and dimensional analysis. |
| **CO4** | To determine the losses in a flow system, flow through pipes, boundary layer flow and flow past immersed bodies. |
| **CO5** | Students are able to understand the concept of turbulent flow in in pipe and its nature. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | Introduction & Fluid Statics | **Introduction:** Fluid Statics Fluid and continuum, physical properties of fluids, ideal and real fluids, Newtonian and NonNewtonian fluids, measurement of surface tension. **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. | **8** | CO1 |
| 2 | Kinematics & Dynamics of Fluid Flow | **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. **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. | **8** | CO2 |
| 3 | Dimensional Analysis & Laminar Flow | **Dimensional Analysis and Hydraulic Similitude:** Dimensional analysis, Buckingham's $\pi$ theorem, important dimensional numbers and their significance, similitude, similarity laws, geometric, Kinematics and dynamic similarity, model studies. **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 | **8** | CO3 |
| 4 | Turbulent Flow & Boundary Layer Analysis | **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. **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. | **8** | CO4 |
| 5 | Flow Past Submerged Bodies & Pipe Flow | **Flow Past Submerged Bodies:** Drag and lift, drag on sphere, Cylinder and disc, lift, Magnus effect and circulation. **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. **Compressibility Effects in Pipe Flow:** Transmission of pressure waves in rigid and elastic pipes; Water hammer, analysis of simple surge tank excluding friction. | **8** | CO5 |

**Reference Books:**


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

| e-Learning Source: |
|---|
| 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/ |

| | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 2 | 1 | 1 | 0 | 2 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 3 |
| **CO2** | 3 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 3 | 2 |
| **CO3** | 2 | 3 | 2 | 2 | 2 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 2 |
| **CO4** | 2 | 0 | 2 | 1 | 2 | 2 | 0 | 0 | 1 | 0 | 2 | 1 | 2 | 2 |
| **CO5** | 3 | 2 | 1 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 3 |

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

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2019-20 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE202 | **Title of the Course** | Basic Surveying | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 3rd | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | NIL | **Co-requisite** | NIL | | | | |
| **Course Objectives** | 1. To learn the different techniques of measurements of distances, directions and elevations by means of advanced surveying instruments.<br>2. To learn about the process of establishment of horizontal control points necessary for carrying out survey of the area.<br>**3.** To learn about the procedures of preparations of topographical maps of the areas. | | | | | | |

1.

| **Course Outcomes** | |
|---|---|
| **CO1** | The students have the ability to understand the measurement techniques and equipment used in land surveying. |
| **CO2** | The students have the ability to take angular measurement from compass and correct them from different errors. |
| **CO3** | The students have an ability to calculate the linear measurement and area of the land. |
| **CO4** | The students will Gain the ability to measure differences in elevation |
| **CO5** | The students will be able to represent the topography of the land graphically. |

| Unit No. | Title of the Unit | Content of Unit | 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.<br>**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 | 1 |
| 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 | 2 |
| 3 | **Traversing and Tachometry** | **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 | 3 |
| 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 | 4 |
| 5 | **Contouring and Sheet** | **Contouring:** Definition and characteristics of contours, contour interval, Use of contour maps, storage capacity of reservoir, direct and Indirect methods of contouring.<br>**Sheet Numbering System**: CIM and I and A.C series, Scales and Numbering of Indian Topographic maps | 8 | 5 |

**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/

| | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 2 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 0 |
| **CO2** | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| **CO3** | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **CO4** | 2 | 2 | 1 | 1 | 1 | 0 | 1 | 0 | 2 | 1 | 0 | 1 | 0 | 0 |
| **CO5** | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |

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

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|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2019-20 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE204 | **Title of the Course** | Strength of Materials | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 3rd | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | ------ | **Co-requisite** | ------ | | | | |
| **Course Objectives** | • To understand the stress-strain developed in structural members including their materials properties.<br>• To form bending moment equations, shear force equations and bending stress diagram for a determinant beams.<br>• To familiarize with strain energy and the theories of failure.<br>• To introduce methods in order to calculate the deflections and rotations of a determinant beams and buckling load of long columns.<br>• To impart knowledge in order to access the stress and strain developed in cylindrical and spherical vessels. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | In-depth understanding of stress strain relationship and of various properties for different materials with ability to calculate stress- strain for different structural members subjected to given loading conditions. |
| **CO2** | Interpretation of bending moments, shear forces and bending stresses for determinant beams under different loading and support conditions. Be able to analyze the effects of torsion on shafts. |
| **CO3** | Insight of strain energy in a structural element subjected to various types of forces and understanding of different failure theories. |
| **CO4** | Ability to calculate the deflections and rotations of a beam under given loading and support conditions and be able to comprehend the buckling loads of a long column according to its support conditions. |
| **CO5** | Ability to analyze the stresses and strains associated with thin- thick wall cylindrical and spherical pressure vessels. |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **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 [5]<br>**Principal stresses:** Stress transformation, Application of Mohr's circle in stress analysis [3] | 8 | CO1 |
| 2 | Bending & Torsion Theory | **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]<br>**Torsion of Shafts:** Torsion of circular shaft, power transmitted by shaft, combined bending and torsion in shafts. [3] | 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. [4]<br>**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] | 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. [4]<br>**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. | 8 | CO4 |
| 5 | Thin and Thick Cylinder | **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]<br>**Thick Cylinders and Spherical Shells:** Stresses and strain in thick shells/cylinder subjected to pressures, compound cylinders press fits on solid shaft.[4] | 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/ |
| |

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 3 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |
| **CO2** | 3 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |
| **CO3** | 3 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |
| **CO4** | 3 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |
| **CO5** | 3 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |

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

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2022-23 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE231 | **Title of the Course** | Geotechnical Engineering | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 3rd | 3 | 1 | 0 | 4 |
| **Pre-Requisite** | ------ | **Co-requisite** | ------ | | | | |
| **Course Objectives** | • To impart origin, index properties and classification of soil engineering.<br>• To Impart basics principles of flow , soil permeability through porous media and effective stress<br>• To impart about how stress are developed and distributed in soil due different load conditions<br>• To impart the knowledge of soil compaction ,Consolidation and their application<br>• To impart the knowledge about shear strength of soil and their application. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Learner should be able to describe soil properties, relate index properties and able to classify soil. |
| **CO2** | Learner should be able to assess the permeability and formulate effective stress for different conditions. |
| **CO3** | Leaner should be able to compute stress in soil under different loading condition. |
| **CO4** | Leaner should be able to interpret compaction and consolidation characteristics of different soil and their application. |
| **CO5** | Leaner should be able to evaluate shear strength of soil. |

| 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 |

**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.

By B. C. Punmia, Ashok Kumar Jain, "Soil Mechanics and Foundations", Laxmi Publications Ltd., 16th edition (2017), New Delhi.


**e-Learning Source:**

https://nptel.ac.in/courses/105105168/

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

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 3 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |
| **CO2** | 3 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |
| **CO3** | 3 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |
| **CO4** | 3 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |
| **CO5** | 3 | 3 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |

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

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2022-23 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE101 | **Title of the Course** | Construction Materials | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 3rd | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | NIL | **Co-requisite** | NIL | | | | |
| **Course Objectives** | 1. The objective of this course is to introduce students to the science and technology of construction materials.<br>2. To teach students how to select appropriate construction materials.<br>**3.** To teach technologies of basic construction materials, such as bricks, lime, timber, Plywood, Glass, plastics, P.V.C. Steel, Aluminum, Gypsum, pozzolana, and Asphalt, Bitumen and Tar, Metals, insulating material. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Understand terminology and units related to engineering properties and testing of construction materials (aggregates, cement, concrete, steel, masonry, wood, and soil). |
| **CO2** | Understand terminology and units related to engineering properties and testing of construction materials like glass, steel, and metals |
| **CO3** | Understand how to interpret select testing reports for construction materials like cement and aggregates |
| **CO4** | Understand how to select timber and its preservation |
| **CO5** | Learner will able to identify and use suitable material which are economical and environment friendly materials for construction projects |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Introduction to Construction Materials. Bricks and Stones | Introduction and properties of construction materials. Introduction to brick and its types, roperties and classification. Selection of stones and their uses. | 08 | CO1 |
| 2 | Glass, metal and Ceramic materials | Classification, properties and selection criteria Glass, plastics, Steel, Aluminum, Metals. Introduction to ceramic materials, properties and uses. | 08 | CO2 |
| 3 | Cement and Aggregates and fly ash | Introduction to cement, classification, and test for quality control. Aggregates, properties of aggregates and their types. Fly ash: uses and classification. | 08 | CO3 |
| 4 | Timber and Wood-based materials | Source of good timber, properties and classification of timber, preservation of timber. Wood products: properties, classification and applications. | 08 | CO4 |
| 5 | Paints and Modern Materials | Paints: classification and uses. Modern materials: Autoclave Aerated Concrete, Polyvinyl Chloride Panels and Unplasticized Polyvinyl Chloride Panels Aerocon Panels, Damp Proofing Materials | 08 | CO5 |

**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:**

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

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 2 | 1 | 1 | 0 | 2 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |
| **CO2** | 3 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 2 |
| **CO3** | 2 | 3 | 2 | 2 | 2 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | 2 | 1 |
| **CO4** | 2 | 0 | 2 | 1 | 2 | 2 | 0 | 0 | 1 | 0 | 2 | 1 | 1 | 1 |
| **CO5** | 3 | 2 | 1 | 0 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 3 |

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

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|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2022-23 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code CE211** | CE211 | **Title of the Course** | Concrete Technology | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 4th | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | NIL | **Co-requisite** | NIL | | | | |
| **Course Objectives** | • To understand concepts related to Concrete technology which involves types and property of concrete.<br>• To known the procedure & significance of test on concrete and mix design | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | To understand the manufacturing process of cement and its various properties. |
| **CO2** | To learn about various types of cement and test on coarse aggregates. |
| **CO3** | To learn about various problems arising while concreting and tests performed on fresh and hardened concrete. |
| **CO4** | To learn the procedure of the mix design of concrete as per Indian standard. |
| **CO5** | To understand about special concretes |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **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 [4]. Testing of cement for general physical and chemical properties as per BIS specifications. | 08 | 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 | 08 | CO2 |
| 3 | Tests on Fresh 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 | 08 | CO3 |
| 4 | Mix Design | Concrete Mix Design: Principle and methods, Statistical quality control, concrete rheology, maturity concept, IS code method, ACI code method<br>Admixture in concrete: Introduction, functions, classification, and IS specification. | 08 | 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 | 08 | CO5 |

**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/

https://npetl.ac.in/courses/105104030/

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 2 | 0 | 1 | 1 | 3 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **CO2** | 3 | 1 | 1 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| **CO3** | 2 | 2 | 0 | 2 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| **CO4** | 3 | 2 | 3 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| **CO5** | 3 | 1 | 0 | 0 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2015-16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE205 | **Title of the Course** | Fluid Mechanics Lab | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 3rd | **0** | **0** | **2** | **1** |
| **Pre-Requisite** | NIL | **Co-requisite** | NIL | | | | |
| **Course 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. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Students are able to learn the concept of Buoyancy and Metacenter Height in a ship model |
| **CO2** | Students are able to learn the concept of Bernoulli's Theorem and its application. |
| **CO3** | Students are able to learn to find the discharge using Venturimeter and Orifice meter. |
| **CO4** | Students are able to learn to find the discharge using Orifice meter. |
| **CO5** | Students are able to learn to find the Coefficient of Discharge in rectangular and triangular notch. |
| **CO6** | Students are able to verify the Impulse Momentum equation experimentally |
| **CO7** | Students are able to plot flow pattern net using the Hele-shaw apparatus. |
| **CO8** | Students are able to study the variation of friction factor 'f', for turbulent flow in commercial pipes. |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Experiment-1 | To determine experimentally the meta-centric height of a ship model. | 2 | 1 |
| 2 | Experiment-2 | To verify the Bernoulli's equation experimentally. | 2 | 2 |
| 3 | Experiment-3 | To verify the Impulse Momentum equation experimentally. | 2 | 3 |
| 4 | Experiment-4 | To plot flow net using the Hele-shaw apparatus. | 2 | 4 |
| 5 | Experiment-5 | To calibrate an orifice meter and study the variation of the coefficient of discharge with the Reynolds number. | 2 | 5 |
| 6 | Experiment-6 | To calibrate an venturimeter and study the variation of the coefficient of discharge with the Reynolds number. | 2 | 6 |
| 7 | Experiment-7 | To calibrate a given V-notch and Rectangular notch and determine the coefficient of discharge. | 2 | 7 |
| 8 | Experiment-8 | To study the variation of friction factor 'f', for turbulent flow in commercial pipes. | 2 | 8 |

**Reference Books:**


Lab Manual Provided by the Department.

Modi P.N. and Seth S.N., "Hydraulics and Fluid Mechanics", Standard Book House, Delhi, India.

Shames, "Mechanics of Fluids", McGraw-Hill, Auckland, N. Land.

Garde R.J., "Fluid Mechanics" RPH, Roorkee, India. Additional Learning Source.


**e-Learning Source:**

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| **CO2** | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| **CO3** | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| **CO4** | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| **CO5** | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| **CO6** | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| **CO7** | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 |
| **CO8** | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2015-16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE206 | **Title of the Course** | BASIC SURVEY FIELD WORK | **L** | **T** | **P** | **C** |
| **Year** | **2nd** | **Semester** | 3rd | **0** | **0** | **2** | **1** |
| **Pre-Requisite** | NIL | **Co-requisite** | NIL | | | | |
| **Course Objectives** | 1. To apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying.<br>2. To use techniques, skills, and modern engineering tools necessary for engineering practice.<br>3. To use techniques, skills, and modern engineering tools necessary for engineering practice.<br>To function as a member of a team. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Students are able to perform ranging and taking offset along a survey line. |
| **CO2** | Students are able to find out the reduced level of given points using Dumpy level by height of collimation method. |
| **CO3** | Students are familiar about Auto level and find out the reduced levels of given points by rise and fall method. |
| **CO4** | Students are able to perform fly leveling with a level. |
| **CO5** | Students are able to draw the longitudinal and cross sectional profiles along a given route. |
| **CO6** | Students are familiar about use of transit theodolite and total station. |
| **CO7** | Students are able to measure horizontal angle by Repetition method using transit theodolite. |
| **CO8** | Students are able to measure horizontal angle by reiteration method using transit theodolite |
| **CO9** | Students are able to determine the Tacheometric constants of a given Theodolite. |
| **CO10** | Students are able to to determine the bearing of a given traverse using prismatic compass and plotting of the traverse. |
| **CO11** | Students are able to determine the elevations of a given point. |

| **Unit No.** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|
| 1 | Ranging and taking offset along a survey line. | 2 | 1 |
| 2 | To find out the reduced level of given points using Dumpy level by height of collimation method. | 2 | 2 |
| 3 | Study of Auto level and find out the reduced levels of given points by rise and fall method. | 2 | 3 |
| 4 | To perform fly leveling with a level. | 2 | 4 |
| 5 | To draw the longitudinal and cross sectional profiles along a given route. | 2 | 5 |
| 6 | Study of transit theodolite and total station. | 2 | 6 |
| 7 | Measurement of horizontal angle by Repetition method using transit theodolite. | 2 | 7 |
| 8 | Measurement of horizontal angle by reiteration method using transit theodolite | 2 | 8 |
| 9 | Determination of the Tacheometric constants of a given Theodolite. | 2 | 9 |
| 10 | To determine the bearing of a given traverse using prismatic compass and plotting of the traverse. | 2 | 10 |
| 11 | Students are able to determination of the elevations of a given point. | 2 | 11 |

| **Reference Books:** |
|---|
| Lab Manual Provided by the Department. |
| Kanetkar, T. P., “Surveying and Levelling” Vol I and II, Pune Vidyarthi Griha Prakashan, Pune, India. |
| Punmia, B. C., “Surveying Vol I and II” Laxmi Publications, Delhi, India. |
| |
| **e-Learning Source:** |
| ----- |
| ----- |

| | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO** / **CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 3 | 3 |
| **CO2** | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 3 | 3 | 3 |
| **CO3** | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 3 | 3 |
| **CO4** | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 3 | 3 | 3 |
| **CO5** | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 2 | 3 | 3 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2022-23 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE238 | **Title of the Course** | Geotechnical Engineering Laboratory | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 3rd | 0 | 0 | 2 | 1 |
| **Pre-Requisite** | ------ | **Co-requisite** | ------ | | | | |
| **Course Objectives** | • To learn the process/procedure to determine the various 'Index Properties' of soil practically.<br>• To learn the process/procedure to calculate various 'Engineering Properties' of soil practically.<br>• To perform various ex-situ practical do understand the behavior and nature of soil. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Learner should be able to determine various index and engineering properties of soil by following Indian codes. |
| **CO2** | Learner should be able to determine compaction and consolidation properties of soil by following Indian codes. |
| **CO3** | Learner should be able to determine the shear strength of the soil by following the codal provision. |

| **Experiment No.** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|
| 1 | Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method. | 2 | CO1 |
| 2 | Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method. | 2 | CO1 |
| 3 | Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method. | 2 | CO1 |
| 4 | Determination of relative density and grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis. | 2 | CO1 |
| 5 | Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (grain-size analysis). | 2 | CO1 |
| 6 | Determination of compaction characteristics (OMC & MDD) of a given soil sample. | 2 | CO2 |
| 7 | Determination of permeability of a remolded soil sample by constant head &/or falling head method. | 2 | CO1 |
| 8 | Determination of consolidation characteristics of a remolded soil sample by an oedometer test. | 2 | CO2 |
| 9 | Determination of shear strength characteristics of a given soil sample from Tri-axial Shear Test. | 2 | CO3 |
| 10 | Determination of shear strength characteristics of a given soil sample from Direct Shear Test. | 2 | CO3 |

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 3 | 3 | 0 | 3 | 3 | 3 |
| **CO2** | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 3 | 3 | 0 | 3 | 3 | 3 |
| **CO3** | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 | 3 | 3 | 0 | 3 | 3 | 3 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2015-16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE208 | **Title of the Course** | Material Testing Laboratory | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 3rd | 0 | 0 | 2 | 1 |
| **Pre-Requisite** | ------ | **Co-requisite** | ------ | | | | |
| **Course Objectives** | • To understand the properties of constituents of building materials. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Able to evaluate the properties and quality of bricks. |
| **CO2** | Ability to test the properties of steel |

| **Unit No.** | **Title of the Experiments** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Brick Testing | Water absorption test<br>Dimension tolerance<br>Compressive strength<br>Efflorescence Test | 16 | CO1 |
| 2 | Steel Testing | Hardness test<br>Impact Test<br>Torsion test<br>Tensile Strength test<br>Double Shear test | 16 | CO2 |

**References:**


Lab Manual Provided by the Department.

Neville, A.M., "Properties of Concrete", Longman, India.

Jha. J. &Sinha S.K. ,"Building Construction", Khanna Publishers, Delhi.

Arora,S.P&Bindra S.P.," A text book of building Construction", DhanpatRai& Sons.,Delhi.

Singh Surendra,"Engineering Materials", Konark Publishers Pvt. Ltd.


| **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 3 | 3 | 3 | 0 | 3 | 2 | 2 |
| **CO2** | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 3 | 3 | 3 | 0 | 3 | 2 | 2 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2015-16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE209 | **Title of the Course** | Hydraulic & Hydraulic Machines | **L** | **T** | **P** | **C** |
| **Year** | **2nd** | **Semester** | 4th | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | CE201 | **Co-requisite** | CE314 | | | | |
| **Course Objectives** | • Students are expected to realize the importance of Hydraulics & Hydraulic Machines and its application in the field of Civil Engineering | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Students will learn basic concept of open channel flow and its types. |
| **CO2** | Students will learn about different equation and their application related to non-uniform flow. |
| **CO3** | Students will learn about basic principle of Gradually Varied flow GVF and its applications. |
| **CO4** | Students will learn about the condition and criteria of flow through hydraulic jump. |
| **CO5** | Students will learn about the Hydraulic machines and there function, application. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | **Introduction & Uniform Flow** | **Introduction:** Difference between open channel flow and pipe flow, geometrical parameters of a channel, continuity equation. **Uniform Flow:** Chezy's and Manning's Equations for uniform flow in open channel, velocity distribution, most efficient channel section. | **08 Hrs** | 1 |
| 2 | **Energy and Momentum Principles** | **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 | **08 Hrs** | 2 |
| 3 | **Non-uniform Flow in Open Channel** | **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. | **08 Hrs** | 3 |
| 4 | **Hydraulic Jump & Hydraulic Pumps** | **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. **Hydraulic Pumps:** Rotodymanic pumps, basic equations, axial and mixed flow pumps, cavitation in pumps, characteristic curves. | **08 Hrs** | 4 |
| 5 | **Hydraulic Turbines** | **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. | **08 Hrs** | 5 |

**Reference Books:**


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.


**e-Learning Source:**

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

| | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 2 | 3 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 2 | 3 |
| **CO2** | 2 | 2 | 3 | 2 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 2 | 3 |
| **CO3** | 2 | 3 | 3 | 2 | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 1 | 3 | 2 |
| **CO4** | 2 | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 0 | 2 | 2 |
| **CO5** | 3 | 2 | 2 | 2 | 0 | 1 | 0 | 0 | 3 | 2 | 3 | 1 | 2 | 3 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2019-20 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE210 | **Title of the Course** | Advance Surveying | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 4th | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | CE202 | **Co-requisite** | Nil | | | | |
| **Course Objectives** | • To learn about the principles involved in the advanced surveying instruments.<br>• 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.<br>• 3. To learn about the techniques of layout: (a) curves in transportation and irrigation engineering (b) building, culvert etc | | | | | | |

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| **Course Outcomes** | |
|---|---|
| **CO1** | The students have the ability to prepare a small scale maps. |
| **CO2** | The students have the ability to make control points of long observation and to measure them accurately. |
| **CO3** | The students have an ability to calculate the errors and correct them by applying different numerical methods. |
| **CO4** | The students will be able to make different types of curves used on highways and railway project. |
| **CO5** | The students will be able to tell about the general requirements and specifications of various civil engineering projects. |

| Unit No. | Title of the Unit | Content of Unit | Contact Hrs. | Mapped CO |
|---|---|---|---|---|
| 1 | Plane Table Surveys | 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. | 8 | 1 |
| 2 | Trilateration and Triangulation | 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. | 8 | 2 |
| 3 | Theory of Errors | 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. | 8 | 3 |
| 4 | Curves | 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. | 8 | 4 |
| 5 | Project Surveys | 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.<br>Field Astronomy: Astronomical terms, coordinate systems, spherical trigonometry, Astronomical Triangle, relationship between coordinates | 8 | 5 |

**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/

| | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 3 | 1 | 1 | 2 | 1 | 1 | 0 | 0 | 3 | 1 | 2 | 2 | 2 | 0 |
| **CO2** | 2 | 2 | 1 | 2 | 1 | 1 | 0 | 0 | 3 | 2 | 1 | 1 | 2 | 0 |
| **CO3** | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 0 |
| **CO4** | 3 | 2 | 1 | 1 | 1 | 1 | 0 | 0 | 3 | 2 | 1 | 2 | 2 | 0 |
| **CO5** | 2 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 2 | 1 | 2 | 0 |

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

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|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2019-20 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE212 | **Title of the Course** | Structural Analysis - I | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 4th | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | CE204 | **Co-requisite** | Nil | | | | |
| **Course Objectives** | ● To impart knowledge about classification of structures, then they should be able classify structure as well as able to calculate degree of determinacy by knowing its form and end condition. □<br>● To impart concept of truss, then they should be able classify truss as well as able to analyse simple and compound truss for given loads.<br>● To impart concept of rolling load, then they able to formulate and analyse beams/girder and arches as well as able to draw shear force, bending moment and influence lines diagram for determinate structure.<br>● To impart concept of arches, so that they should able to classify, analyse and compute bending moment and shear forces for three hinged arches.<br>● To impart principle of Strain energy, then they should able to know the significances and applications of different strain energy methods. After completing they should able to calculate deflection in determinate structures for given load conditions.<br>● To impart concept of unsymmetrical bending, then learner should able to analysis unsymmetrical beams by knowing the load pattern. | | | | | | |

| **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** | Learner should able to analysis unsymmetrical beams by knowing the load pattern. |

| 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 |

**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/

| | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 2 |
| **CO2** | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 2 |
| **CO3** | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 2 |
| **CO4** | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 2 |
| **CO5** | 3 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 2 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2022-23 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE234 | **Title of the Course** | Design of Reinforced Concrete Structure-I | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 4th | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | CE204 | **Co-requisite** | NIL | | | | |
| **Course Objectives** | To understand the Basic concept and procedure of Designing Reinforced Concrete Structural Components | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Student will be able to design singly reinforced beam of different spans and loading. |
| **CO2** | Student will be able to design doubly reinforced beam of different spans and loading. |
| **CO3** | Student will be able to design beams for shear reinforcement and can determine development length. |
| **CO4** | Student will be able to design slab and design the structure for serviceability |
| **CO5** | Student will be able to design compression member (column) by limit state method. |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Attributes of Structural Design | 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 | 8 | 1 |
| 2 | Limit State Design of Beams | Assumption in Limit state design method, Codal recommendations, Design of a rectangular singly & doubly reinforced section, T & L sections by limit state method. | 8 | 2 |
| 3 | Limit State Design of Slab & Stair | One way solid slabs, Simply supported and continuous. Two way slabs: Simply supported and continuous.<br>Types of RCC stairs, loads and load effects on stairs, design of doglegged stairs. Introduction to Short term, long term deflections & Cracks in RCC. | 8 | 3 |
| 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 (tied and helically reinforced short columns by Limit state method | 8 | 4 |
| 5 | Limit State Design of footing | 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. | 8 | 5 |

**Reference Books:**


A.K. Jain "Reinforced concrete design, limit state Method", Nem Chand & Bros.; 7th Edition 2012

S.Unnikrishna. and Devdas Menon, "Reinforced concrete design", McGraw Hill Education; 3rd Edition 2009

B.C. Punmia and A.K. Jain "Limit State Design of Reinforced Concrete", Laxmi Publications,1st Edition Reprint 2007

Sayal I.C and Goel A.K., "Reinforced Concrete Structures" S Chand & Company; 4th Edition 2007

IS 456-2000 Indian Standard "Plain & Reinforced Concrete-code of practice", BIS, New Delhi.


**e-Learning Source:**

http://nptel.ac.in/courses/105105105/

http://nptel.ac.in/downloads/105105104/

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 3 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 3 | 2 |
| **CO2** | 3 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 2 |
| **CO3** | 3 | 2 | 2 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 3 | 2 |
| **CO4** | 3 | 2 | 3 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 3 | 2 |
| **CO5** | 3 | 2 | 3 | 1 | 2 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 3 | 2 |

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

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|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2022-23 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE106 | **Title of the Course** | Introduction to Civil Engineering Profession | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 4th | **3** | **1** | **0** | **4** |
| **Pre-Requisite** | Nil | **Co-requisite** | Nil | | | | |
| **Course Objectives** | To develop perspective to different disciplines of civil engineering along with the pre-requisites, scope and opportunities.<br>To make familiar with career prospects and novel/emerging areas of civil engineering. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Learner will able to get background, application and future prospects of Civil Engineering |
| **CO2** | Learner will be able to identify the role of structural and geotechnical engineering |
| **CO3** | Learner will be able to comprehend the need of Water Resource Engineering in national as well as state projects |
| **CO4** | After completing this unit learner will be able to identify the role of Highway Engineering, Traffic Engineering and Environmental engineering from sustainability prospective. |
| **CO5** | This unit will develop an understanding of role of management in construction industry especially in the context resource optimization |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | What is Civil Engineering-History, Scope and Future | History of Civil Engineering, Development in civil engineering, Skill required for civil engineering, Various scope of civil engineering. | 08 | CO1 |
| 2 | Structure and Geotechnical Engineering | Introduction to structures and various elements. Basic requirement and performance of structure. Application and scope of structural engineering.<br>Introduction to geotechnical engineering. Role of soil and rocks in civil engineering, and Application& scope of geotechnical engineering. | 08 | CO2 |
| 3 | Water Resource Engineering and Hydrology | Introduction to Water Resource Engineering. Behavior and effects of water on structures. Application and scope of water resource engineering.<br>Introduction to hydrology. Role of hydrology in society, and Application & scope of hydrology. | 08 | CO3 |
| 4 | Environment, Highway and Traffic Engineering | Introduction to Environmental engineering. Importance of environment, Effect of civil engineering on environment, Application and scope of environmental engineering.<br>Introduction to highway and traffic engineering. Role of highway and traffic in society, and Application & scope of highway and traffic engineering. | 08 | CO4 |
| 5 | Project Management, Structural Modelling and Introduction to Computational Engineering | Introduction to project management. Application and scope of project management. Introduction to structural modelling and its need. Role of computation in engineering with application scope. | 08 | CO5 |

**Reference Books:**


Civil Engineering Profession for Intelligent People, Civil Press, Independently Published, 2019.

Introduction to Civil Engineering: A Student's Guide to Academic and Professional Success, S. T. Mau & Sami Maalouf, Cognella, Inc, Revised edition (18 August 2014).

Introduction to Civil Engineering, Valdengrave Okumu, Createspace Independent Pub (22 October 2014).


**e-Learning Source:**

https://archive.nptel.ac.in/courses/105/106/105106201/

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **CO2** | 2 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 1 |
| **CO3** | 2 | 1 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| **CO4** | 1 | 1 | 0 | 0 | 0 | 1 | 3 | 1 | 0 | 0 | 0 | 0 | 2 | 0 |
| **CO5** | 1 | 2 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 | 0 | 1 | 1 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2015-16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE213 | **Title of the Course** | Hydraulic & Hydraulic Machines Lab | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 4th | **0** | **0** | **2** | **1** |
| **Pre-Requisite** | NIL | **Co-requisite** | CE209 | | | | |
| **Course Objectives** | 1. Students are expected to hand on experience different hydraulic machine.<br>**2.** Also understand characteristics of flow and hydraulic machines | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Students are able to learn to find the Manning's coefficient of roughness 'n' for the bed of a given flume. |
| **CO2** | Students are able to learn to study the velocity distribution in an open channel and to determine the energy and momentum correction factors. |
| **CO3** | Students are able to learn the rot dynamic pumps and their characteristics. |
| **CO4** | Students are able to calibrate a sharp-crested rectangular and triangular weirs. |
| **CO5** | Students are able to learn the characteristics of free hydraulic jump. |
| **CO6** | Students are able to learn the flow characteristics over a hump placed in an open channel. |
| **CO7** | Students are able to learn the flow through a horizontal contraction in a rectangular channel. |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Experiment -1 | To determine the Manning's coefficient of roughness 'n' for the bed of a given flume. | **2** | 1 |
| 2 | Experiment-2 | To study the velocity distribution in an open channel and to determine the energy and momentum correction factors. | **2** | 2 |
| 3 | Experiment-3 | To study the flow characteristics over a hump placed in an open channel. | **2** | 3 |
| 4 | Experiment-4 | To study the flow through a horizontal contraction in a rectangular channel. | **2** | 4 |
| 5 | Experiment-5 | To calibrate a sharp-crested rectangular and triangular weirs. | **2** | 5 |
| 6 | Experiment-6 | To calibrate a broad-crested weir and study the pressure distribution on the upstream face of the weir. | **2** | 6 |
| 7 | Experiment-7 | To calibrate a Venturiflume. | **2** | 7 |
| 8 | Experiment-8 | To study the characteristics of free hydraulic jump. | **2** | 8 |
| 9 | Experiment-9 | To study the flow over a free overfall in an open channel and to determine the end depth. | **2** | 9 |
| 10 | Experiment-10 | To study rotodynamic pumps and their characteristics. | **2** | 10 |
| 11 | Experiment-11 | To study rotodynamic turbines and their characteristics | **2** | 11 |

**Reference Books:**


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.


**e-Learning Source:**

| | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| **CO2** | 3 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| **CO3** | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| **CO4** | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| **CO5** | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| **CO6** | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |
| **CO7** | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2015-16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE214 | **Title of the Course** | Advance Survey Field Work | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 4th | **0** | **0** | **2** | **1** |
| **Pre-Requisite** | NIL | **Co-requisite** | CE210 | | | | |
| **Course Objectives** | • To apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying.<br>• to make student competent enough to, carry out triangulation, topographic mapping, layout of building plans & curves on ground<br>• To use techniques, skills, and modern engineering tools necessary for engineering practice.<br>• To function as a member of a team. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Students are able setting up the plane table and plotting the given area by radiation method. |
| **CO2** | Students are able setting up the plane table and plotting the given area by intersection method. |
| **CO3** | Students are able to do traversing of the given area by plane table. |
| **CO4** | Students are able to solve three point problem by mechanical method. |
| **CO5** | Students are able to solve three point problem by graphical method. |
| **CO6** | Students are able to solve two point problem. |
| **CO7** | Students are able to carry out Triangulation and Trilateration of a given area. |
| **CO8** | Students are able to layout a simple circular curve on the ground using tape by perpendicular offset method. |
| **CO9** | Students are able to layout a simple circular curve on the ground using tape by radial offset method. |
| **CO10** | Students are able to layout a simple circular curve on the ground using two theodolite method. |
| **CO11** | Students are able to layout a building on the ground. |
| **CO12** | Students are able to plot the details as well as contours (topographic mapping) of area. |
| **CO13** | Students are able work on Electronic Total Survey Station. |

| **Unit No.** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|
| 1 | Setting up the plane table and plotting the given area by radiation method. | 2 | 1 |
| 2 | Setting up the plane table and plotting the given area by intersection method. | 2 | 2 |
| 3 | Traversing of the given area by plane table. | 2 | 3 |
| 4 | To solve three point problem by mechanical method. | 2 | 4 |
| 5 | To solve three point problem by graphical method. | 2 | 5 |
| 6 | To solve two point problem. | 2 | 6 |
| 7 | To carry out Triangulation and Trilateration of a given area. | 2 | 7 |
| 8 | Layout a simple circular curve on the ground using tape by perpendicular offset method. | 2 | 8 |
| 9 | Layout a simple circular curve on the ground using tape by radial offset method. | 2 | 9 |
| 10 | Layout a simple circular curve on the ground using two theodolite method. | 2 | 10 |
| 11 | Layout a building on the ground. | 2 | 11 |
| 12 | To plot the details as well as contours (topographic mapping) of area. | 2 | 12 |
| 13 | Demonstration and working on Electronic Total Survey Station. | 2 | 13 |

| **Reference Books:** |
|---|
| Lab Manual Provided by the Department. |
| Kanetkar, T. P., “Surveying and Levelling” Vol I and II, Pune Vidyarthi Griha Prakashan, Pune, India. |
| Punmia, B. C., “Surveying Vol I and II” Laxmi Publications, Delhi, India. |
| |
| **e-Learning Source:** |
| |

| | Course Articulation Matrix: (Mapping of COs with POs and PSOs) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 2 | 3 |
| **CO2** | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 3 | 2 | 3 |
| **CO3** | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 2 | 3 |
| **CO4** | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 3 | 2 | 3 |
| **CO5** | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 2 | 2 | 3 |
| **CO6** | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 2 | 3 |
| **CO7** | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 3 | 2 | 3 |
| **CO8** | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 3 | 2 | 3 |
| **CO9** | 2 | 0 | 0 | 2 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 2 | 2 | 3 |
| **CO10** | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 2 | 3 |
| **CO11** | 2 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 | 2 | 0 | 3 | 2 | 3 |

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

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| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2015-16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE215 | **Title of the Course** | Concrete Technology Laboratory | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 4th | 0 | 0 | 2 | 1 |
| **Pre-Requisite** | ------ | **Co-requisite** | ------ | | | | |
| **Course Objectives** | • To understand the properties of ingredients of concrete.<br>• To study the behavior of concrete in fresh and hardened state. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Able to evaluate the quality of cement for various concrete works. |
| **CO2** | Able to evaluate the quality of fine and coarse aggregates for various concrete works. |
| **CO3** | Ability to test the properties of fresh and hardened concrete. |

| **Unit No.** | **Title of the Experiments** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | Cement | Normal Consistency of cement.<br>Initial & final setting time of cement.<br>Compressive strength of cement.<br>Fineness of cement by air permeability method.<br>Tensile strength. | 6 | CO1 |
| 2 | Fine and Coarse Aggregate | Water absorption of aggregate.<br>Sieve Analysis of Aggregate 8. Specific gravity & bulk density.<br>Grading of aggregates.<br>Sieve analysis of sand.<br>Silt content of sand.<br>Bulking of sand. | 6 | CO2 |
| 3 | Fresh and Hardened Concrete | Slump Test.<br>Compaction factor test.<br>Vee Bee Consistometer test.<br>Compressive Strength test.<br>Flexural Strength test.<br>Non-Destructive Test (Rebound Hammer and PUNDIT) | 6 | CO3 |

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 3 | 3 | 3 | 0 | 3 | 2 | 0 |
| **CO2** | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 3 | 3 | 3 | 0 | 3 | 2 | 0 |
| **CO3** | 0 | 0 | 0 | 3 | 3 | 1 | 0 | 3 | 3 | 3 | 0 | 3 | 2 | 0 |

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

| | |
|---|---|
| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |

# Integral University, Lucknow

| **Effective from Session:** 2022-23 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | CE252 | **Title of the Course** | Comprehensive Assessment-I | **L** | **T** | **P** | **C** |
| **Year** | 2nd | **Semester** | 4th | - | - | - | **1** |
| **Pre-Requisite** | Nil | **Co-requisite** | Nil | | | | |
| **Course Objectives** | • To test the learner's knowledge, skills and understanding of civil engineering at undergraduate level. | | | | | | |

| **Course Outcomes** | |
|---|---|
| **CO1** | Learner should be able to demonstrate their knowledge in the field of civil engineering. |

| **Unit No.** | **Title of the Unit** | **Content of Unit** | **Contact Hrs.** | **Mapped CO** |
|---|---|---|---|---|
| 1 | - | Complete syllabus of 2nd year B.Tech Civil Engineering | - | CO1 |
| 2 | - | | - | |
| 3 | - | | - | |
| 4 | - | | - | |
| 5 | - | | - | |
| **Reference Books:** | | | | |
| - | | | | |
| **e-Learning Source:** | | | | |
| - | | | | |

| | **Course Articulation Matrix: (Mapping of COs with POs and PSOs)** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PO-PSO CO** | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| **CO1** | 3 | 3 | 3 | 3 | 0 | 3 | 0 | 3 | 0 | 0 | 0 | 3 | 3 | 1 |

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

| **Name & Sign of Program Coordinator** | **Sign & Seal of HoD** |
|---|---|