# M.D. UNIVERSITY, ROHTAK

## SCHEME OF STUDIES AND EXAMINATION

**(Under NEP-2020)**

## BACHELOR of TECHNOLOGY

## (CIVIL ENGINEERING)

## SEMESTER 3rd & 4th

## Scheme effective from academic session 2026-27

## ‘H’ Scheme (Under NEP-2020)

## 1. Definition of Credit

| | |
|---|---|
| 1 Hr. Lecture (L) per week | 1 credit |
| 1 Hr. Tutorial (T) per week | 1 credit |
| 1 Hr. Practical (P) per week | 0.5 credits |
| 2 Hours Practical (Lab) per week | 1 credit |

## 2. Structure of the Undergraduate Engineering program

| Sr. No. | Category |
|---|---|
| 1. | Humanities and Social Sciences, including Management courses |
| 2. | Basic Science Courses |
| 3. | Engineering Science courses |
| 4. | Program Core Courses (Branch-specific) |
| 5. | Professional Elective courses relevant to the chosen specialization/branch |
| 6. | Open Elective Courses (from Humanities, Technical Emerging, or other Subjects) |
| 7. | Project work, Seminar, and Internship in Industry or elsewhere |
| 8. | Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition], etc. (non-credit) |

## 3. Course Code and Definition

| Course Code | Definitions |
|---|---|
| L | Lecture |
| T | Tutorial |
| P | Practical |
| BSC | Basic Science Courses |
| ESC | Engineering Science Courses |
| HSMC | Humanities and Social Sciences, including Management courses |
| PCC | Professional Core Courses |
| LC | Laboratory Courses |
| AU | Audit (Mandatory) Courses |
| PT | Practical Training |
| PEC | Professional Elective courses |
| OEC | Open Elective courses |
| PRROJ/SEM | Seminar Employment Enhancement Courses (Project/Summer Internship/ Seminar) |

**PROGRAM OUTCOMES (PO)**

Engineering Graduates will be able to:

**PO1**. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2.** Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3.** Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4**. Conduct investigations of complex problems: Use research-based knowledge and research methods, including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5**. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

**PO6.**Analyze and evaluate societal and environmental aspects while solving complex engineering problems, considering their impact on sustainability with reference to economy, health, safety, legal frameworks, culture, and the environment.

**PO7.** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO8.** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO9.** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO10.** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO11.** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Programme Specific Outcomes (PSO) for Civil Engineering

**PSO1:** Structural and Infrastructure Design: An ability to apply principles of structural engineering, geotechnical engineering, transportation engineering, and water resources engineering to analyze, design, and construct safe, sustainable, and economical civil engineering projects.

**PSO2:** Modern Engineering Tools and Project Management: Capability to utilize modern engineering software, surveying techniques, construction technologies, and project management practices for effective planning, execution, and maintenance of civil engineering works.

**PSO3:** Sustainable, Ethical and Professional Applications: An ability to develop environmentally responsible and socially sustainable solutions to Civil Engineering problems while adhering to professional ethics, safety standards, and relevant codes and regulations.

# B. Tech Civil Engineering 3rd Semester

| Sr. No. | Course Code | Course Title | Hours per week | | | Total Contact Hrs. per week | Credit | Examination Scheme (Marks) | | | | Duration of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | | Internal awards | Theory | Practical | Total | |
| 1. | 26BSC-MATHCE-203-H* | Mathematics-III (PDE & NM) | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 2. | 26PCC-CE- 201-H | Structural Mechanics | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 3. | 26PCC-CE- 203-H | Fluid Mechanics-I | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 4. | 26PCC-CE- 205-H | Surveying-I | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 5. | 26ESC-CE-207-H | Engineering Geology | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 6. | 26PEC-CE-209-H | Building Construction and Materials | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 7. | 26LC-CE-201-H | Fluid Mechanics Lab | 0 | 0 | 2 | 2 | **1** | 5 | - | 20 | 25 | 3 |
| 8. | 26LC-CE-203-H | Surveying-I Lab | 0 | 0 | 2 | 2 | **1** | 5 | - | 20 | 25 | 3 |
| 9. | 26LC-CE-205-H | Computer-based Building Drawing Lab | 0 | 0 | 2 | 2 | **1** | 5 | - | 20 | 25 | 3 |
| 10. | 26LC-CE-207-H | Material Testing Lab | 0 | 0 | 2 | 2 | **1** | 5 | - | 20 | 25 | 3 |
| 11. | *26AU-ENV-202-H | Environmental Science | 2 | 0 | 1 | 3 | **0** | Refer Note 1 | | | | |
| | | | | | **Total** | 29 | **22** | | | | 550 | |

## FOR HONORS COURSE

| Sr. No. | Course Code | Course Title | Hours per week | | | Total Contact Hrs. per week | Credit | Examination Scheme (Marks) | | | | Duration of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 26PCC-CE-211-H | Sustainable and Green construction | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 2 | 26LC-CE-207-H | Green concrete lab | 0 | 0 | 2 | 2 | **1** | 5 | | 20 | 25 | 3 |
| | | | | | **Total** | **5** | **4** | | | | 100 | |

**Note-1:26AU-ENV-202-H** is a mandatory non–credit course in which students must obtain passing marks in theory. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of a degree. However, these marks will appear on the student detailed marks certificate.

**Marks Distribution:**

- Internal Assessment: 30 marks
- Theory Examination: 70 marks

The institute will conduct the theory examination at its own level

## B. Tech Civil Engineering 4th Semester

| Sr. No. | Course Code | Course Title | Hours per week | | | Total Contact Hrs. per week | Credit | Examination Scheme (Marks) | | | | Duration of Exam (Hours) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | | | Internal awards | Theory | Practical | Total | |
| 1 | 26PCC-CE-202-H | Structural Analysis | 3 | 1 | 0 | 4 | **4** | 30 | 70 | | 100 | 3 |
| 2 | 26PCC-CE-204-H | Fluid Mechanics-II | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 3 | 26PCC-CE-206-H | Surveying-II | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 4 | 26PCC-CE-208-H | Design of Concrete Structure | 3 | 1 | 0 | 4 | **4** | 30 | 70 | | 100 | 3 |
| 5 | 26PCC-CE-210-H | Concrete Technology | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 6 | 26PCC-CE-212-H | Waste Supply and Treatment | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | 3 |
| 7 | 26LC-CE-202-H | Structural Analysis Lab | 0 | 0 | 2 | 2 | **1** | 5 | | 20 | 25 | 3 |
| 8 | 26LC-CE-204-H | Fluid Mechanics Lab -II | 0 | 0 | 2 | 2 | **1** | 5 | | 20 | 25 | 3 |
| 9 | 26LC-CE-206-H | Surveying-II Lab | 0 | 0 | 2 | 2 | **1** | 5 | | 20 | 25 | 3 |
| 10 | 26LC-CE-208-H | Concrete Technology Lab | 0 | 0 | 2 | 2 | **1** | 5 | | 20 | 25 | 3 |
| | | | | | **Total** | 28 | 24 | | | | 600 | |

## FOR HONORS COURSE

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 26PCC-CE-214-H | Remote Sensing and GIS | 3 | 0 | 0 | 3 | **3** | 25 | 50 | | 75 | *3* |
| 2 | 26LC-CE-210-H | Remote Sensing and GIS Lab | 0 | 0 | 2 | 2 | **1** | 5 | | 20 | 25 | 3 |
| | | | | | **Total** | **5** | 4 | | | | 100 | |

**Note**: At the end of 4th semester each Student has to undergo for industrial training/project related to engineering sectors for the duration of 4 to 6 weeks after the end of semester exam. Students must submit training report along with certificate from the organization, which will be evaluated in 5th sem.

The students of **B. Tech (Working Professionals)** courses have to submit training/ project report of their work in their respective company/ organization for the period of Sumer training/ industrial training for the evaluation purpose.

| Course Title | MATHEMATICS-III (PDE & NM) | Semester-3rd | |
|---|---|---|---|
| Course Code | 26BSC-MATHCE203-H | External marks: | 50 |
| Category | Basic Science Courses | Internal marks: | 25 |
| Credits | 3 | Total marks: | 75 |
| L-T-P | 3-0-0 | Duration of Examination: | 3 Hrs. |

**Note:** Examiner will set 9 questions in all with two questions from each unit and one question covering all units which will be Q.1. This Q1 is compulsory and of short answer type. Each question carries equal marks (10 marks). Examinees have to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

The objectives of this course are to.

- Develop the ability to formulate and solve boundary value problems related to heat, wave, Laplace, and diffusion equations.
- Provide a thorough understanding of Laplace transform methods and their applications in solving ordinary differential equations and evaluating integrals.
- To enable students to solve the polynomial and transcendental equations using numerical methods.
- To understand the concept of interpolation using various difference tables in various engineering problems.

## Course Outcomes (CO)

By the end of the course, students will be able to.

**CO1:** To define and apply the concepts and terminology of Partial differential equation (PDE) including formulation and solution methodologies for first (linear and non-linear, both) and second order PDE with applications in engineering.

**CO2:** To understand the concept of Laplace Transform and Methods of Separation of variables with applications in real world problems.

**CO3:** Apply the knowledge & ideas of various numerical techniques to solve algebraic/transcendental equations and to evaluate the numerical differentiationand integration.

**CO4:** Analyze different problems of interpolation using various different difference table.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 1 | 1 | | | | | | | 3 | | |
| CO2 | 3 | 3 | 2 | 2 | 1 | | | | | | | 3 | | |
| CO3 | 3 | 3 | 3 | 2 | 2 | | | | | | | 3 | | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 | | | | | | | | 3 | |
| **WT.** | 3 | 2.75 | 2.25 | 1.75 | 1.75 | | | | | | | 3 | 3 | 3 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AVG** | | | | | | | | | | | | | | | |
| | | | | | | | | | Overall Mapping of Subject | | | | | | 2.56 |

**COURSE CONTENT**

**UNIT-I**

Partial Differential Equations: Formulation of PDE, Lagrange's linear PDEs; First order non-linear PDEs, Charpit's Method. Initial and boundary conditions. Separation of variables method to simple problems in Cartesian coordinates. Methods of Separation of variable's applications to one dimensional Heat and Wave Equations, Two-dimensional Heat flow and Laplace equation.

**UNIT-II**

**Transform Calculus:** Laplace Transform, Properties of Laplace transform, Laplace transformof periodic functions, Inverse Laplace transform by different methods, Convolutiontheorem, Evaluation of integrals by Laplace transform, Solving ordinary differentialequations by Laplace transform method.

**UNIT-III**

**Numerical Methods 1:** Error analysis, Solution of algebraic and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae.

**UNIT-IV**

**Numerical Methods 2:** Numerical differentiation and integration, Trapezoidal rule and Simpson's 1/3 and 3/8 rules, Taylor's series, Euler and modified Euler's methods, Runge-Kutta method of fourth order for solving first and second order ordinary differential equations.

## Suggested Books:


- Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
- B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Limited
- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers
- N. P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications
- P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company.
- S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning.

| Course Title | STRUCTURAL MECHANICS | Semester -3rd |
|---|---|---|
| Course Code | 26PCC-CE-201-H | External marks: 50 |
| Category | Professional Core Course | Internal marks: 25 |
| Credits | 3 | Total marks: 75 |
| L-T-P | 3-0-0 | Duration of Examination: 3Hrs. |

**Note**: Examiner will set 9 questions in all. Q.1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (10 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

The objectives of this course are to.

- Students can apply the concepts of analysis for the design of various civil engineering structures.
- Covers the relationship between stress and strain on deformable solids, principal stresses, maximum shearing stress, and the stresses acting on a structural member.
- To provide basic knowledge in mechanics of materials so that the students can solve real engineering problems and design engineering systems.

## Course Outcomes (CO)

At the end of the course, the students will be able to.

**CO1:**Identify different materials and their behaviour.

**CO2:**Analyse various civil engineering structures under different loading conditions.

**CO3:**Apply the principles of structural mechanics in design structural elements.

**CO4:**Apply the concepts of failure theories for design of structures.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 2 | | | 3 | | | | | 3 | | |
| CO2 | 2.5 | 2 | 2 | | | 3 | | | | | | | 3 | 2 |
| CO3 | 2.5 | | 2 | 2 | | | | | | | | 2 | | |
| CO4 | | 3 | | 2 | 3 | | | | | | | | | 3 |
| **WT. AVG** | 2.66 | 2.33 | 2 | 2 | 3 | 3 | 3 | | | | | 2.5 | 3 | 2.5 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.59 |

**COURSE CONTENT**

**UNIT-I**

**Module 1: Simple Stresses and Strains**

Idealized stress- strain diagrams, Concept of stresses and strains, Relationship between elasticconstants, Poisson's Ratio,Stress and extension of uniform bar and tapered bar under its own weight and due to load, stresses produced in compound bars due to axial loads,Thermal stress and strain.

**Module 2: Compound Stress and Strains**

Normal stress, Tangential Stresses,Stresses induced due to Uni-axial loads, stresses induced by state of simple shear, stresses induced due to biaxial loads, Mohr's Circle (Graphical Method), Principal stresses and principal planes, Maximum shear stresses.

**UNIT-II**

**Module 3: Shear Force and Bending Moment in Beams and Frames**

Type ofloads, Relation between shear force and bending moment, Shear force and bending moment diagram,

**Module 4: Bending Stresses and Shear stresses in Beam**

Pure bending, bending stresses, combined bending and direct stresses, Variation of shear stresses for various cross-sections of a beam.

**UNIT-III**

**Module 5: Torsion and Thin Cylinder**

Torsion equation, hollow and solid circularshafts and its comparison, shafts in series and parallel. Combined torsion and bending of circular shafts.Stresses in thin cylinder vessels subjected to internal pressure, Circumferential stresses (Hoop Stresses) and, longitudinal stress.

**Module 6:Column and Strut**

Criteria for stability of columns, buckling of columns, Euler's formula for various end restraints, Rankine's formula, eccentrically loaded struts, struts with initial curvature, struts with lateral loading.

**UNIT-IV**

**Module 7:Analysis of Plane Trusses**

Different types of trusses,Analysis of plane determinate trusses by method of joints, method of sections and analysis of Space Trusses using Tension Coefficient Method.

**Module 8:Failure Theories**

Theories of failure: maximum principal stress theory, maximum principal strain theory, maximum shear stress theory, maximum strain energy theory, distortion energy theory, and comparison of the failure theories.

## Suggested Books


- Mechanics of Materials byPunmia and Jain, Laxmi Publications (P) Ltd.
- Mechanics of Materials by R.C.Hibbeler, Pearson Higher Education.
- Strength of Materials by Timoshenko and Young, East West Press.

- Mechanics of materials by V Gupta, Narosa publishing house.
- Strength of Materials by R.K. Bansal by Laxmi Publications (P) Ltd.

| | | |
|---|---|---|
| **Course Title** | **FLUID MECHANICS-I** | **Semester -3rd** |
| **Course Code** | **26PCC-CE-203-H** | **External marks: 50** |
| **Category** | **Professional Core Course** | **Internal marks: 25** |
| **Credits** | **3** | **Total marks: 75** |
| **L-T-P** | **3-0-0** | **Duration of Examination: 3 Hrs.** |

**Note**: Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (10 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

The objectives of this course are to.

- Introduce the concepts of fluid mechanics useful in Civil Engineering applications.
- To provide the students with a first-level exposure related to fluid statics, kinematics, and dynamics.
- To provide the knowledge for measurement of pressure, computations of hydrostatic forces on structural components, concepts of Buoyancy and their applications in many engineering problems.
- Topics included in this course are aimed to prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology in later semesters.

## Course Outcomes (CO)

**CO1:**Understand the broad principles of fluid statics, kinematics and dynamics

**CO2:**Understand definitions of the basic terms used in fluid mechanics

**CO4:**Be able to apply the continuity, momentum and energy principles

**CO4:**Be able to apply dimensional analysis

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | | | 3 | | 2 |
| CO2 | 3 | 2 | | 2 | | | 2 | | | | | 2 | | |
| CO3 | 3 | 2 | 2 | 3 | 3 | | | | | | | 2 | 2 | 2 |
| CO4 | 3 | 2 | | 3 | | | | | | | | 3 | 2 | 2 |
| **WT. AVG** | 3 | 2 | 2 | 2.6 | 3 | | 2 | | | | | 2.5 | 2 | 2 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.34 |

## COURSE CONTENT

### UNIT-I

**Module 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, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility, types of fluids

### UNIT-II

**Module 2:Fluid Statics**
Fluid Pressure: Pressure density height relationship, pressure at a point, Pascal's law, gauge and absolute pressure, Pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, pressure gauges,

**Module 3:Hydrostatic pressure and force**
Hydrostatic pressure and force: horizontal, vertical and inclined surfaces, centre of pressure. Buoyancy and stability of floating bodies, metacentric height

### UNIT-III

**Module 4: 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 incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; rotation and circulation; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

**Module 5:Fluid Dynamics**
Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; limitations of Bernoulli's equation, Practical applications of Bernoulli's equation: Venturi-meter, Orifice meter and Pitot tube

### UNIT-IV

**Module 6: Boundary Layer Analysis**
Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries, Local and average friction coefficients Separation and Control.

**Module 7:Dimensional Analysis and Hydraulic Similitude**
Dimensional analysis, Buckingham theorem, important dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, physical modelling, similar and distorted models.

## Suggested Books

- Hydraulic and Fluid Mechanic by P.N.Modi & S.M.Seth

- Introduction to Fluid Mechanics by Robert W.Fox & Alan T.McDonald 3 Fluid Mechanics Through Problems by R.J.Garde
- Engineering Fluid Mechanics by R.J.Garde& A.G.Mirajgaoker
- Fluid Mechanic and Hydraulic machines R.K. Bansal

| **Course Title** | **Surveying-I** | **Semester -3rd** |
|---|---|---|
| **Course Code** | **26PCC-CE-205-H** | **External marks: 50** |
| **Category** | **Professional Core Course** | **Internal marks: 25** |
| **Credits** | **3** | **Total marks: 75** |
| **L-T-P** | **3-0-0** | **Duration of Examination: 3 Hrs.** |

**Note**: Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (10 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

- To understand the importance of surveying in Civil engineering.
- To study the basics of linear, angular and direction measurements using chain/tape, theodolite and compass.
- To study the method of determination of height of points using various levelling method and Tacheometer.
- To study the significance of Plane Table surveying in preparation of map and setting of different types of curves.

## Course Outcomes (Co)

At the end of the course, the students will be able to

**CO1:** To carry out surveying in the field for various civil engineering projects, prepare a contour map and plan of the area.

**CO2:** Taking accurate measurements with different surveying instruments.

**CO3:** Adjustment of traverse, and understand the process of setting of different curves for road and railway designs.

**CO4:** Preparation of map using plane table surveying.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | | | | | | | | | 3 | | 2 |
| CO2 | 3 | 2 | | 2 | | | 2 | | | | | 2 | | |
| CO3 | 3 | 3 | 2 | 3 | 3 | | | | | | | 2 | 2 | 2 |
| CO4 | 3 | 2 | | 3 | | | | | | | | 3 | 2 | 2 |
| **WT.** | 3 | 2.25 | 2.5 | 2.6 | 3 | | 2 | | | | | 2.5 | 2 | 2 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AVG** | | | | | | | | | | | | | | | |
| | | | | | | | | | Overall Mapping of Subject | | | | | | 2.42 |

## COURSE CONTENT

### UNIT-I

**Module 1: Basics of Surveying and Linear measurement**
Definition and principles of surveying, objectives and classifications, Instruments used for measuring distance, chaining, errors in chaining, tape corrections and examples.

**Module 2:Direction Measurement**
Types of compass- prismatic and surveyor's compass, Bearings and meridians, declination, local attraction, errors and adjustments, Methods of compass traversing, checks in traversing, adjustment of closed traverse and examples.

### UNIT-II

**Module 3: Levelling**
Terms used in levelling, types of levels and staff, principles of levelling, temporary adjustments of levels, reduction of levels and booking of staff readings, examples.

**Module 4:Geodetic Trigonometric levelling**
Height and distances- base of the object accessible and inaccessible, geodetical observation, correction due to curvature and refraction, axis signal correction, difference in elevation between two points.

### UNIT-III

**Module 5:Plane Table Surveying**
Plane table accessories, methods of plane table surveying, sources of error, advantages and disadvantages of plane table surveying; contouring and characteristics of contour lines, locating contours, interpolation of contours, contour maps.

**Module 6:Angle Measurement**
Theodolite, parts of theodolite, Temporary adjustment of Theodolite, measurement of horizontal and vertical angles by different methods, theodolite traversing, adjustments of closed traverse.

### UNIT-IV

**Module 7: Tachometric Surveying**
Principle, Iinstrument used intachometry, stadia and tangential method oftachometry, tachometric constants and their determinations, examples.

**Module 8: Curves**
Classification of curves, elements of simple circular curve, Location of tangent points- chain and tape methods, instrumental methods, Examples; Types of transition curves; Introduction to Vertical Curves: Necessity and types.

## Suggested Books

- Surveying volume I and II: B. C.Punmia.
- Engineering Surveying (Sixth Edition): W. Schofield.
- Text Book of Surveying: C. Venkataramiah.
- Introduction to GPS: The Global Positioning System: Ahmed El-Rabbany.
- Various Online resources including NPTEL.

| **Course Title** | **ENGINEERING GEOLOGY** | **Semester -3rd** |
|---|---|---|
| **Course Code** | **26PESC-CE- 207-H** | **External marks: 50** |
| **Category** | **Engineering Science Course** | **Internal marks: 25** |
| **Credits** | **3** | **Total marks: 75** |
| **L-T-P** | **3-0-0** | **Duration of Examination: 3Hrs.** |

**Note**: Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (10 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

- To make the students familiar interior of Earth.
- To aware about different geological maps, different organizations related with geological study.
- To provide knowledge about geological forces and formation of Superficial Deposits.
- To provide adequate knowledge about geological considerations in civil engineering projects.

## Course Outcomes(CO)

At the end of the course, the students will be able to:

**CO1:** To Conduct geological survey by knowing the interior of Earth.

**CO2:** To study different geological maps with geological symbols.

**CO3:** To determine different geological forces and formation of Superficial Deposits.

**CO4:** To acquire the knowledge about geological considerations in civil engineering projects

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 3 | 2 | | | | | | | 3 | | 2 |
| CO2 | 3 | 2 | | 2 | | | 3 | | | 2 | | 2 | | |
| CO3 | 3 | 2 | 2 | 2 | 3 | | | | | | | 2 | | 2 |
| CO4 | 3 | 2 | | 3 | | | | | | | | 3 | 2 | 2 |
| **WT. AVG** | 3 | 2 | 2 | 2.5 | 2.5 | | 3 | | | 2 | | 2.5 | 2 | 2 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.35 |

## COURSE CONTENT

### UNIT-I

**Module 1: Introduction to Geology**
Geology and its importance in civil engineering, branches of geology, origin and structure of the Earth (crust, mantle and core), geological processes, geological time scale, basic geological terms and their use in engineering projects.

**Module 2: Minerals and Rocks**
Minerals and their properties, common rock-forming minerals, classification of minerals, types of rocks (igneous, sedimentary and metamorphic), formation of rocks, characteristics of rocks and their use in construction works.

### UNIT-II

**Module 3: Weathering and Erosion**
Weathering and its types (physical, chemical and biological), factors affecting weathering, soil formation, erosion and transportation of sediments by water and wind, effects of weathering and erosion on engineering structures, basic methods of erosion control.

**Module 4: Geological Structures**
Introduction to geological structures, folds and faults and their types, joints and fractures, dip and strike of rock layers, identification of geological structures using simple diagrams, importance of geological structures in construction projects.

### UNIT-III

**Module 5: Groundwater**
Water cycle, occurrence of groundwater, porosity and permeability, types of aquifers (confined and unconfined), groundwater movement, wells and their types, importance of groundwater in engineering projects and water supply.

**Module 6: Natural Hazards**
Earthquakes and their causes, effects of earthquakes on structures, landslides and their types, causes of floods and flood control measures, disaster prevention and safety considerations in engineering works.

### UNIT-IV

**Module 7: Site Investigation**
Need and importance of site investigation, geological survey and mapping, sampling methods, basic subsurface investigation techniques, collection of geological information, role of geology in site selection and planning of engineering projects.

**Module 8: Engineering Structures and Environmental Impact**

Basic concepts of dams, tunnels, roads and bridges, geological considerations in construction, selection of suitable construction sites, common geological problems during construction, environmental impact of engineering projects and basic environmental protection measures.

## Suggested Books

- A Textbook of Geology by P.K. Mukherjee.
- Physical and General Geology by S.K. Garg.
- Engineering and General Geology by PrabinSingh.
- Introduction of physical Geology byA.Holmes.

| Course Title | BUILDING CONSTRUCTION AND MATERIAL | Semester -3rd |
|---|---|---|
| Course Code | 26PEC-CE-209-H | External marks: 50 |
| Category | Professional Engineering Course | Internal marks:25 |
| Credits | 3 | Total marks: 75 |
| L-T-P | 3-0-0 | Duration of Examination: 3Hrs. |

**Note:** Examiner will set 9 questions in total, with two questions from each section and one question covering all the sections, which will be Q. 1. Question number 1 will be compulsory and of short answer type. Each question carries equal marks (15 marks). Students have to attempt five questions in total by selecting one question from each section.

## Course Objectives

The objectives of this course are to

- To provide the students an overview of the profession of Civil Engineering.
- To provide students with an understanding of Civil Engineering and the properties, characteristics, and applications of various building materials.
- To familiarize students with the basic functional requirements of buildings and the fundamental principles and practices of building construction.

## Course Outcomes (CO)

At the end of the course, the students will be able to.

**CO1**: Explain the importance of Civil Engineering in the infrastructural development of society

**CO2**: They will be able to illustrate the types and properties of various building materials.

**CO3**: To be aware of various traditional building materials and also the emerging materials in the field of Civil Engineering construction.

**CO4**: To select a suitable type of flooring, Plastering, and varnishes with their application.They should be able to describe the basic requirements to construct a building.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | 3 | | | | | 3 | | |
| CO2 | | 3 | | | | 3 | | | | | | 3 | | 2 |
| CO3 | 2 | | | 3 | 2 | | | | | | | 2 | | 2 |
| CO4 | 2 | | | 3 | 2 | | | | | | | | 3 | 2 |
| **WT. AVG** | 2.33 | 2.5 | | 3 | 2 | 3 | 3 | | | | | 2.66 | 3 | 3 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.72 |

## COURSE CONTENT

### UNIT-I

**Module 1:Civil Engineering and Society**

Basics of Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Early constructions and developments over time; Ancient monuments & Modern marvels, Works of Eminent civil engineers, Impact (social, economic, environmental) of Civil Engineering on Society, Introduction to green building concept and methods, Job opportunities in Civil Engineering.

**Module 2: Masonry Construction**

Introduction, Various terms used in brick masonry, classification of bricks, composition, bonds in brick work, laying brick work, structural brick work, reinforced brick work, Defects in brick masonry, Stone masonry and its classification, composite masonry, Glass block masonry.

### UNIT-II

**Module 3: Stones and Tiles**

**Stones:** Classification, requirements of good structural stone, quarrying, blasting, dressing of stones, prevention and seasoning of stone. **Tiles:** Manufacturing of tiles, Terra-cotta and its types, uses of terracotta.

**Module 4: Timber, Paints and Varnishes**

Classification of timber, structure of timber, seasoning of timber, defects in timber, fireproofing of timber, advantages of plywood and fiber boards, Important Indian timbers; Basic constituents of paints, types of paints, constituents of varnishes, characteristics and types of varnishes.

### UNIT-III

**Module 5:Roofs, Floors, and Doors, Windows**

Types of roofs, various terms used, roof trusses-king post truss, queen post truss, etc. Floor structures, ground, basement, and upper floors, various types of floorings. Doors and Windows: Locations, sizes, types of doors and windows, fixtures, and fasteners for doors and windows.

**Module 6:Cavity, Partition Walls and Foundations**

Cavity walls and their position, advantages of cavity walls, types of non-bearing partitions, construction details and precautions, and construction of masonry cavity walls. Types of foundations, sub-surface investigation, Foundation in waterlogged areas, Masonry wall foundation, Introduction to deep foundations.

**UNIT-IV**

**Module 7:Damp-Proofing, Water-Proofing and Fire Protection**

Dampness and its causes; prevention of dampness; materials used; and amp-proofing treatment in buildings; Water proofing: water-proofing treatment of roofs; Fire protection: fire-resistant construction, fire protection requirements for buildings.

**Module 8: Sound Insulation and Acoustics**

Classification, measurement, and transmission of sound, sound insulation of buildings, Acoustical materials and geo-textiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites, and other engineering materials, including properties and uses.

## Suggested Books

- Building Construction by Sushil Kumar, Standard Pub., N. Delhi
- Building Material byRangawala
- Construction Engineering by Y.S. Sane
- Building Construction by Gurcharan Singh, Standard Pub., N. Delhi.
- https://onlinecourses.nptel.ac.in/e-learning/preview/noc21_ce10
- https://www.youtube.com/playlist?list=PLyqSpQzTE6M_RfjEQMK7_LUvxAMhplT

| Course Title | FLUID MECHANICS LAB | Semester -3rd |
|---|---|---|
| Course Code | 26LC-CE-201-H | External marks: 20 |
| Category | Laboratory Courses | Internal marks: 5 |
| Credits | 1 | Total marks: 25 |
| L-T-P | 0-0-2 | Duration of Examination: 3 Hrs. |

## Course Objectives

The objectives of this course are to

- To understand the physical processes of fluid more closely.
- To study Bernoulli's apparatus and to determine different properties of fluid.
- To study and determine fluid properties using venturimeter& Orifice meters.
- To study the mouthpiece, notches,and vortex flow apparatus,to understand different processes.

## Course Outcomes (Co)

At the end of the course, the students will be able to

**CO1:**VerifyBernoulli's theorem.

**CO2:**Calibrate different properties using notches, venturimeter, and orifice meter.

**CO3:**Determine different coefficient and their verification.

**CO4:**Analyze different properties of fluid flow using the mouthpiece, vortex flow apparatus

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 3 | 2 | | | | | | | 3 | | 3 |
| CO2 | 3 | 2 | | | | | | | | 2 | | 2 | | |
| CO3 | 3 | | 2 | | 3 | | | | | | | 2 | | 2 |
| CO4 | 3 | 2 | | | | | | | | | | 3 | 2 | |
| **WT. AVG** | 3 | 2 | 2 | 3 | 2.5 | | | | | 2 | | 2.5 | 2 | 2.5 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.38 |

## LIST OF EXPERIMENTS

1. Verification of Bernoulli's Theorem.
2. Calibration of V notchand Rectangular notch.
3. Calibration of Trapezoidal notch.
4. Study of Pressure Measuring Devices.
5. Determination of Metacentric height.
6. Hydrostatics Force on Flat Surfaces/Curved Surfaces.
7. To study the Venturimeterand determine fluid properties.
8. To study Orifice meter and determine fluid properties.
9. Determination of coefficient $C_d$, $C_v$, and $C_c$.

| | | | |
|---|---|---|---|
| **Course Title** | **SURVEYING-I LAB** | **Semester -3rd** | |
| **Course Code** | **26LC-CE-203-H** | **External marks:** | **20** |
| **Category** | **Laboratory Courses** | **Internal marks:** | **5** |
| **Credits** | **1** | **Total marks:** | **25** |
| **L-T-P** | **0-0-2** | **Duration of Examination:** | **3 Hrs.** |

## Course Objectives

The objectives of this course are to

- To use of Chain for linear measurement and traversing.
- To use of different compass for determination of directions and for traversing.
- To use different levels and determine the reduced levels, elevation and depressions of ground.
- To prepare maps using plane table by applying different methods.

## Course Outcomes (Co)

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

**CO1:**Use conventional surveying tools such as chain/tape, compass, plane table, levels in the field for various civil engineering applications.
**CO2:**Enter observation in field book, adjusting and plotting a traverse.
**CO3:**To calculate the earth work for cutting and filling.
**CO4:**To prepare contour maps of a small area and its importance in Civil Engineering.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 3 | 2 | | 3 | | | | | 3 | 3 | |
| CO2 | 3 | 2 | | 2 | | | | | | | | 2 | 2 | |
| CO3 | 3 | 2 | 2 | 2 | 2 | | | | | | | 2 | 2 | 2 |
| CO4 | 3 | 2 | | 3 | | | | | | 3 | | 3 | 2 | 2 |
| **WT. AVG** | 3 | 2 | 2 | 2.5 | 2 | | 3 | | | 3 | | 2.5 | 2.25 | 2 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.42 |

## LIST OF EXPERIMENTS

1. Chain Traversing
2. Compass Traversing
3. Fly Levelling
4. Profile levelling &Cross Sectioning
5. Plane Table surveying: Radiation and Intersection.
6. Resection- 2 and 3-point problem with plane Table.

7. Contouring and preparation of contour map.

| Course Title | COMPUTER-BASED BUILDING DRAWING LAB | Semester -3rd |
|---|---|---|
| Course Code | 26LC-CE-205-H | External marks:20 |
| Category | Laboratory Courses | Internal marks: 05 |
| Credits | 1 | Total marks: 25 |
| L-T-P | 0-0-2 | Duration of Examination: 3Hrs. |

## Course Objectives

The objectives of this course are to

- To understand the principles of building planning and relevant building bylaws.
- To develop the ability to prepare plans, elevations, and sections of brick bonds, walls, foundations, and building structures.
- To prepare detailed working drawings of various components and parts of a building in accordance with standard engineering practices.

## Course Outcomes (CO)

At the end of the course, the students will be able to

**CO1:**Demonstrate proficiency in engineering sketching, drafting techniques, orthographic projections, sectional drawings, and the use of architectural and engineering scales.
**CO2:**Prepare detailed drawings of building components such as doors, windows, floors, staircases, walls, and other structural and architectural elements.
**CO3:**Develop and draft plans, elevations, and sections for residential and public buildings using planning principles, building bylaws, and AutoCAD software.
**CO4:**Read, interpret, and prepare professional civil engineering drawings while ensuring compliance with functional planning requirements and standard engineering practices.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | | | | | | | | | 2 | | |
| CO2 | | 3 | | | | 3 | | | | | | 3 | | 1 |
| CO3 | 2 | | | 3 | 2 | | | | | | | 2 | | 2 |
| CO4 | 1 | 2 | | 3 | 3 | | | | | | 2.5 | | 2.5 | 3 |
| **WT. AVG** | 2 | 2.33 | | | 2.5 | 3 | | | | | 2.5 | 2.33 | 2.5 | 2 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.39 |

**LIST OF EXPERIMENTS**

**1. Drawing Basics**: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962.

**2. Simple Engineering Drawings with CAD Drawing Tools:**Lines, Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text.

**3. Special Features:**View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, working with multiple drawings, Functional design of building (Residential, Public and Industrial), positioning of various components of buildings, orientation of buildings, building standards, bye laws, set back distances and calculation of carpet area, plinth area and floor area ratio.

**Drawings Related to Different Building Elements:**

Following drawings are to be prepared for the data given using CAD Software

1. Cavity Wall.
2. Different Bonds in brick work.
3. Grillage foundation.
4. Preparation of building drawing mentioning its salient features including the following details: a) Ground floor plan b) Two Sectional Elevations c) Front and Side Elevations
5. Plan and Sectional Elevation of different Stair-Cases.
6. Plan and Sectional Elevation of different Doors and Windows.
7. Plan and Sectional Elevation of different Ventilators.
8. Plan and Sectional Elevation of Floors.
9. Plan and Sectional Elevation of different roofs.

## Suggested Books


- Civil Engineering Drawing by M. Chakraborti.
- Building Drawing by M. G. Shah, C. M. Kale, and S. Y. Patki.
- A Course in Civil Engineering Drawing by V.B. Sikka.
- Planning and Designing Buildings by Y.S. Sane.
- Building Planning and Drawing by B.P. Verma.
- Computer Aided Building Planning and Drawing (Various Authors/Publishers like Nirali Prakashan).
- IS 962: 1989 - Code of Practice for Architectural & Building Drawings.
- https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ar11
- https://www.youtube.com/playlist?list=PLp6ek2hDcoNCjoRLQ4rjpCozisCACBxKA

| Material Testing Lab. | | | |
|---|---|---|---|
| **Course Code** | **26LCPCC-CE-220H** | **External marks:** | **20** |
| **Credits** | **1** | **Internal marks:** | **05** |
| **L-T-P** | **0-0-2** | **Total marks:** | **25** |
| | | **Duration of Examination:** | **3 Hrs.** |

## Course Objectives

1. To determine important properties of cement with different tests.
2. To study the various test on aggregates and their properties.
3. To study the material properties.
4. To understand the Mechanical properties of the material.
5. To calculate the different material strength.
6. To check the Hardness of the material.

## Course Outcomes (CO)

At the end of the course, the students will be able to:

**CO1:**Identify and determine the physical and mechanical properties of common construction materials such as cement, aggregates, concrete, and bricks using standard laboratory procedures.

**CO2:** Conduct laboratory tests on civil engineering materials in accordance with relevant Indian Standards (IS Codes) and interpret the test results.

**CO3:** Analyze test data, prepare laboratory reports, and compare experimental results with specified standards and acceptance criteria.

**CO4:**Analyze test data, prepare laboratory reports, and compare experimental results with specified standards and acceptance criteria.

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 3 | | | 2 | | | | 2.5 | 3 | | |
| CO2 | 2 | 2 | | | | 3 | 1 | | | | | | | 3 |
| CO3 | 3 | | | 2 | 2 | | | | | | | | 2.6 | |
| CO4 | | 2 | | 2.5 | 2 | 3 | | | | | | | 2.6 | 3 |
| **WT. AVG** | 2.66 | | | 2.5 | 2 | 3 | 1.5 | | | | 2.5 | 3 | 2.6 | 3 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.53 |

## LIST OF EXPERIMENTS

1. Determine the standard consistency of cement using Vicat`s apparatus.
2. Determine the Fineness of cement by Sieve analysis.
3. Determine the Soundness of cement by Le-Chatelier`s apparatus.
4. Determine the Setting time of cement, initial and final of cement.
5. Determine the specific gravity of cement.

6. Determine the heat of Hydration of cement.
7. Determine the Chemical Properties of cement.
8. Determine the compressive strength of cement.
9. Determine the Fineness modulus of Coarse and fine aggregates.
10. Determine Specific gravity, water absorption and bulking of fine aggregate.

## Suggested Books.

- Concrete & Aggregates:IS 2386 governs aggregate testing (sieve analysis, crushing value). IS 516 covers compressive strength of concrete.
- Cement:IS 4031 defines physical testing methods (setting time, soundness).
- Steel: IS 1608 details the tensile testing of metals. Globally, ASTM A370 is used for the mechanical testing of steel.
- Building Materials:"Building and construction materials-Testing and quality control" by M.L. Gambhir
- Civil Engineering Materials: Introduction and Laboratory Testing is a civil engineering textbook by M. Rashad Islam
- Concrete Technology: Theory and Practice is a widely used civil engineering textbook by M. S. Shetty
- Handbook of Material Testing is a technical reference manual published by the Indian Railways Institute of Civil Engineering (IRICEN).

| Course Title | ENVIRONMENTAL SCIENCE | Semester -3rd |
|---|---|---|
| Course Code | 26AU-ENV- 202-H | External Marks:70 |
| Category | Audit Course (Mandatory) | Internal Marks: 30 |
| Credits | 0 | Total marks: 100 |
| L-T-P | 2-0-1 | Duration of Examination: 3 Hrs. |

## Course Objectives

- People working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce the most efficient, economical, and eco-friendly finished product. It will guide the students living in a historic transitional period of burgeoning awareness of the conflict between human activities and environmental constraints, to help and save the fragile and endangered planet, with the natural resources already overexploited

## Course Outcomes (Co)

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

**CO1:** Solve various engineering problems by applying an environmentally sustainable approach to produce eco-friendly products.

**CO2:** Use relevant pollution control methods to solve domestic and industrial problems.

**CO3:** To recognize eco-friendly and sustainable energy resources for combating global problems like climate change, acid rain, and resource depletion, etc.

**CO4:** To solve local solid hazardous and e-waste problems.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | | | | | | | | |
| CO2 | | 3 | | | | | | | | | | | | |
| CO3 | 2 | 3 | | | | | | | | | | | | |
| CO4 | | | 3 | | | | 1 | | | | | | | |
| **WT. AVG** | 2.5 | 2.67 | 3 | | | | 1 | | | | | | | |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.29 |

### COURSE CONTENT

**Unit-1.** The Multidisciplinary nature of environmental studies. Definition, scope and importance. Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Interaction between earth, man and environment. (2lectures)

**Unit-2. Natural Resources**

Renewable and non-renewable resources: Natural resources and associated problems.

a) Forest resources:Useandover-exploitation;deforestation, casestudies.Timberextraction,miningdamsandtheireffects onforestsandtribalpeople.

b) Waterresources:Useandover-utilizationofsurfaceand groundwater,floods,drought,conflictsoverwater,dams- benefitsandproblems.

c) Mineralresources:Useandexploitation,environmentaleffects ofextractingandusingmineralresources,casestudies.

d) Foodresources: World foodproblems,changes,causedby agricultureandovergrazing,effectsofmodernagriculture, fertilizer-pesticideproblems,Waterlogging,salinity,case studies.

e) Energyresources:Growingenergyneeds;renewableandnon-renewableenergysource,useofalternatesources,case studies.

f) Landresources:Landasaresource,landdegradation,man-induced landslides, soil erosion,anddesertification.

* Roleofanindividualintheconservationofnaturalresources.

* Equitableuseofresourcesforsustainablelifestyles. (5lectures)

**Unit-3Ecosystem and biodiversity conservation**

* Structure of ecosystem, Biotic and Abiotic components

* Energyflowintheecosystem.
* Ecologicalsuccession.
* Foodchains,foodwebs,andecologicalpyramids.
* Aquatic and terrestrial ecosystems
* Different levels of biodiversity: Genetic, species,andecosystemdiversity.
* Valueofbiodiversity:consumptiveuse,productiveuse, social,ethical,aestheticandoptionvalues.
* Biodiversityatglobal,national,andlocallevels.
* Indiaasamega-diversitynation.
* Hot-spotsofbiodiversity.
* Threatstobiodiversity:habitatloss,poachingofwildlife, and man-wildlifeconflicts.
* EndangeredandendemicspeciesofIndia.
* Conservationofbiodiversity:In-situandex-situ conservationofbiodiversity.

(6lecture)

**Unit-4.** Environmental Assessment and Management:

Aims and objectives of environmental impact assessment (EIA), Environmental Impact Statement (EIS), and environment management plan (EMP). Structure and role of the central and state pollution control board, ISO14000: implementation in industries for benefit.

* EnvironmentProtectionAct.
* Air(PreventionandControlofPollution)Act.
* Water(PreventionandControlofPollution)Act.
* WildlifeProtectionAct.
* ForestConservationAct.

* Issuesinvolvedintheenforcementofenvironmentallegislation.

*Publicawareness.

(4 lectures)

**Unit-5.EnvironmentalPollution**

Definition,causes,effectsandcontrolmeasuresof.

a) Airpollution.

b) Waterpollution c) Soilpollution

d) Marinepollution e) Noisepollution

f) Thermalpollution g) Nuclearhazards

* Bag filters, cyclone separator, electrostatic precipitator, catalytic converter.

* Roleofanindividualinpreventionofpollution.

* Pollutioncasestudies.

* Disastermanagement:floods,earthquake,cycloneand landslides.

(5lectures)

**Unit-6Contemporary Environmental Issues**

* Fromunsustainabletosustainabledevelopment.

* Urbanproblemsrelatedtoenergy, National solar mission.

* Waterconservation,rainwaterharvesting, watershed management, Namami Gange and Yamuna action plan.

* Resettlementandrehabilitationofpeople:itsproblems andconcernscasestudies.

* Environmentalethics:Issuesandpossiblesolutions.

* Climatechange,globalwarming,acidrain,ozonelayerdepletion, sea level rise,nuclearaccidentsandholocaust.Casestudies.

* Wastelandreclamation.

* Carbon sequestration and carbon credits, carbon foot print

* Waste management- Swachha Bharat Abhiyan

* Consumerismandwasteproducts.

(4lectures)

**Unit-7** HumanpopulationandtheEnvironment. Populationgrowth,variationamongnations.Populationexplosion-FamilyWelfareProgramme. Environmentandhumanhealth. Epidemiological issues: Fluorosis, Arsenocosis, Goitre, Dengue. HumanRights, ValueEducation, HIV/AIDS. WomanandChildWelfare. RoleofInformationTechnologyinEnvironmentandhuman health. CaseStudies. (4 lectures)

Unit-8 FieldWork

* Visittoalocalareatodocumentenvironmentalassets- river/forest/grassland/hill/mountain.

* Visittoalocalpollutedsite-urban/Rural/Industrial/ Agricultural.

* Study of water polluted site

* Studyofcommonplants,insects,birds.

* Studyofsimpleecosystems-pond,river,hillslopes,etc.
(Fieldworkequalto15 lecturehours).

**Suggested Text Books** / Reference Books:


1. Agarwal,K.C.2001EnvironmentalBiology,NidiPub.Ltd. Bikaner.
2. Bharucha,Frach,TheBiodiversityofIndia,MApinPublishingPvt.Ltd.Ahmedabad-380013,India,E-mail:mapin@icenet.net(R).
3. BrunnerR.C.1989,HazardousWasteIncineration,Mc.Graw HillInc.480p.
4. ClarkR.S.,Marinepollution,SlandersonPressOxford(TB).
5. Cunningham,W.P.Cooper,T.H.Gorhani,E&Hepworth,M.T.2001,EnvironmentalEncyclopedia,JaicoPub.House,Mumbai1196p.
6. DeA.K.,EnvironmentalChemistry,WileyEasternLtd.
7. DowntoEarth,CentreforScienceandEnvironment(R).
8. Gleick,H.P.,1993.Waterincrisis,PacificInstituteforStudiesinDev.Environment&SecurityStockholmEnv.Institute, OxfordUniv.Press,473p.
9. HawkinsR.E.EncyclopediaofIndianNaturalHistory,BombayNaturalHistorySociety,Bombay(R).
10. Heywood,V.H.&Watson,R.T.1995. Global BiodiversityAssessment,CambridgeUni.Press1140p.
11. Jadhav,H&Bhosale,V.M.1995.EnvironmentalProtection andLaws.HimalayaPub.House,Delhi284p.
12. Mackinney,M.L.&Schoch,RM1996,EnvironmentalSciencesystems&solutions,Webenhanced edition.639p.
13. MhaskarA.K., MayyerHazardous,Tekchno-SciencePublications(TB).
14. MillerT.G.Jr.EnvironmentalScience,WadsworthPublishing Co. TB).
15. Odum,E.P.1971,FundamentalsofEcology.W.B.SaundersCo.USA,574p.
16. RaoM.N.&Datta,A.K.1987WasteWaterTreatment.Oxford&TBHPubl.Co.Pvt.Ltd.345p.
17. Sharma,B.K.2001,EnvironmentalChemistry,GoalPubl.House,Meerut.
18. SurveyoftheEnvironment,TheHindu(M).
19. TownsendC.,HarperJ.andMichaelBegon.Essentialsof Ecology,BlackwellScience(TB).
20. TrivediR.K.,HandbookofEnvironmentalLaws,Rules, Guidelines,ComliancesandStandards,Vol.IandIIEnviroMedia(R).
21. TrideviR.K.andP.K.Goal,Introductiontoairpollution,Techno SciencePublications(TR).
22. WagnerK.D.,1998,EnvironmentalManagement,W.B. Saundersco.Philadelphia, 499p.
23. AtextbookenvironmentaleducationG.V.S.PublishersbyDr. J.P.Yadav. (M) Magazine (R) Reference (TB)textbook


Theschemeofthepaperwillbe asunder:

ThesubjectofEnvironmental Sciencewill beincludedasa

qualifyingpaperinallUGCoursesandthestudentswillberequiredtoqualifythesame.Thedurationofthe coursewillbe45lectures.The examinationwillbeconductedalong withthesemesterexaminations.

Exam.Pattern:Incaseofawardingthemarks,thepaperwill carry100marks.

Theory:70marks,Practical/ Field visit:30marks.

Thestructure ofthequestionpaperwillbe:

| | | |
|---|---|---|
| Part-A:ShortAnswerPattern | : | 10marks |
| Part-B:EssayTypewithinbuiltchoice | : | 60marks |
| Part-C:FieldWork(Practical) | : | 30marks |

InstructionsforExaminers:

Part-A:QuestionNo.1iscompulsoryandwillcontainfiveshort- answertypequestionsof2 markseachcoveringtheentiresyllabus.

Part-B:Eightessaytypequestions(withinbuiltchoice)willbeset fromtheentiresyllabusandthecandidatewillberequiredtoanswer anyfourofthem.Eachessaytypequestionwillbeof15marks.

Theexaminationoftheregularstudentswillbeconductedbytheconcernedcollege/Institute.Each studentwillberequiredtoscoreminimum40%markseparatelyin theoryandpractical/Field visit.Themarks inthisqualifyingpaperwillnotbe includedindeterminingthepercentageofmarksobtainedfortheaward ofdegree.However,thesemarkswillbeshowninthedetailedmarks certificateofthestudents.

| | | |
|---|---|---|
| **Course Title** | **SUSTAINABLE AND GREEN CONSTRUCTION** | **Semester -3rd** |
| **Course Code** | **26PCC-CE-211H** | **External marks: 20** |
| **Category** | **Professional Core Course** | **Internal marks: 05** |
| **Credits** | **3** | **Total marks: 25** |
| **L-T-P** | **3-0-0** | **Duration of Examination: 3Hrs.** |

**Note:** The examiner will set 9 questions in total, with 2 questions from each section and 1 question covering all the sections. Question 1 will be compulsory and of short-answer type. Each question carries equal marks (15 marks). Students must attempt five questions in total, selecting one from each section.

## Course Objectives

The objectives of this course are to

- To understand the principles of green concrete and the importance of sustainable construction materials.
- To study the properties and applications of supplementary cementitious materials and recycled aggregates in concrete.
- To develop skills in the design, preparation, and casting of green concrete mixes.
- To evaluate fresh and hardened properties of green concrete through testing.

## Course Outcomes (CO)

At the end of the course, the students will be able to

**CO1**: Identify and explain the role of sustainable materials used in green concrete production.

**CO2**: Design and prepare green concrete mixes using appropriate laboratory procedures.

**CO3**: Perform and interpret tests related to workability, strength, and durability of green concrete.

**CO4**: Assess the environmental benefits and suitability of green concrete for sustainable construction projects.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 3 | 2 | | 3 | | | | | 3 | 3 | 3 |
| CO2 | 3 | 2 | | 2 | | | | | | | | 2 | 2 | 3 |
| CO3 | 3 | 2 | 2 | 2 | 2 | | | | | | | 2 | 2 | 3 |
| CO4 | 3 | 2 | | 3 | | | | | | 3 | | 3 | 2 | 3 |
| **WT. AVG** | 3 | 2 | 2 | 2.5 | 2 | | 3 | | | 3 | | 2.5 | 2.25 | 3 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.52 |

**COURSE CONTENT**

**UNIT-I**

**Module 1: Introduction to Sustainable Construction**

Sustainable construction and why it is needed in civil Engineering, goals of sustainable development in construction, impacts of conventional construction practices, Concept of life cycle of a building.

**Module 2: Green Building Concepts**

Green building: key features, principles of green construction, differences between conventional and green buildings, and green building certification systems (LEED, GRIHA).

**UNIT-II**

**Module 3: Sustainable Building Materials**

Eco-friendly and sustainable building materials, recycled and reused construction materials, role of fly ash, slag, and other industrial waste in construction, are benefits and limitations of green materials.

**Module 4: Energy and Water Efficiency**

Energy efficiency in buildings, passive design techniques for energy saving, water conservation in construction, rainwater harvesting and water recycling systems.

**UNIT-III**

**Module 5: Construction Waste Management**

Construction and demolition waste, methods of waste reduction and recycling on site, sustainable site management, impacts of construction waste on environment.

**Module 6: Pollution Control in Construction**

Types of pollution from construction activities, dust, noise, and water pollution control methods, sustainable construction site practices, and environmental protection measures during construction.

**UNIT-IV**

**Module 7: Green Building Design Techniques**

Sustainable architectural design, passive cooling and natural ventilation systems, orientation and shading in building design, and low-carbon design strategies.

**Module 8: Applications and Case Studies**

Real-life examples of green buildings, smart cities, and sustainable infrastructure concepts, challenges in implementing green construction, and the future scope of sustainable construction in civil engineering.

## Suggested Books


- Sustainable Construction Materials-Ravindra K. Dhir, Jorge de Brito, Gurmel S. Ghataora, Chao Qun
- Sustainability Issues in Civil Engineering-G. L. Sivakumar Babu, Sireesh Saride, B. MunwarBasha
- Building Materials for Sustainable and Ecological Environment-Varenyam Achal aur Chee Seong
- Sustainability of Construction Materials-Jamal M. Khatib.

| | | | |
|---|---|---|---|
| **Course Title** | **GREEN CONCRETE LAB** | **Semester -3rd** | |
| **Course Code** | **26LC-CE-207-H** | **External marks:** | **20** |
| **Category** | **Laboratory Courses** | **Internal marks:** | **5** |
| **Credits** | **1** | **Total marks:** | **25** |
| **L-T-P** | **0-0-2** | **Duration of Examination:** | **3 Hrs.** |

## Course Objectives

The objectives of this course are to.

- To understand the principles of green concrete and the importance of sustainable construction materials.
- To study the properties and applications of supplementary cementitious materials and recycled aggregates in concrete.
- To develop skills in the design, preparation, and casting of green concrete mixes.
- To evaluate the fresh and hardened properties of green concrete through laboratory testing.

## Course Outcomes (CO)

At the end of the course, the students will be able to.

**CO1**: Identify and explain the role of sustainable materials used in green concrete production.

**CO2**: Design and prepare green concrete mixes using appropriate laboratory procedures.

**CO3**: Perform and interpret tests related to workability, strength, and durability of green concrete.

**CO4**: Assess the environmental benefits and suitability of green concrete for sustainable construction projects.

## Co-Po Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 3 | 2 | | 3 | | | | | 3 | 3 | 3 |
| CO2 | 3 | 2 | | 2 | | | | | | | | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 2 | 3 | | | | | | | 2 | 2 | 3 |
| CO4 | 3 | 2 | | 3 | | | | | | 3 | | 3 | 2 | 3 |
| **WT. AVG** | 3 | 2 | 3 | 2.5 | 2.5 | | 3 | | | 3 | | 2.5 | 2.25 | 3 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.67 |

## LIST OF EXPERIMENTS

1. To prepare green concrete using fly ash as a partial replacement of cement and to determine its compressive strength.
2. To prepare green concrete using Ground Granulated Blast Furnace Slag (GGBS) and to determine its workability using the slump test.
3. To prepare concrete using recycled coarse aggregates and to evaluate its compressive strength.
4. To prepare concrete using silica fume as a supplementary cementitious material and to determine its flexural strength.
5. To prepare eco-friendly concrete using rice husk ash and to determine its water absorption characteristics.
6. To prepare concrete using plastic waste as a partial replacement material and to evaluate its density and compressive strength.
7. To prepare lightweight green concrete using suitable waste materials and to determine its compressive strength.
8. To prepare concrete using demolished concrete waste aggregates and to study its durability characteristics.
9. To prepare green concrete using a combination of fly ash and GGBS and to determine its split tensile strength.
10. To prepare a sustainable concrete mix using alternative materials and compare its strength and performance with conventional concrete.

| | | |
|---|---|---|
| **Course Title** | **STRUCTURAL ANALYSIS** | **Semester -4th** |
| **Course Code** | **26PCC-CE-202-H** | **External marks: 70** |
| **Category** | **Professional Core Course** | **Internal marks: 30** |
| **Credits** | **4** | **Total marks: 100** |
| **L-T-P** | **3-1-0** | **Duration of Examination: 3 Hrs.** |

**Note**: Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

- To provide basic knowledge in the mechanics of materials so that the students can solve real engineering problems and Design Engineering Systems.
- Covers the relationship between stress and strain on deformable solids, principal stresses, maximum shearing stress, and the stresses acting on a structural member.
- Applies analysis to members subjected to axial, bending, and Torsional loads.
- Learn to evaluate internal forces, moments, and corresponding stresses in beams through problem-solving sessions using different methods.

## Course Outcomes (CO)

At the end of the course, the students will be able to:

**CO1:** Helps to determine the deflections and rotations produced by the three fundamental types of loads: axial, Torsional, and flexural.

**CO2:** Identify the internal forces and moments in beams to develop shear force and bending moment diagrams. Assess section properties, bending, and deflections in beams.

**CO3:** Use various classical methods for analysis of indeterminate structures.

**CO4:** Apply the methods of indeterminate truss analysis to demonstrate the behavior of arches and their methods of analysis.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | | | | | | | | 3 | | |
| CO2 | 1.75 | 3 | | | | | | | | | | 2 | 2 | |
| CO3 | 2.5 | 1.5 | 3 | 1 | | | | | | | | 3 | | |
| CO4 | 1.75 | 1.5 | 3 | 2 | | | | | | | | | | 3 |
| **WT. AVG** | 2.25 | 2.25 | 2.66 | 1.66 | | | | | | | | 2.66 | 2 | 3 |

| | | | | | | | | | Overall Mapping of Subject | 2.35 |
|---|---|---|---|---|---|---|---|---|---|---|

## COURSE CONTENT

### UNIT-I

**MODULE 1: Deflection of Statically Determinate Structures**

Double integration method, Conjugate beam method, Moment area methods, Principle of virtual work (unit load method), and Castigliano's theorem.

**MODULE 2: Deflection of Statically Determinate Frame and Truss**

Deflection of determinate pin-jointed trusses and rigid-jointed frames by principle of virtual work, Strain energy and Castiglino's theorem, Williot Mohr method and Maxwell's laws of reciprocal theorem

### UNIT-II

**MODULE 3: Travelling Loads**

Maximum shear force and bending moment diagrams for beams carrying moving loads: a single concentrated load, a uniformly distributed load, two concentrated loads, fixed distance apart, a series of concentrated loads, and an equivalent UDL for bending and shear force in each of the above cases.

**MODULE 4: Influence Line**

Influence lines for reactions, BM, and SF for simply supported beam; influence lines for forces in trusses with top horizontal and curved; use of influence lines for calculating design forces due to dead load and moving live loads.

### UNIT-III

**MODULE 5: Arches**

Determination of Horizontal thrust, Shear force, and Bending moment diagram for:

**1**. Two-hinged arches **2**. Three hinged arches, and **3**. Fixed arches.

**MODULE 6: Column Analogy Method, Cable and Suspension Bridge**

Elastic centre, Properties of analogous column, Application to beam and frames. Introduction of cable and suspension bridge, uniformly loaded cables, Temperature stresses, and two and three-hinged stiffening Girder.

### UNIT-IV

**MODULE 7: Methods for Indeterminate Structures.**

Determination of static and kinematic in determinacy of beams, frames, and trusses, Slope Deflection and Moment Distribution Methods- Analysis of continuous beams and frames.

**MODULE 8: Kani's Method**

Analysis of continuous beam and simple frames, Analysis of frames with different column lengths and end condition of the bottom storey.

## Suggested Books

- Statically Indeterminate Structures by C.K. Wang, McGraw-Hill Book Co., New York.
- Advanced Structural Analysis by A.K. Jain, Nem Chand & Bros., Roorkee.
- Indeterminate Structures by R.L. Jindal, S. Chand & Co., New Delhi.
- Theory of Structures, Vol. I, by S.P. Gupta & G.S. Pandit, Tata McGraw-Hill, New Delhi.


| | | |
|---|---|---|
| **Course Title** | **FLUID MECHANICS-II** | **Semester -4th** |
| **Course Code** | **26PCC-CE-204-H** | **External marks: 50** |
| **Category** | **Professional Core Course** | **Internal marks: 25** |
| **Credits** | **3** | **Total marks: 75** |
| **L-T-P** | **3-0-0** | **Duration of Examination: 3 Hrs.** |

**Note**: Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (10 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

- To introduce the fundamental concepts and principles of fluid mechanics and hydraulic engineering.
- To develop an understanding of different types of fluid flow, including laminar flow, flow through pipes, open channel flow, and hydraulic jump.
- To familiarize students with the analysis and solution of common hydraulic engineering problems encountered in practice.
- To enable students to apply theoretical knowledge of fluid mechanics and hydraulics for solving practical engineering problems and interpreting real-life hydraulic systems.

## Course Outcomes (CO)

**CO1**: Explain the basic concepts, properties and principles of fluid mechanics and hydraulic engineering.

**CO2**: Analyze different types of fluid flow, including laminar flow, flow through pipes, open channel flow and hydraulic jump.

**CO3**: Apply hydraulic principles and equations to solve engineering problems related to fluid flow and hydraulic systems.

**CO4**: Relate theoretical knowledge with practical applications in hydraulic engineering and evaluate the performance of hydraulic structures and systems.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 2 | | 2 | 2 | | | | | 2 | | 2 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | 3 | | 2 | | | 2 | | | | | | 3 | 2 | |
| CO3 | 3 | 2 | | | | | | | | | | 3 | | 2 |
| CO4 | 3 | | 3 | 2 | | | | 3 | | | | 3 | 2 | 2 |
| **WT. AVG** | 3 | 2 | 2.5 | 2 | | 2 | 2 | 3 | | | | 3 | 2 | 2 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.35 |

## COURSE CONTENT

### UNIT-I

**Module 1**: **Laminar Flow**
Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.

**Module 2**: **Turbulent Flow**
Reynolds experiment, Transition from laminar to turbulent flow, Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes

### UNIT-II

**Module 3:Flow Through Pipes**
Loss of head through pipes, Darcy-Weisbach equation, Minor losses, Total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, siphon, power transmission through pipes, Analysis of pipe networks: water hammer in pipes and control measures, branching of pipes.

### UNIT-III

**Module 4:Open Channel Flow: Uniform flow**
Definition, Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channel flow.
Uniform Flow- Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient 'n', Most economical section of channel, Computation of Uniform flow, Normal depth.

**Module 5: Open Channel Flow: Non-Uniform Flow**
Specific energy, Specific energy curve, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Channel Transitions, Gradually Varied Flow- Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile

### UNIT-IV

**Module 6:Hydraulic Jump**
Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump,

**Module 7: Dynamics of Fluid Flow**

Surges, Positive and negative surges, Dynamics of Fluid Flow- Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation,

## Suggested Books

- Hydraulics and Fluid Mechanics, P.M. Modi and S.M. Seth,
- Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw-Hill.
- Open channel Flow, K. Subramanya, Tata McGraw-Hill.
- Open Channel Hydraulics, VenTe Chow, Tata McGraw-Hill.
- Burnside, C.D., "Electromagnetic Distance Measurement," Beekman Publishers,1971
- Fluid Mechanics and Hydraulic Machines R.K. Bansal.

| **Course title** | **SURVEYING-II** | **Semester -4** |
|---|---|---|
| **Course Code** | **26PCC-CE- 206-H** | **External marks: 50** |
| **Category** | **Professional Core Course** | **Internal marks: 25** |
| **Credits** | **3** | **Total marks: 75** |
| **L-T-P** | **3-0-0** | **Duration of Examination: 3 Hrs.** |

**Note**: Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (10 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

- To understand the principle of surveying on a very large scale by locating precise horizontal controls.
- To learn about determining absolute positions of a point using celestial measurements.
- To learn about different types of errors in measurements and their adjustment.
- To introduce the basic concept of photogrammetry, Remote sensing, and GIS.

## Course Outcomes (CO)

**CO1:** Students would be able to know about advanced methods of locating horizontal controls.

**CO2:** Set out various civil engineering structures, learn about different types of time and solution of astronomical triangle.

**CO3:** Apply corrections to the measurements for different errors, and understand the difference between aerial photograph and satellite images and their use in map making.

**CO4:** Apply remote sensing and GIS. for different Civil Engineering problems.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | 3 | 2 | | | | | 3 | | 3 |
| CO2 | 3 | | | | 2 | | | | | | 2 | 2 | | |
| CO3 | 3 | 2 | 2 | | | | | | | | | | | 3 |
| CO4 | 3 | | 3 | | 3 | 1 | | | | | | 2 | | 2 |
| **WT. AVG** | 3 | 2 | 2.5 | | 2.5 | 2 | 2 | | | | 2 | 2.33 | | 2.66 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.33 |

## COURSE CONTENT

### UNIT-I

**Module 1:Triangulation and Trilateration**

Triangulation systems, classification, strength of figure, selection of triangulation stations, grade of triangulation, field work of triangulation, triangulation computations, Trilateration-Principle, Methods, advantages and disadvantages, introduction to total station.

**Module 2:Survey Adjustment and Computations**

Definitions, types of error, weight of an observation, law of weights, most probable values, principle of least squares, method of correlates, normal equation, adjustment of triangulation figures by method of least squares.

### UNIT-II

**Module 3:Astronomy**

Definitions of astronomical terms, celestial coordinate systems, Napier's rule of circular parts, star at elongation, star at prime vertical, star at horizon, star at culmination, Astronomical triangle, various time systems: sidereal, apparent, solar and mean solar time; Equation of time-its cause and effect, inter-conversion of time, determination of azimuth, latitude, longitude etc. by astronomical observations.

### UNIT-III

**Module 4:Elements of Photogrammetry**

Introduction, types of photographs, aerial camera, scale of a photograph, height displacements of vertical photographs, flight planning and its uses, crab and drift, number of photographs, relief displacements, Stereoscopic vision and stereoscopes, height determination from parallax measurement, flight planning, principle of photo interpretation, photogrammetric monitoring.

### UNIT-IV

**Module 5:Introduction to remote sensing**

Definition of Remote Sensing, types of remote sensing, remote sensing system and components. EMR source and its characteristics. Application of remote sensing in Civil Engineering.

**Module 6:Geographical Information System (GIS)**

Definition, and Objectives, Components of GIS, Spatial data models: Raster and Vector, Data inputting in GIS, Digital Elevation Model, introduction to GPS and its applications.

## Suggested Books


- Chang. T. K. 2002: Geographic Information Systems, Tata McGraw-Hill
- Punmia, B.C. 2005: Surveying I and II, Luxmi Publications
- Charles D. Ghilani: Adjustment Computations: Spatial Data Analysis (Fifth Edition)
- Paul R Wolf: Elements of Photogrammetry
- G S Srivastava: An introduction to Geoinformatics
- Basudeb Bhatta: Remote Sensing and GIS
- G. L. Hosmer: Text-book on Practical Astronomy
- Various Online resources including NPTEL


| **Course Title** | **DESIGN OF CONCRETE STRUCTURE** | **Semester -4th** |
|---|---|---|
| **Course Code** | **26PCC-CE- 208-H** | **External marks: 70** |
| **Category** | **Professional Core Course** | **Internal marks: 30** |
| **Credits** | **4** | **Total marks: 100** |
| **L-T-P** | **3-1-0** | **Duration of Examination: 3 Hrs.** |

**Note**: The examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (14 marks). The examinee has to attempt 5 questions in total, selecting at least one from each unit.

## Course Objectives

- To understand the behavior and design principles of reinforced concrete structures.
- To analyze and design RC beams, columns, slabs, foundations, and retaining walls.
- To learn reinforcement detailing and contemporary practices in RC construction.
- To apply relevant design codes and standards in reinforced concrete design.

## Course Outcomes

At the end of the course, the students will be able to

**CO1:** Explain the design philosophy, behavior, and fundamental mechanics of reinforced concrete structures, including the assumptions used in analysis and design.

**CO2:**Analyze reinforced concrete structural systems and components subjected to gravity and lateral loads.

**CO3**: Design reinforced concrete elements such as beams, slabs, columns, and foundations in accordance with relevant design codes.

**CO4:** Apply analysis and design principles to develop and evaluate a complete reinforced concrete structural system through comprehensive design projects.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 2 | | 2 | 2 | | | | | 2 | | 2 |
| CO2 | 3 | 2 | 3 | | | 2 | | | | | | 3 | 2 | 2 |
| CO3 | 3 | 2 | | 3 | | 3 | | | | | | 3 | 2 | 2 |
| CO4 | 3 | | 3 | 2 | | | | 3 | | | | 3 | 2 | 2 |
| **WT. AVG** | 3 | 2 | 3 | 2.33 | | 2.33 | 2 | 3 | | | | 3 | 2 | 2 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.46 |

## COURSE CONTENT

### UNIT-I

**Module 1: Design methodology in Reinforced Concrete and Working Stress Method**
Stress-Strain relationship for concrete and steel, Characteristic strength and characteristic loads, Partial safety factors and Factored loads, Working stress and limit state methods and its comparison, Design values. Working Stress Method: Permissible stresses in concrete and steel, Design of singly and doubly reinforced rectangular and flanged beams in flexure, Design Examples.

**Module 2: Limit State Method**
Analysis and design of singly and doubly reinforced rectangular flanged beams, minimum and maximum reinforcement requirements, and design examples.

### UNIT-II

**Module 3: Shear Reinforcement**
Shear force and shear failure, need for shear reinforcement in RCC members, Types of shear reinforcement (stirrups, bent-up bars, and inclined bars), Modes of shear failure in beams, Role of stirrups in shear resistance and its Design examples

**Module 4: Serviceability Limit State**
Control of deflection, Cracking, slenderness, and vibrations, Deflection and moment relationship for limiting values of span to depth, Limit state of crack width, Design examples.

### UNIT-III

**Module 5: Design of Slabs**
General considerations, Design of one-way and two-way slabs for distributed and concentrated loads, Non-rectangular slabs, Openings in slabs, Design Examples.

### UNIT-IV

**Module 6: Columns**
Effective length, Minimum eccentricity, Short columns, under axial compression, Uniaxial and biaxial bending, Design examples.

**Module 7: Footings and Foundation**
Types of Foundation: Isolated, wall footings, Combined footings, raft foundation, Design of pile cap and Piles, and under-reamed piles; design examples.

## Suggested Books

- P. C. Varghese – Limit State Design of Reinforced Concrete, PHI Learning Pvt. Ltd.
- N. Subramanian – Design of Reinforced Concrete Structures, Oxford University Press.
- A. K. Jain – Reinforced Concrete: Limit State Design, Nem Chand & Bros.
- V. L. Shah and S. R. Karve – Limit State Theory and Design of Reinforced Concrete, Structures Publications.
- B. C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain – Reinforced Concrete Structures, Laxmi Publications.
- M. L. Gambhir – Fundamentals of Reinforced Concrete Design, PHI Learning Pvt. Ltd.

## Reference Codes

- Bureau of Indian Standards (BIS) – IS 456: Plain and Reinforced Concrete – Code of Practice.
- Bureau of Indian Standards (BIS**)** – SP 16: Design Aids for Reinforced Concrete to IS 456.
- Bureau of Indian Standards (BIS) – SP 34: Handbook on Concrete Reinforcement and Detailing.
- Bureau of Indian Standards (BIS) – IS 875 (Parts 1–5): Design Loads for Buildings and Structures.
- Bureau of Indian Standards (BIS) – IS 1893: Criteria for Earthquake Resistant Design of Structures.
- Bureau of Indian Standards (BIS**)** – IS 13920: Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces.

## Online Learning Resources

1. NPTEL – Design of Reinforced Concrete Structures.
2. Oxford University Press – Design of Reinforced Concrete Structures (N. Subramanian).
3. PHI Learning Publications.
4. Bureau of Indian Standards (BIS) Standards Catalogue.
5. SWAYAM Courses Portal.

| Course Title | CONCRETE TECHNOLOGY | Semester -4th | |
|---|---|---|---|
| Course Code | 26PCC-CE- 210-H | External marks: | 50 |
| Category | Professional Core Course | Internal marks: | 25 |
| Credits | 3 | Total marks: | 75 |
| L-T-P | 3-0-0 | Duration of Examination: | 3 Hrs. |

**Note**: Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (10 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

- To provide knowledge of various engineering materials and the properties of concrete ingredients.
- To understand the behavior of concrete under different loading and environmental conditions.
- To develop an understanding of concrete mix design and quality control practices.
- To familiarize students with special concretes, their applications, and the equipment used in heavy construction projects.

## Course Outcomes

At the end of the course, the students will be able to.

**CO1:** To explain various types of constructions in Civil Engineering.
**CO2:** Design the concrete mix using ACI and IS code methods.
**CO3:** Determine the properties of fresh and hardened of concrete.
**CO4:** Design special concretes and their specific applications to ensure quality control while testing/ sampling and acceptance criteria.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | | 2 | | | 2.5 | | | | 3 | 3 | | |
| CO2 | | 2 | 2.5 | | | 2.5 | | | | | | | | 3 |
| CO3 | 3 | | | 2 | 2.5 | | | | | | | | 2 | |
| CO4 | 2 | 2 | | 2 | | | | | | | | | 2 | 3 |
| **WT. AVG** | 2.33 | 1.66 | 2.5 | 2 | 2.5 | 2.5 | 2.5 | | | | 3 | 3 | 2 | 3 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.45 |

### COURSE CONTENT

### UNIT-I

**Module 1: Introduction to Engineering Materials**

Cements, M-Sand, Concrete (plain, reinforced and steel fibre/glass fibre-reinforced, light-

weight concrete, High Performance Concrete, Polymer Concrete) Ceramics and Refractories, Bitumen and asphaltic materials, Glass and Plastics, Structural Steel and other Metals

**Module 2: Limes, cement and mortars**

Lime: classification of lime, manufacturing, testing of lime, storage of lime, Cement: cements composition, types of cement, manufacturing of ordinary Portland cement, special types of cement, storage of cement, testing of cement. Mortars: Proportions of lime and cement mortars, mortars for masonry and plastering.

## UNIT-II

**Module 3: Concrete making materials**

Proportions of cements, aggregates- Classification of aggregates, Important physical properties, Mechanical properties, Specific gravity, Bulk density, Moisture content and Water absorption of aggregates, Sieve analysis, Fineness modulus, Grading curves, Gap Grading, Deleterious Substances in aggregates, Alkali-aggregate reaction, Maximum size of aggregates, water and admixtures; properties of fresh and hardened concrete, variability of concrete strength, extreme weather concreting, Pre-stressed concrete; Durability of concrete - alkali aggregate reaction, reinforcement corrosion, freezing and thawing, etc.

**Module 4: Mix Design**

Principles of concrete mix design, basic considerations, Factors in the choice of mix design, outline of mix design procedure, ACI mix design practice, USBR method, IS guidelines and Methods of mix design – IS 10262 method of mix design in detail with examples.

## UNIT-III

**Module 5: Steel and its testing**

Types of steel, mechanical behaviour and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; tensile test– standards for different material (brittle, quasi-brittle, elastic and so on); Bending and torsion test, procedure and standards, Strength of ceramic, Internal friction, creep – fundaments and characteristics; Brittle fracture of steel – temperature transition approach; concept of fracture mechanics; fracture toughness testing.

## UNIT-IV

**Module 6: Testing and Evaluation Procedures**

Testing of concrete mixes, Description for various concrete, steels, aggregates; Elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Shrinkage, Creep.

**Module 7: Construction Equipments and Heavy Construction**

Construction of large structures, dams, bridges, multi-storeyed buildings, etc., Construction Equipment - crushers, hot mix, plants, dozers, etc., Introduction to heavy construction equipment.

## Suggested Books


- Handbook of mix design – BIS.
- Concrete Technology by M.S. Shetty.
- Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.), R. Butterworth- Heinemann
- Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand& Bros, Fifth Edition
- Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. corresponding to materialsused for Civil Engineering applications
- Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella
- E.N. Dowling (1993), Mechanical Behaviour of Materials,Prentice Hall International Edition
- American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards (post 2000).

| Course Title | WATER SUPPLY AND TREATMENT | Semester -4th | |
|---|---|---|---|
| Course Code | 26PCC-CE- 212-H | External marks: | 50 |
| Category | Professional Core Course | Internal marks: | 25 |
| Credits | 3 | Total marks: | 75 |
| L-T-P | 3-0-0 | Duration of Examination: | 3 Hrs. |

**Note**: Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (10 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

- To quantify the water demands and its variations.
- To analyze the different characteristics of water.
- To study the different units of treatment.
- To deal with water supply and water distribution to consumers.
- To develop basic knowledge about the water pollution and its control.

## Course Outcomes (CO)

At the end of the course, the students will be able to

**CO1:** Understand the sources of water and characterization of water including physical, chemical and biological water quality parameters.
**CO2:** Develop basic knowledge about the transmission, storage and distribution of water.
**CO3:** Knowledge of water pollution and its control.
**CO4:** Recommend the degree of treatment required for the water.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 3 | 2 | | 2 | | | | 2 | 3 | | |
| CO2 | 3 | 3 | 2 | | | 2 | | | | | | | | 3 |
| CO3 | 3 | | | 3 | 2 | | | | 3 | | | 2 | 2 | 2 |
| CO4 | 3 | 2 | 2 | 2 | | | | | | | | | 2 | |
| **WT. AVG** | 3 | 2.33 | 2 | 2.67 | 2 | 2 | 2 | | 3 | | 2 | 2.5 | 2 | 2.5 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.33 |

# COURSE CONTENT

### UNIT-I

**Module 1: Introduction**
Water Supply System – Planning, Objectives, Design Period, Population Forecasting, Water Demands and its Variations, Sources of Water and their Characteristics, Development and Selection of Source, Intakes and their Types.

**Module 2: Water Characteristics**
Sources of Impurities, Type of Impurities in Water and their Sanitary Significance, Physical, Chemical and Bacteriological Analysis of Water, Indian and Global Standards of Water Quality, Effluent Standards.

**UNIT-II**

**Module 3: Water Treatment**
Necessity of Water Treatment, Flow Diagram of Different Treatment Units; Constructional Details, Working and Operation of Preliminary Units, Aeration Units, Sedimentation Units and their Types, Features and Design Aspects; Mixing Basins, Flocculation; Filtration – Mechanisms, Characteristics and Design of Slow and Rapid Sand Filtration Unit; Disinfection - Theory, Methods and Practices.

**Module 4: Advanced Water Treatment**
Water Softening, Desalination- R.O. Plant, Demineralization, Adsorption, Ion Exchange, Membrane Systems; Iron and Manganese Removal, Defluoridation, Dissolved Solids Removal.

**UNIT-III**

**Module 5: Water Conveyance System**
Methods of Supply - Intermittent and Continuous, Pipes and Conduits for Water-PipeMaterials, Laying, Jointing and Testing of Pipes, Valvesand Appurtenances

**Module 6: Pumps and Pumping Stations**
Need of Pumping, Terminology used, Classification of Pumps, Different Type of Pumps used in Water Supply, Power of Pumping, Total Lift of Pump, Location of Pumping Station, and Site Selection.

**UNIT-IV**

**Module 7: Water Distribution System**
Requirements of Water Distribution, Type of Distribution System, Layout of Distribution System – Dead End System, Grid Iron System, Ring System, Radial System and their Merits and Demerits; Distribution Reservoir-Functions and Determination of StorageCapacity,WaterDistributionNetwork- Layout, Capacity, PressureRequirements, Analysis; LeakDetection and Maintenance of Water Distribution Network.

**Module 8: Water Pollution and Control**
Sources of Water Pollution, Types and their Effects, Preventive Measures and Control of Water Pollution, Description of Legislation Related to Water Pollution Control.

## Suggested Books


- Water Supply Engineering: S.K. Garg.
- Water Supply Engineering: B.C. Punmia.
- Environmental Engineering: Peavy H. S., Rowe D. R. and Tchobanoglous G.
- Introduction to Environmental Engineering: Davis M. L. and Cornwell D. A.
- Water Supply and Sanitary Engineering: Birdie, G. S. and Birdie 8. Manual on Water Supply and Treatment: Ministry of Urban Dev., New Delhi.

| Course Title | STRUCTURAL ANALYSIS LAB | Semester -4 |
|---|---|---|
| Course Code | 26LC-CE- 202-H | External marks: 20 |
| Category | Laboratory Courses | Internal marks: 05 |
| Credits | 1 | Total marks: 25 |
| L-T-P | 0-0-2 | Duration of Examination: 3 Hrs. |

## Course Objectives

- Structural Analysis experiments help to understand, to know the practical behaviour of the physical structures like beams, different arches, roof truss etc.
- To know the practical behaviour of the physical structures like beams, roof truss etc.
- A proper structural analysis of these structures helps the students to solve the practical problems.
- Different structural apparatus like two-hinge arch, three- hinge arch are studied in the laboratory.

## Course Outcomes (CO)

At the end of the course, the students will be able to:

**CO1:** Various experimental and analytical studies for different structural members and their comparison.

**CO2:** Demonstration of frame and will be able to calculate the about forces, moments and deflections.

**CO3:** To understand the Able to calculate the deflection of springs

**CO4:** To verify and compare different theoretical and experimental theorems.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 1 | | | | | | | | 3 | | |
| CO2 | 2 | | | 1 | | | | | | | | 3 | | |
| CO3 | 2 | | | 2 | | | | | | | | 2 | | |
| CO4 | 1 | 3 | 2 | 2 | | | | | | | | 2 | | |
| **WT. AVG** | 2.66 | 3 | 2 | 1.5 | | | | | | | | 2.5 | | |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.33 |

## COURSE CONTENT

1. To determine and analyse deflection of curved beams.
2. Experimental and analytical study of behaviour of struts with various end conditions.
3. To determine deflection of trusses – Horizontal and vertical deflection of various joints of a pin jointed truss.
4. Experimental and analytical study of a 3-bar pin jointed Truss
5. To verify Moment area theorem regarding slope and deflection in a beam

6. To verify Maxwell's Reciprocal Theorem.
7. Experiment on a two-hinged arch for horizontal thrust and influence line for horizontal thrust
8. Analytical and experimental study of a three-hinged arch
9. Sway in portal frames – Demonstration.

| Course Title | FLUID MECHANICS LAB –II | Semester -4th | |
|---|---|---|---|
| Course Code | 26LC-CE- 204-H | External marks: | 20 |
| Category | Laboratory Courses | Internal marks: | 05 |
| Credits | 1 | Total marks: | 25 |
| L-T-P | 0-0-2 | Duration of Examination: | 3 Hrs. |

## Course Objectives

- To understand the flow measurement in a pipe flow.
- To determine the energy loss in pipe flow.
- To study the loss due to pipe fittings.
- To measure the discharge in an open channel flow.

## Course Outcomes (CO)

At the end of the course, the students will be able to:

**CO1:** Measure and analyze flow parameters such as velocity, discharge, and flow rate in pipe and open-channel flow systems.

**CO2:** Determine major energy losses due to friction in pipe flow and evaluate the factors affecting head loss.

**CO3:** Investigate and quantify minor losses caused by pipe fittings, bends, valves, and other flow disturbances.

**CO4:** Apply fluid mechanics principles to measure discharge using different flow-measuring devices in closed conduits and open channels.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | | 3 | | | | 3 | 2 | 3 | 2 |
| CO2 | 3 | 2 | 2 | | | | | | | | 3 | | 2 | 3 |
| CO3 | 3 | 2 | 3 | 3 | | | 3 | | 3 | | | | | |
| CO4 | 3 | | | 2 | | | 2 | | | | 2 | | 2 | 3 |
| **WT. AVG** | 3 | 2.33 | 2.5 | 2.5 | | | 2.67 | | 3 | | 2.67 | 2 | 2.33 | 2.67 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.56 |

## LIST OF EXPERIMENTS

1. To determine the coefficient of drag by Stokes' law for spherical bodies.
2. To study the phenomenon of Cavitations in pipe flow.
3. To determine the critical Reynolds number for flow through commercial pipes.
4. To determine the coefficient of discharge for flow over a broad crested weir.
5. To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis, including friction blocks.
6. To study the scouring phenomenon around a bridge pier model
7. To study the scouring phenomenon for flow past a spur.
8. To determine head loss due to various pipe fittings.

| | | | |
|---|---|---|---|
| **Course Title** | **SURVEYING-II LAB** | **Semester -4** | |
| **Course Code** | **26LC-CE- 206-H** | **External marks:** | **20** |
| **Category** | **Laboratory Courses** | **Internal marks:** | **05** |
| **Credits** | **1** | **Total marks:** | **25** |
| **L-T-P** | **0-0-2** | **Duration of Examination:** | **3 Hrs.** |

## Course Objectives

- To study and use of theodolite for angle measurements use tachometer.
- To measure base line measurement.
- To study total station and its use for measuring distance, elevation and coordinates
- To draw simple circular curves and use total station to plot a map.

## Course Outcomes (CO)

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

**CO1:** Use the theodolite for measuring angles and use the tacheometer to determine distance and elevation.

**CO2:** Draw simple circular curves.

**CO3:** Calculate base line measurement and importance of triangulation.

**CO4:** Use a total station to measure distance, elevation and coordinates.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 2 | | | 2 | | | | 2 | 2 | | 2 |
| CO2 | 3 | 3 | | | | | 3 | | | | | | | 3 |
| CO3 | 3 | | | | 2 | | 4 | | | | | | 3 | |
| CO4 | 3 | 2 | | 2 | | | | | | | | | 2 | |
| **WT. AVG** | 3 | 2.3 | | 2 | 2 | | 3 | | | | 2 | 2 | 2.5 | 2.5 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.37 |

## LIST OF EXPERIMENTS

1. Measurement of horizontal and vertical angles using theodolite
2. Measurement of Tachometric constants.
3. Calculating horizontal distance and elevations using tachometer.
4. Base line measurement.
5. Setting out simple circular curves by deflection angle method.
6. Study the various parts of a total station.
7. Measurements of distance, elevation, coordinate with total station.
8. Special problems with total station.

| Course Title | CONCRETE TECHNOLOGY LAB | Semester -4th |
|---|---|---|
| Course Code | 26LC-CE-208-H | External marks: 20 |
| Category | Laboratory Courses | Internal marks: 05 |
| Credits | 1 | Total marks: 25 |
| L-T-P | 0-0-2 | Duration of Examination: 3Hrs. |

## Course Objectives

- To determine the physical and mechanical properties of cement, aggregates, and other engineering materials through standard laboratory tests.
- To evaluate the strength characteristics and performance of construction materials using appropriate testing methods.
- To understand and assess the mechanical behavior of materials under different loading conditions.
- To perform tests for determining material properties such as hardness, strength, and durability, and interpret the results.

## Course Outcomes (CO)

At the end of the course, the students will be able to:

**CO1:** Identify and determine the physical and mechanical properties of common construction materials such as cement, aggregates, concrete, and bricks using standard laboratory procedures.

**CO2:** Conduct laboratory tests on civil engineering materials in accordance with relevant Indian Standards (IS Codes) and interpret the test results.

**CO3:** Analyze test data, prepare laboratory reports, and compare experimental results with specified standards and acceptance criteria.

**CO4:** Analyze test data, prepare laboratory reports, and compare experimental results with specified standards and acceptance criteria.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | 2 | | | 2 | | | | 3 | 3 | | |
| CO2 | 2 | 2 | | | | 2 | 1 | | | | | | | 3 |
| CO3 | 3 | | | 2 | 3 | | | | | | | | 2 | |
| CO4 | | 2 | | 2 | 3 | 2 | | | | | | | 2 | 3 |
| **WT. AVG** | 2.66 | | | 2 | 3 | 2 | 1.5 | | | | 3 | 3 | 2 | 3 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.46 |

## LIST OF EXPERIMENTS

11. Determine the standard consistency of cement using Vicat`s apparatus.

12. Determine the fineness of cement by Sieve analysis.
13. Determine the soundness of cement by Le-Chatelier`s apparatus.
14. Determine the setting time of cement, initial, and final.
15. Determine the specific gravity of cement.
16. Determine the Heat of Hydration of cement.
17. Determine the Chemical Properties of cement.
18. Determine the Compressive strength of cement.
19. Determine the fineness modulus of Coarse and fine aggregates.
20. Determine the Specific gravity, water absorption, and bulking of fine aggregate.

| Course Title | REMOTE SENSING AND GIS | Semester -4 |
|---|---|---|
| Course Code | 26PCC-CE- 214-H | External marks: 50 |
| Category | Professional Core Course | Internal marks: 25 |
| Credits | 3 | Total marks: 75 |
| L-T-P | 2-0-1 | Duration of Examination: 3 Hrs. |

**Note**: Examiner will set 9 questions in all. Q1 is compulsory and of short answer type covering all the four units. Remaining eight questions are to be set by taking two questions from each unit. Each question carries equal marks (10 marks). Examinee has to attempt 5 questions in total selecting at least one from each unit.

## Course Objectives

- To provide a rigorous graduate-level treatment of remote sensing principles and geographic information systems.
- To gain theoretical grounding in electromagnetic radiation, sensor systems, image processing, and spatial analysis, combined with practical skills in industry-standard software.
- Emphasis is placed on research applications, data integration, and the design of geospatial workflows for real-world problems in the environment, urban planning, agriculture, and disaster management.

## Course Outcomes

At the end of the course, the students will be able to

**CO1:** Explain the physical principles of electromagnetic radiation and sensor design across optical, thermal, and microwave spectra.

**CO2:** Apply image preprocessing techniques, including radiometric correction, atmospheric correction, and geometric rectification.

**CO3:** Design and execute spatial analysis workflows in a GIS environment for real-world problem solving.

**CO4:** Critically evaluate peer-reviewed literature and communicate geospatial findings through maps, reports, and presentations.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | 3 | | |
| CO2 | | 2.8 | | 2.9 | | | | | | | | | 3 | |
| CO3 | | | 3 | | 2.9 | | | | | | | | 2.8 | |
| CO4 | 2.8 | | | | 2.7 | | | | | | | | | 3 |
| **WT. AVG** | 2.9 | 2.8 | 3 | 2.9 | 2.8 | | | | | | | 3 | 2.9 | 3 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.9 |

# COURSE CONTENT

## UNIT-I

**Module 1: Introduction**
**Course intro & geospatial data landscape**: History of RS & GIS, data types, coordinate systems, overview of platforms.

**Module 2: Electromagnetic radiation & spectral properties:** EM spectrum, reflectance, emittance, spectral signatures of land covers.

## UNIT-II

**Module 3: Image Pre-processing and classification- radiometric & atmospheric correction**: DN to reflectance, dark object subtraction, FLAASH/ATCOR methods, Land cover classification using supervised methods

**Module 4: GIS fundamentals & spatial data management:** Vector/raster models, geodatabases, projections, topology rules.

## UNIT-III

**Module 5: Spatial analysis: vector & raster operations**: Overlay, buffer, network analysis, terrain analysis (DEM, slope, aspect).

**Module 6: Machine learning in remote sensing:** Random forest, deep learning (CNNs), object-based image analysis (OBIA).

## UNIT-IV

**Module 7: Microwave & thermal remote sensing:** SAR fundamentals, In SAR surface deformation, thermal IR, LST retrieval.

**Module 8: Applications: environment, agriculture & urban:** Crop monitoring, urban heat islands, flood mapping, deforestation detection.

## Suggested Books


- Remote Sensing and Image Interpretation: Lillesand, T. M., Kiefer, R. W., &Chipman, J. W.
- Introduction to Remote Sensing: Campbell, J. B., & Wynne, R. H.
- Remote Sensing Digital Image Analysis: An Introduction: Richards, J. A.
- Geographic Information Science and Systems: Longley, P. A., Goodchild, M. F., Maguire, D. J., &Rhind, D. W.
- Geographic Information Analysis: O'Sullivan, D., & Unwin, D. J.

| Course title | REMOTE SENSING AND GIS LAB | Semester -4 |
|---|---|---|
| Course Code | 26LC-CE- 210-H | External marks: 20 |
| Category | Laboratory Courses | Internal marks: 05 |
| Credits | 1 | Total marks: 25 |
| L-T-P | 0-0-2 | Duration of Examination: 3 Hrs. |

## Course Objectives

- Learning installation and hands on practice GIS software.
- Applying image pre-processing techniques including radiometric correction, atmospheric correction, and geometric rectification.
- To perform image classification and change detection using machine-learning approaches.
- Spatial analysis workflows in a GIS environment for real-world problem solving.

## Course Outcomes

At the end of the course, the students will be able to:

**CO1:** Learning installation and hands on practice GIS software.

**CO2:** Applying image pre-processing techniques including radiometric correction, atmospheric correction, and geometric rectification.

**CO3:** To perform image classification and change detection using machine-learning approaches.

**CO4:** Spatial analysis workflows in a GIS environment for real-world problem solving.

## CO - PO Mapping

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2.6 | | | | | | | | 2.7 | |
| CO2 | | | | | | 2.7 | | | | | | | 2.9 | |
| CO3 | | | | | | | | | | | 2.8 | | | 2.8 |
| CO4 | | | | | | | | | | | 3 | | | 3 |
| **WT. AVG** | | | | | 2.6 | 2.7 | | | | | 2.9 | | 2.8 | 2.9 |
| | | | | | | | | | Overall Mapping of Subject | | | | | 2.8 |

## COURSE CONTENT

1. To setup software; QGIS & Google Earth Engine orientation.
2. Spectral signature analysis in ENVI/QGIS.
3 Exploring Landsat, Sentinel-2, and MODIS archives.
4. Pre-processing Sentinel-2 imagery.
5. Land cover classification using supervised methods.
6. Spatial database design in Post GIS.