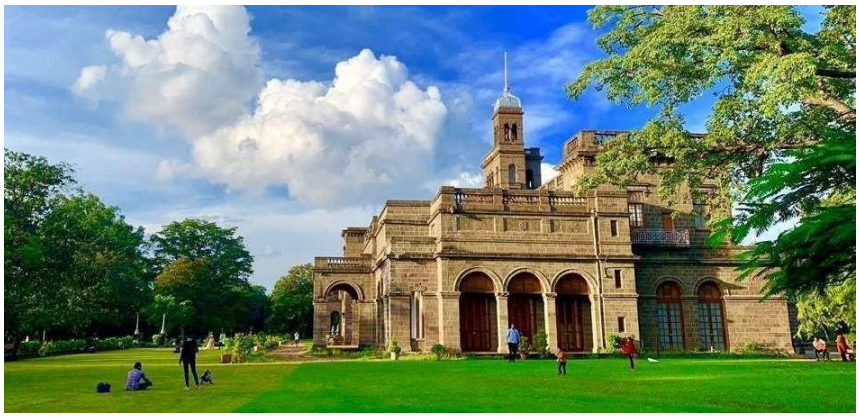
सावित्रीबाई फुले पुणे विद्यापीठ

Savitribai Phule Pune University, Pune, Maharashtra, India

Faculty of Science and Technology



National Education Policy (NEP)-2020 Compliant Curriculum

Second Year Engineering (2024 Pattern)

Civil Engineering

(With effect from Academic Year 2025-26)

CONTENTS

Preface by Board of Studies

Dear Students and Teachers,

We, the members of Board of Studies Civil Engineering, are very happy to present the Second Year Civil Engineering syllabus effective from the Academic Year 2025-26. The present curriculum will be implemented for the Second Year of Civil Engineering from the Academic Year 2025-26. Subsequently this will be carried forward for TE and BE in A.Y. 2026-27, 2027-28, respectively.

Civil Engineering is a dynamic discipline that lies at the intersection of engineering, design and environmental stewardship. It provides the foundation for the planning, design, construction and maintenance of infrastructure systems that support modern society. This curriculum is designed to provide students with a comprehensive understanding of the fundamental principles, theories and practices of Civil Engineering, while also preparing them to address the challenges of an ever-evolving built environment and sustainable development.

The revised syllabus falls in line with the objectives of NEP-2020, Savitribai Phule Pune University(SPPU), AICTE New Delhi, UGC and various accreditation agencies by keeping an eye on the technological developments, innovations and industry requirements. Learners are now getting sufficient time for self-learning either through online courses or additional projects for enhancing their knowledge and skill sets. Learners can be advised to take up online courses, on successful completion they are required to submit certification for the same. This will definitely help learners to facilitate their enhanced learning based on their interest.

This curriculum is the result of extensive consultation with academic experts, industry professionals and alumni to ensure relevance and excellence. It is designed not only to meet the current industry standards but also to prepare students for higher studies and research in the field of Civil Engineering.

We hope that this curriculum will inspire students to become competent professionals, responsible citizens and contributors to the technological advancement of society.

Dr. Sunil B. Thakare
Chairman
Board of Studies, SPPU, Pune

Members, Board of Studies-Civil Engineering	
Dr. Ganesh A. Hinge	Dr. Pratibha M. Alandkar
Dr. Uttam R. Awari	Dr. Jyotiba B. Gurav
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Dr. Wasudev N. Deulkar	Er. Yusuf A. S. Inamdar
Dr. Vinaykumar C. H.	Er. Ramesh D. Raskar

Program Specific Outcomes (PSO's)

PSO 1: Application of Core Civil Engineering Principles

Graduates will be able to apply fundamental concepts of structural analysis, geotechnical engineering, transportation systems, water resources engineering, and environmental engineering to design and develop sustainable and efficient civil infrastructure.

PSO 2: Proficiency in Modern Tools and Techniques

Graduates will be proficient in using modern tools & Software's for planning, analysis, design, and execution of Civil Engineering projects in compliance with safety, environmental, and ethical standards.

PSO 3: Problem Solving and Project Execution Skills

Graduates will demonstrate the ability to identify, analyze, and solve real-world Civil Engineering problems and effectively manage construction projects, incorporating principles of design thinking, innovations, and lifelong learning.

Program Educational Objectives (PEO's)

Program Educational Objectives (PEOs): Program Educational Objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

PEO1 : Core Competency and Professional Excellence

Graduates will establish themselves as successful Civil Engineering professionals by applying their technical knowledge, problem-solving abilities, and ethical values in planning, designing, and executing infrastructure projects that meet societal needs.

PEO2 : Higher Education and Lifelong Learning

Graduates will pursue advanced education, research, or professional development to stay current with emerging trends, technologies, and practices in Civil Engineering and related interdisciplinary fields.

PEO3 : Leadership and Social Responsibility

Graduates will demonstrate leadership, teamwork, effective communication, and a commitment to sustainable development by engaging in projects that contribute to environmental conservation and the betterment of society.

Program Outcomes (PO's)

Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behavior that students acquire through the program. On successful completion of Civil Engineering, graduating students/graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **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.
4. **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.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

General Rules and Guidelines

Course Outcomes (CO): Course Outcomes are narrower statements that describe what students are expected to know and are able to do at the end of each course. These relate to the skills, knowledge and behavior that students acquire in their progress through the course.

Assessment: Assessment is one or more processes, carried out by the institution, that identify, collect and prepare data to evaluate the achievement of Program Educational Objectives and Program Outcomes.

Evaluation: Evaluation is one or more processes, done by the Evaluation Team, for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which Program Educational Objectives or Program Outcomes are being achieved, and results in decisions and actions to improve the program

Guidelines for Examination Scheme

Examination:

The examination consists of two parts, Comprehensive Continuous Evaluation (CCE) and End-Semester Examination (ESE).

Part I : Comprehensive Continuous Evaluation (CCE)

Comprehensive Continuous Evaluation (CCE) of 30 marks based on all units of course, to be scheduled & conducted at institute level. Comprehensive Continuous Evaluation (CCE) consists of parameters & weightage as mentioned below:

Sr. No	Parameters	Marks	Based on	Marking Scheme
1	Unit Test	12 Marks	Units 1 & Unit 2	6 Marks per Unit
2	Assignments / Case Study	12 Marks	Units 3 & Unit 4	6 Marks per Unit
3	Seminar Presentation /Open Book Test/Quiz	06 Marks	Unit 5	6 Marks per Unit

1. Unit Test

Unit Test	**Format:** Questions to be designed as per Bloom's Taxonomy guidelines to assess various cognitive levels (Remember, Understand, Apply, Analyze, Evaluate, Create).
	Implementation: Schedule the test after completing Units 1 and 2. Ensure the question paper is balanced and covers key concepts and applications.
	Evaluation and Feedback: Evaluate promptly and provide constructive feedback on strengths and areas for improvement.
	Sample Question Distribution ➢ **Remembering (2 Marks):** Define key terms related to [Topic from Units 1 and 2]. ➢ **Understanding (2 Marks):** Explain the principle of [Concept] in [Context]. ➢ **Applying (2 Marks):** Demonstrate how [Concept] can be used in [Scenario]. ➢ **Analyzing (3 Marks):** Compare & contrast [Two related concepts] from Units 1 and 2. ➢ **Evaluating (3 Marks):** Evaluate the effectiveness of [Theory / Model] in [Situation].

2. Assignments / Case Study

Assignments / Case Study	**Format:** Problem-solving tasks, theoretical questions, practical exercises, or case studies that require in-depth analysis and application of concepts.
	Implementation: Distribute the assignments or case study after covering Units 3 & 4.
	Provide clear guidelines and a rubric for evaluation.
	Evaluation and Feedback: Assess the quality of submissions based on the provided rubric. Offer feedback to help students understand their performance.

3. Seminar Presentation /Open Book Test/Quiz

Seminar Presentation	**Format:** Presentation on a topic from Unit 5, followed by a Q & A session. **Deliverables:** Presentation slides, a summary report in 2 to 3 pages and performance during the presentation.
	Implementation: Schedule the seminar presentations at the end of the course.
	Provide clear guidelines and a rubric for evaluation.
	Evaluation and Feedback: Evaluate based on content, delivery and engagement during the Q & A session. Provide feedback on presentation skills and comprehension of the topic.
Open Book Test	**Format:** Analytical and application-based questions to assess depth of understanding.
	Implementation: Schedule the open book test at the end of the course, ensuring it covers critical aspects of Unit 5.
	Evaluation and Feedback: Evaluate based on the depth of analysis and application of concepts.
Quiz	**Format:** Quizzes can help your students practice existing knowledge while stimulating interest in learning about new topic in that course. You can set your quizzes to be completed individually or in small groups.
	Implementation: Online tools and software can be used to create quiz. Each quiz is made up of a variety of question types including multiple choice, missing words, true or false etc.
	Evaluation and Feedback: Evaluate promptly and provide constructive feedback on strengths and areas for improvement.

Schedule for conducting CCE

Duration	Deliverable
Week 1-4	Units 1 and 2
Week 5	Unit Test
Week 6-8	Units 3 and 4
Week 9	Assignments / Case Study
Week 10-12	Unit 5
Week 13	Seminar Presentations / Open Book Test / Quiz

Part II: End-Semester Examination (ESE)

End-Semester Examination (ESE) of 70 marks theory examination based on all the unit of course scheduled by the university. Question papers will be sent by the University through QPD (Question Paper Delivery). University will schedule and conduct ESE at the end of the semester.

Format and Implementation

Question Paper Design: Below structure is to be followed to design an End-Semester Examination (ESE) for a theory subject of 70 marks on all 5 units of the syllabus with questions set as per Bloom's Taxonomy guidelines and 14 marks allocated per unit.

Balanced Coverage: Ensure balanced coverage of all units with questions that assess different cognitive levels of Bloom's Taxonomy: Remember, Understand, Apply, Analyze, Evaluate, and Create.

The questions should be structured to cover:

- Remembering: Basic recall of facts and concepts.
- Understanding: Explanation of ideas or concepts.
- Applying: Use of information in new situations.
- Analyzing: Drawing connections among ideas.
- Evaluating: Justifying a decision or course of action.
- Creating: Producing new or original work (if applicable).

Detailed Scheme:

Unit-Wise Allocation (14 Marks per Unit): Each unit will have a combination of questions designed to assess different cognitive levels. By following this scheme, you can ensure a comprehensive and fair assessment of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.

NEP 2020 Compliant Curriculum Structure

Second Year Engineering (SPPU 2024 Pattern)

Civil Engineering

Level 5.0															
Course Code	**Course Type**	**Course Name**	**Teaching Scheme (Hrs./week)**			**Examination Scheme and Marks**					**Credits**			
			Theory	**Tutorial**	**Practical**	**CCE***	**End-Sem**	**Term work**	**Practical**	**Oral**	**Theory**	**Tutorial**	**Practical**	**Total**
Semester I														
PCC-201-CVL	Program Core Course	Mechanics of Structures	3	-	-	30	70	-	-	-	3	-	-	3
PCC-202-CVL	Program Core Course	Surveying	3	-	-	30	70	-	-	-	3	-	-	3
PCC-203-CVL	Program Core Course	Building Construction and Materials	3	-	-	30	70	-	-	-	3	-	-	3
PCC-204-CVL	Program Core Course Lab	Building Construction and Materials Lab	-	-	2	-	-	25	25	-	-	-	1	1
PCC-205-CVL	Program Core Course Lab	Mechanics of Structures Lab	-	-	2	-	-	25	-	25	-	-	1	1
	Open Elective	*Open Elective - I	2	-	-	15	35	-	-	-	2	-	-	2
MDM-230- CVL	Multidisciplinary Minor	Engineering Mathematics -III	3	-	-	30	70	-	-	-	3	-	-	3
EEM-240-CVL	Entrepreneurship / Economics/ Management	Economics for Civil Engineers	1	-	2	-	-	25	-	-	1	-	1	2
VEC-250-CVL	Value Education	Universal Human Values and Professional Ethics	2	-	-	15	35	-	-	-	2	-	-	2
CEF-260-CVL	Field Project	Field Survey Project	-	-	4	-	-	25	50	-	-	-	2	2
Total			**17**	**-**	**10**	**150**	**350**	**100**	**75**	**25**	**17**	**-**	**5**	**22**
			27 Hrs.			**700 Marks**					**22 Credits**			

***Note:** Students can opt for Open Electives offered by different faculty like Arts, Science, Commerce, Management, Humanities or Inter-Disciplinary studies.

- Example – Open Elective I - Financial Accounting, Digital Finance and Digital Marketing can be opted from Commerce and Management faculty.
- Elective II - Project Management, Business Analytical and Financial Management can be opted from Inter-Disciplinary studies, Commerce and Management faculty respectively.

NEP 2020 Compliant Curriculum Structure

Second Year Engineering (SPPU 2024 Pattern)

Civil Engineering

Level 5.0														
Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks					Credits			
			Theory	Tutorial	Practical	CCE*	End-Sem	Term work	Practical	Oral	Theory	Tutorial	Practical	Total
Semester II														
PCC-206-CVL	Program Core Course	Fluid Mechanics	3	-	-	30	70	-	-	-	3	-	-	3
PCC-207-CVL	Program Core Course	Structural Analysis	3	-	-	30	70	-	-	-	3	-	-	3
PCC-208-CVL	Program Core Course	Concrete Technology	3	-	-	30	70	-	-	-	3	-	-	3
PCC-209-CVL	Program Core Course Lab	Concrete Technology Lab	-	-	2	-	-	25	-	25	-	-	1	1
PCC-210-CVL	Program Core Course Lab	Fluid Mechanics Lab	-	-	2	-	-	-	-	25	-	-	1	1
	Open Elective	*Open Elective - II	2	-	-	15	35	-	-	-	2	-	-	2
MDM-231-CVL	Multidisciplinary Minor	Engineering Geology	2	-	-	30	70	-	-	-	2	-	-	2
VSE- 270-CVL	Vocational and Skill Enhancement	Application of Python	-	-	2	-	-	25	-	25	-	-	1	1
AEC-281-CVL	Ability Enhancement	Modern Indian Language (Marathi/Hindi)	-	1	2	-	-	50	-	-	-	1	1	2
EEM-241-CVL	Engineering Economics and Applications	Project Management	1	-	2	-	-	25	-	-	1	-	1	2
VEC-251-CVL	Value Education	Environment Awareness	2	-	-	15	35	-	-	-	2	-	-	2
Total			**16**	**1**	**10**	**150**	**350**	**125**	**-**	**75**	**16**	**1**	**5**	**22**
			27 Hrs.			**700 Marks**					**22 Credits**			

***Note:** Students can opt for Open Electives offered by different faculty like Arts, Science, Commerce, Management, Humanities or Inter-Disciplinary studies.

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SAVITRIBAI PHULE PUNE UNIVERSITY (SPPU),

PUNE, MAHARASHTRA, INDIA

SE - CIVIL ENGINEERING

Semester - I

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-201-CVL

Course Name: Mechanics of Structures

Teaching Scheme	Credit	Examination	
Theory: 3 hours / week	03	CCE ESE	30 marks 70 marks

Perquisites: Engineering Mechanics

Companion Course: Mechanics of Structures Lab

Course Objectives:

1. Analysis of simple and compound stresses and strains, including thermal effects and indeterminate structures.
2. Construction and interpretation of shear force and bending moment diagrams.
3. Understanding bending and shear stresses in beams.
4. Understand the torsional effects in shafts and determination of principal stresses & strains in beams
5. Evaluation of strength of columns under axial loading & Determination of slope and deflection in beams.

Course Outcomes :

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

1. Understand stress-strain behavior, apply Hooke's law, and analyze axial stresses, strains and deformations in structures.
2. Analyze shear force & bending moment under various loading conditions.
3. Analyze bending & shear stresses in beams.
4. Apply torsion theory to circular shafts & determine principal stresses in beams.
5. Analyze axially loaded columns and determine slope and deflection of beams.

COURSE CONTENTS

Unit I	Simple Stresses and Strains	(08 hours)

Simple Stresses & Strains: Concepts, Types, Stress-Strain Diagram (elastic, plastic, brittle materials), Concept of axial stresses (compression, tension), strains (linear, lateral, shear, volumetric), Elastic constants and their relations, Stresses and strains due to change in temperature, Stresses, strains, and deformations in determinate and indeterminate structures for homogeneous and composite sections under concentrated loads and temperature changes.

Unit II	Shear Force and Bending Moment	(08 hours)

Concept of shear force and bending moment, Relationship between shear force, bending moment, and intensity of loading, Shear force and bending moment diagrams for determinate beams under different loadings (concentrated, uniformly distributed, uniformly varying loads, and couples), Point of Contra-

flexure & inflexion.

Unit III	Bending and Shear Stresses in Beams	(08 hours)

Bending Stresses in Beams: Theory of simple bending, assumptions, derivation of flexure formula, Bending stress distribution diagrams and Moment of Resistance of cross-sections

Shear Stresses in Beams: Concept of shear, complementary shear, derivation of shear stress formula, Shear stress distribution for various cross-sections, maximum and average shear stress for circular and rectangular sections.

Unit IV	Torsion, Principal Stresses and Strains	(08 hours)

Torsion of Circular Shafts: Theory of torsion, assumptions, derivation of torsion formula, Stresses, strains and deformations in determinate and indeterminate shafts of solid and hollow sections under twisting moments, Power transmitted by shafts.

Principal Stresses and Strains: Concept of principal planes and principal stresses, Normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses, maximum shear stress.

Unit V	Axially Loaded Columns, Slope and Deflection of Beams	(08 hours)

Axially Loaded Columns: Concept of critical load and buckling, Euler's formula for buckling load with hinged ends, Equivalent length for various end conditions, Rankine's formula, safe load on column, limitations of Euler's formula.

Direct and bending stresses for eccentrically loaded short columns, Structural components under eccentric loading (retaining walls, dams, chimneys), Effect of lateral force and self-weight, resultant stress diagrams for axial loads, uni-axial and bi-axial bending, Concept of core of section for solid and hollow rectangular and circular sections.Slope and deflection of determinate beams by Macaulay's method.

LEARNING RESOURCES

Text Books

1. Mechanics of Structures Vol. I &II by S. B. Junnarkar and Dr. H. J. Shah, Charotar Publishing House Pvt Ltd.
2. Strength of Materials by R. Subramanian, Oxford University Press.
3. Strength of Materials by S. S. Ratan, Tata McGraw Hill.
4. Strength of Materials by B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications.

Reference Books

1. Elements of Strength of Materials by Timoshenko and Young, East-West Press Ltd.
2. Mechanics of Materials by Beer and Johnston, McGraw Hill Publication.
3. Introduction to Mechanics of Solids by E.P. Popov, Prantice Hall Publication.
4. Mechanics of Materials by Gere & Timoshenko, CBC Publisher.
5. Elementary Structural Analysis by Norris, Wilbur and Utku, Tata McGraw Hill Publisher.
6. Intermediate Structural Analysis by R. C. Hibbler, Pearson Education Publishers.

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-202-CVL

Course Name: Surveying

Teaching Scheme	Credit	Examination	
Theory: 3 hours / week	03	CCE ESE	30 marks 70 marks

Perquisites: Basic Introduction to Civil Engineering

Companion Course: Field Survey Project

Course Objectives:

1. To learn the fundamental concepts and instruments used for compass, plane table surveying and leveling.
2. To study concepts of leveling, methods of leveling and contouring.
3. To learn the essentials of theodolite and theodolite traversing.
4. To study tachometry and tachometric contouring.
5. To study various types of curves and methods of setting out of curves.
6. To study modern instruments like EDM and total station.

Course Outcomes: On completion of the course, learner will be able to:

1. Understand the concept of linear & angular measurements.
2. Demonstrate the knowledge of leveling for determination of reduced levels of various points on the earth surface.
3. Demonstrate the use of theodolite for the measurement of horizontal and vertical angles.
4. Apply the knowledge of tacheometric method of surveying for the preparation of contour map of a given area by conducting tacheometric survey.
5. Apply various methods of curve setting for setting out the horizontal & vertical curves for highway or railway alignment.

COURSE CONTENTS

Unit I	Distance Measurements and Angle Measurement	(08 hours)

Introduction, definition, object of survey, primary division of surveying, classification of surveys, uses of surveys, principles of surveying, units of measurement (linear and angular measure), scale and R.F. Introduction to instruments required for measuring distance and marking of stations. Direct ranging. Survey stations, selection of stations, base line, check line, tie line and offsets. Booking field notes, field work: equipment, reconnaissance, and reference sketches.

Introduction of modern instruments and techniques used in surveying such as drone surveying, laser scanners, space based position survey (SBPS) etc.

Compass traversing: introduction, open traverse, closed traverse, the prismatic compass, methods of using prismatic compass, bearing of lines, meridians: true, magnetic, arbitrary and grid, designation of bearings: whole circle bearing (WCB) and quadrantal or reduced bearing (RB) system, concept of fore and back

bearings, local attraction, dip of the needle, magnetic declination.

Plane table surveying: introduction, list of accessories, orientation, setting up of plane table, methods of plane tabling: radiation, intersection, traversing and resection. Advantages and disadvantages of plane tabling.

Introduction to DGPS equipment and its application.

Unit II	Levelling	(08 hours)

Object and use of levelling, definitions of terms used in levelling, different types of levels: dumpy level, auto level, and digital level, laser level. Levelling staff. Temporary adjustment of level, types of levelling operations; simple levelling, differential levelling, fly levelling, longitudinal profile levelling, cross-sectional levelling, checks in levelling. Curvature and refraction correction. Reciprocal levelling. Methods of calculation of reduced level: the collimation system and rise and fall system. Permanent adjustment of level: two peg test only.

Unit III	Theodolite Traversing	(08 hours)

Study of 20" vernier transit theodolite, definitions of terms, fundamental lines (axes) of theodolite, conditions of adjustments, temporary adjustments of theodolite, measurement of horizontal angle by repetition and reiteration method. Measurement of vertical angle. Concept of direct angles, deflection angles. Setting out an angle, prolonging a line. Computation of latitude and departure. Balancing of traverse: omitted measurements.

Unit IV	Tacheometry Survey and Total Station Survey	(08 hours)

Tachometry: introduction, instruments used in tacheometry, principle of tachometry, theory of stadia tacheometry, determination of tacheometric constants. Methods of tacheometry: fixed hair method- when line of sight is horizontal or inclined and staff is held vertically. Numerical. Contouring: definition of contours, uses of contour maps, characteristics of contours, methods of contouring, and interpolation of contours. Tachometric contour survey. Total station survey: introduction, parts of a total station, methods of observation: radiation method, resection method, Remote Distance Measurement (RDM), Remote Elevation Measurement (REM) Advancement in Total Station: Robotic Total station (RTS), Prism less or Laser based Total Station, Smart Stations, Applications of Total Station.

Introduction to Drone Survey and its applications.

Unit V	Curves	(08 hours)

Introduction, different forms of curves. Definitions and explanation of different terms: degree of curve, relation between radius and degree of curve, super elevation, centrifugal ratio. Types of horizontal curves. Notations used with circular curves. Properties of a simple circular curve. Horizontal curve setting by- a) offsets from chord produced and b) Rankine's method of deflection angles. Field procedure for setting out the curve (by deflection angle) by one and two theodolite methods. Compound curve- calculation of data and setting out in the field. Transition curves: objectives of providing transition curves, requirement of ideal transition curve. Notations used with combined curves. Vertical curves: definition, gradient, rate of change of grade, length of vertical curve, types of vertical curves.

LEARNING RESOURCES

Text Books

1. Surveying and Levelling, R. Subramanian, Oxford Publication.
2. Surveying Vol. I, Dr. B. C. Punmia, Ashok K. Jain, Arun K. Jain, Laxmi Publication.
3. Surveying, Vol. I, S. K. Duggal, Tata Mc-Graw Hill.
4. Surveying and Levelling, Vol. I and Vol. II, T. P. Kanetkar and S. V. Kulkarni, Pune Vidyarthi Griha Prakashan.
5. Plane Surveying & Higher Surveying, Dr. A. M. Chandra, New Age International Publishers New Delhi.

Reference Books

1. Plane surveying, A. M. Chandra, New Age International Publishers New Delhi.
2. Surveying and Levelling, N. N. Basak, Tata Mc-Graw Hill.
3. Surveying Vol. I, Dr. K. R. Arora, Standard Book House.

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-203-CVL

Course Name: Building Construction and Materials

Teaching Scheme	Credit	Examination	
Theory: 3 hours / week	03	CCE ESE	30 marks 70 marks

Perquisites: Basic & Engineering Science Course

Companion Course: Building Construction and Materials Lab

Course Objectives:

1. To understand fundamental concepts of building construction technology.
2. To study building components, traditional and modern construction techniques.
3. To study different conventional building materials with an emphasis on sustainability.
4. To study green building planning and sustainable materials.
5. To learn building bye-laws, regulations and drawing norms, standards with respect to UDCPR, Maharashtra State.

Course Outcomes :

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

1. Understand Building Construction Technology – Demonstrate knowledge of fundamental building construction concepts, including structural and non-structural components.
2. Explain Conventional Building Materials techniques.
3. Summarize Modern Construction Techniques.
4. Apply Green Building Concepts – Integrate principles of green building planning and sustainable materials into construction projects.
5. Describe Building Bye-laws & Regulations – Interpret and apply building bye-laws, regulations, and drawing standards, particularly in line with UDCPR, Maharashtra State.

COURSE CONTENTS

Unit I	Introduction to Building Technology	(08 hours)

Definition and scope of building technology, fundamentals of building construction, classification of buildings as per NBC (National Building Code).Type of structures: load bearing & framed structures and their requirements, type of loads and their effects. Building components and their functions:

a. foundation, types of foundations and their suitability,
b. wall construction techniques: masonry,
c. framed structures components: footing, column, beam, lintels, arches, slabs, precast panels,
d. flooring and roofing: types and methods,
e. openings: doors and windows with types and installation.

Unit II	Conventional Building Materials and Techniques	(08 hours)

Conventional Building Materials- Properties, Types and Uses -Stone, Brick, Cement, Concrete, Concrete Blocks, Flooring Materials-Tiles, Roofing Materials, Mortars and Plasters, Admixtures, Pigments, Timber-types, Products and its Applications in construction, Steel and Aluminum as Structural Materials, Plumbing Materials, Sanitary Wares, Electrical Materials and Appliances, Finishing Materials-Paints, Varnishes, Coatings, Claddings.

Conventional Building Techniques- Load-Bearing Construction, Brick Masonry Construction, Stone Masonry Construction, Timber Construction, Bamboo Construction, Mud and Clay Construction, Lime Plaster and Mortar Construction, Thatch and Bamboo Roofing. Types and Purpose of Formwork and Scaffolding, Construction Site Safety Practices.

Unit III	Modern Construction Techniques	(08 hours)

Modern Construction Process and Stages-Reinforced Cement Concrete (RCC) Construction, Concrete Frame Construction, Prefabrication Construction e.g. Airports, Seaports, Steel Frame Construction, Modular Construction, 3D printing in buildings, Dry Construction Techniques for Sustainability, Automation in the Construction Sector, its Applications and Case Studies.

Unit IV	Green Building planning and Sustainable Materials	(08 hours)

Concept of Green Buildings and Green Ratings (LEED, GRIHA, IGBC), Green Construction-Concept of Green Roof, Importance of Sustainability in Construction, Passive Solar Design and Bioclimatic Architecture, Thermal Insulation. Eco-friendly Materials: Bamboo, Recycled Aggregates, Fly Ash Bricks, AAC Blocks, Green Concrete and Geopolymer Concrete, Use of Industrial and Agricultural Waste Materials, Energy-Efficient Building Materials, Energy Efficiency-Policies of Solar PV in Smart Domains (RPO, REC, Carbon Credit).

Unit V	Building Bye-Laws and Drawings	(08 hours)

Necessity of Bye-Laws, UDCPR (Unified Development Control and Promotion Regulations for Maharashtra State)-Plot Sizes, Road Width, Open Spaces, Marginal Distances, Building Line, Control Line, Room Sizes, Area Calculations-Built-up Area, Carpet Area, Floor Space Index (F.S.I.), Transfer Development Rights (TDR), Norms for Ventilation, Lighting, Vertical Circulation, Sanitation, Parking Spaces of Vehicles, Land Use Planning (Utilization of Space, Zoning).

Introduction of building drawing: Principles of Building Planning and Principles of Architectural Design-Function, Utility, Aesthetics, Selection of Scales for various Drawings, Dimensioning, Abbreviations and Symbols as per IS 962. Norms and Standards of Residential Building and Public Building, Planning Strategy includes Line Plan, Detailed Plan, Elevation, and Section (Teach Students to Draw Residential and Public Building Drawings).

LEARNING RESOURCES

Text Books

1. Building Construction – B.C. Punmia, Ashok Kumar Jain.
2. Building Materials by S.V.Deodhar, Khanna Publication.

3. Building Drawing with an Integrated Approach to Build Environment Sixth Edition (English, Paperback, S Y Patki, M G Shah, C M Kale).

Reference Books

1. Building Materials – S.K. Duggal.
2. Construction Materials & Their Applications – Rangwala.
3. Sustainable Building Materials – J. Khatib.
4. Handbook on Green Building Design & Construction – Charles Kibert.
5. National Building Code (Latest Edition).
6. UDCPR Updated To 30.1.2024.
7. Model Building Bye-Laws 2016.

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-204-CVL

Course Name: Building Construction and Materials Lab

Teaching Scheme	**Credit**	**Examination**	
Practical: 2 hours / week	01	TW PR	25 marks 25 marks

List of Laboratory Assignments

1. Students shall prepare drawings of at least four types of masonry.
2. Students shall prepare drawings of at least two types of lintels or arches.
3. Draw sketches using computer software at least two types of doors.
4. Draw sketches using computer software at least two types of windows.
5. Floor Plan/ Typical floor plan with construction notes, schedule of openings, of any type of building, Plan, Elevation and Section (Full Imperial sheet)
6. Develop typical floor plan drawing exercise as completed in assignment number 5 using computer software and Printout of the same.
7. Site Visit : Any on-going Construction Site (visit report should contain: details of the project, stage of construction, sketches of components with cross section & dimensions, materials used and site plan, etc.)

OR

Site Visit: Green Building, Salient features like materials used/technology etc, benefits, planning concepts of Green Building (site selection, orientation, sun path and wind diagram etc.)

8. Collection of advertisements of modern construction materials and tools used in construction and prepare report on the same.

Note: These are the following computer software list which can be used for assignments no. 3,4 and 6 LibreCAD, FreeCAD, SketchUp or AutoCAD.

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-205-CVL

Course Name: Mechanics of Structures Lab

Teaching Scheme	Credit	Examination	
Practical: 2 hours / week	01	TW OR	25 marks 25 marks

LIST OF PRACTICALS

List of term work consisting of following

A. Lab Work (Any eight)

1. Tension test on Mild and TMT steel.
2. Tension test on Polymer Bar / FRP Rebar Material.
3. Shear (Single & Double) test on mild steel.
4. Torsion test on mild steel.
5. Impact (Izod & Charpy) test on mild steel, aluminum, brass.
6. Compression test on timber (parallel & perpendicular to grains).
7. Bending test on timber and MS Plate.
8. Abrasion test of flooring tiles.
9. Compressive strength test on bricks/ aerated / AAC blocks.
10. Flexural strength of flooring tiles.

B. Assignment Work

1. One assignment on each unit.
2. Market survey of structural materials including its costing.

C. Computational Work

The above assignments to be solved using computational methods.

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: EEM-240-CVL

Course Name: Economics for Civil Engineers

Teaching Scheme	Credit	Examination	
Theory: 1 hours / week Practical: 2 hours / week	02	TW	25 Marks

Perquisites: Civil engineering fundamentals, economics, financial principles and contract management

Companion Course: if any

Course Objectives:

1. To provide students with a comprehensive understanding of economic principles and financial management in the context of civil engineering projects.
2. To equip students with the skills necessary to analyze, evaluate and make decisions regarding the financial aspects of construction projects.

Course Outcomes:

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

1. Understand the fundamental economic principles and their application in the construction industry.
2. Analyze the financial aspects of construction projects using financial statements and key metrics.
3. Evaluate the feasibility of construction projects by applying costing concepts and techniques.
4. Apply economic decision-making tools, such as capital budgeting techniques, to assess construction projects and understand the importance of taxation.

COURSE CONTENTS

Unit I	Fundamentals of Construction Economics	(03 hours)

Introduction to Construction Economics, Scope and importance of economics in construction, Developed and Developing Economies. New Economic Policy, Basic economic principles -supply, demand, equilibrium, Economic cycles and their impact on the construction industry, Market Structure & Pricing Mechanisms, Cost-price relationships in construction projects, Macroeconomic and microeconomics, Factors Affecting Construction, Government regulations and policies on construction economics, Sustainability and Green Economics in Construction.

Unit II	Financial Management in Construction	(03 hours)

Basic concept of finance in the construction sector, Structure of Indian Financial System. Long Term and short term sources of finance, financial market and sources of finance to construction project, Goal of financial management in construction, Financial Statements: Balance Sheet, Profit & Loss Statement, Break-Even Analysis, Cash Flow Statement. Financial institutions in India, Housing finance institutions and their role in development of the construction sector, Earnings Before Interest and Taxes (EBIT)- concept and use in the construction sector, Simple Numerical on calculation of EBIT and leverage ratio.

Unit III	Contract Costing	(03 hours)
Contract-definition, types of Civil Engineering contract, Cost Concepts in Construction, Types of costs - fixed, variable, direct, indirect, Segregation of cost into fixed and variable cost, Balance Depreciation-definition, types and simple numerical of calculation of depreciation. Public Sector Economics & Infrastructure Development-Public Private Partnership, Infrastructure Financing & budgeting. Escalation clause with case study.		
Unit IV	**Capital Budgeting and Taxation**	**(03 hours)**
Budget, types of budgets in construction, preparation of budget for construction company, time value of money concept, Interest rate and their types, simple numerical on calculation of interest rates, Working capital-definition and types, essential of working capital, Numerical of working capital estimation. Project Appraisal & its types. Capital Budgeting Techniques. Tax-Definition and Necessity of tax in construction development, Structure of Indian Taxation System, Types of tax-direct, indirect, Difference between VAT and GST, advantages and disadvantages of GST, Property tax- Types, calculation of property tax.		

Assignments for Term work Assessment

1. Report on risk assessment and mitigation in a civil engineering case (e.g., dam or flyover)
2. Conduct a lifecycle cost analysis for a building project with sustainable alternatives
3. Prepare a detailed cost estimate for a small civil project (e.g., road paving or culvert construction)
4. Compare two project alternatives using NPV and IRR methods
5. Case study: Analyze the economic feasibility of a small-scale infrastructure project (e.g., Community Bridge or water supply system).
6. Write a brief report on case : Delayed residential project penalized under RERA.
7. Report on Real-world case study of project failures due to poor economic planning.

LEARNING RESOURCES

Text Books

1. Engineering Economics Management, Dr. Vilas Kulkarni and Hardik Bavishi, S. Chand Publication
2. Laws for Engineers, Vandana Bhatt and Pinky Vyas, Pro Care Publisher
3. Indian Economy, Gaurav Datt and Ashwani Mahajan, S. Chand Publication
4. Industrial Organization & Engineering Economics, T. R. Banga and S. C. Sharma, Khanna Publisher
5. Engineering Economics – R. Panneerselvam – PHI learning Pvt. Ltd.

Reference Books

1. Engineering Economy, Theusen G. J. and Fabrycky W. J., 9th Edition, Prentice-Hall, Inc., New Delhi
2. Finance for Engineers: Evaluation and Funding of Capital Projects, Crundwell F. K., Springer, London.
3. Construction Project Management: Theory and practice, Jha K.N., 2nd Edition, Pearson India Education Services Pvt. Ltd.
4. Financial Management, Khan and Jain, Tata McGraw-Hill Education
5. Construction Management and Accounts, Singh H, Tata McGraw Hill, New Delhi.
6. Engineering Economy, Leland T. Blank and. Anthony Tarquin, McGraw Hill

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: VEC 250 CVL

Course Name: Universal Human Values and Professional Ethics

Teaching Scheme	Credit	Examination	
Theory : 02 Hours/Week	02	CCE ESE	15 marks 35 marks

Perquisites, if any: Student Induction Program (SIP)

Companion Course, if any

Course Objectives:

The course aims to:

1. To help the students develop a holistic, humane world-vision, and appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity
2. To elaborate on 'Self-exploration' as the process for Value Education
3. To facilitate the understanding of harmony at various levels starting from self and going towards family and society.
4. To elaborate on the salient aspects of harmony in nature and the entire existence
5. To explain how the Right understanding forms the basis of Universal human values and definitiveness of Ethical human conduct.
6. To provide the vision for a holistic way of living and facilitate transition from chaotic life to an orderly life.

Course Outcomes:

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

1. Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.
2. Explore the human being as the coexistence of self and body to see their real needs / basic aspirations clearly.
3. Explain the relationship between one self and the other self as the essential part of relationship and harmony in the family.
4. Interpret the interconnectedness, harmony and mutual fulfilment inherent in nature and the entire existence.
5. Draw ethical conclusions in the light of Right understanding facilitating the development of holistic technologies production systems and management models.

COURSE CONTENTS

Unit I	Introduction to Value Education	(06 hours)

(i) Understanding Value Education
(ii) Self-exploration as the Process for Value Education
(iii) Continuous Happiness and Prosperity - the Basic Human Aspirations and their Fulfilment
(iv) Right Understanding, Relationship and Physical Facility
(v) Happiness and Prosperity - Current Scenario
(vi) Method to Fulfil the Basic Human Aspirations

Unit II	Harmony in the Human Being	(06 hours)

(i) Understanding Human being as the Co-existence of the Self and the Body

(ii) Distinguishing between the Needs of the Self and the Body

(iii) The Body as an Instrument of the Self

(iv) Understanding Harmony in the Self

(v) Harmony of the Self with the Body

(vi) Programme to Ensure self-regulation and Health

Unit III	Harmony in the Family and Society	(06 hours)

(i) Harmony in the Family - the Basic Unit of Human Interaction "Trust' - the Foundational Value in Relationship

(ii) 'Respect' - as the Right Evaluation

(iii) Values in Human-to-Human Relationship

(iv) Understanding Harmony in the Society

(v) Vision for the Universal Human Order

Unit IV	Harmony in the Nature	(06 hours)

(i) Understanding Harmony in the Nature

(ii) Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

(iii) Realizing Existence as Co-existence at All Levels

(iv) The Holistic Perception of Harmony in Existence

(v) Professional Ethics in the light of Right Understanding

(vi) Strategies for Transition towards Value-based Life and Profession

LEARNING RESOURCES

Text Books

1. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81-957703-6-6 (e-book)
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)

Reference Books

1. P. L. Dhar, R. R. Gaur, 1990, Science and Humanism, Commonwealth Publishers.
2. A. Nagaraj, 1999, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak
3. B. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
4. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
5. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

6. B. L. Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
7. M. Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics and Human Values, East- ern Economy Edition, Prentice Hall of India Ltd.
8. M. K. Gandhi, “The Story of my Experiments with Truth”, Discovery Publisher

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: FP-260-CVL

Course Name: Field Survey Project

Teaching Scheme	Credit	Examination	
Practical: 4 hours / week	02	TW PR	25 marks 50 marks

List of Practical for Field Survey Project

Field project 1: a) Measurement of magnetic bearings of sides of a polygon, using prismatic compass and calculations of correction for local attraction and true bearings. b) Determination of elevation difference between any two points in an area using Auto level by taking at least three change points. c) Determination of distance between two points by Radiation & Intersection method of plane table survey.
Field project 2: Measurement of horizontal and vertical angle, horizontal, vertical and Sloping distance, percentage Gradient using Total Station.
Field project 3: Finding horizontal distance and elevation using a Tachometric method and determination of height of the building using Total Station.(Use Remote Elevation Measurement (REM) function).
Field project 4: Determination of horizontal distance and difference in elevation between two consecutive points using Total Station (Use Remote Distance Measurement (RDM) function) and Line out of building using Total Station.
Field project 5: Conduct a topographic survey using DGPS Equipment to determine the coordinates, elevation and features of a given site.
Field project 6: Road project using Auto level for minimum length of 200 mts including fixing of alignment, profile leveling, cross-sectioning, plotting of Longitudinal section and Cross Section. (One full imperial sheet including plan, Longitudinal section and any three typical Cross-sections).
Field project 7: Tacheometric contouring project on hilly area with at least two instrument stations about 60 m to 100 m apart and generating contours using both methods, manual as well as using any suitable software such as Autodesk land desktop, Auto-civil, Foresight etc. (minimum contour interval 1 meter). (Use Drone/Total Station for linear and angular observations).

Proposed Equipment for Course Content

Sr. No.	Topic	Course Content	Proposed Equipment
1.	Introduction and type of Leveling	1. Study of Auto level and Digital level in construction industry. 2. Establishing the Benchmark using Back sight & Foresight. 3. Performing Line leveling. 4. Calculating cut & fill with respect to known TBM.	Auto Level Digital Level

		5. Storing the digital data of measured levels and process, analyze and adjust the level error in Digital level	
2.	Theodolite Surveying and Introduction to Geodetic survey	It should be replaced or addition with new technology of "Electronic Total Station (ETS)" 1. Establishing the coordinate system and measure the X,Y,Z of area with ETS 2. Study of various station set up methods, Surveying, Layout and other land/topographic surveying applications 3. Perform the traverse and adjustment done with Transit & Compass rule 4. Understand the measurement using IR or Prism mode and RL/DR or Reflector less mode 5. Transferring the data from field to office in CSV, XML, DXF etc. formats and work in AutoCAD or any Civil 3D software	Total Station / Leica Total Station
3.	Modern Surveying technique using GNSS	Use of Global Navigation Satellite System of Dual frequency receiver to survey in geodetic coordinate system 1. Perform the Real Time Kinematics survey using well established CORS network in Maharashtra 2. Measure the points and get the data in Latitude/Longitude and East/North 3. Establish and fix the boundary survey, Topographic survey, As-built survey, Layout and other surveying related programs using GNSS receiver 4. Transferring the data in CSV, DXF, XML, KML and other user defined data formats.	GNSS receiver / Leica GNSS receiver
4.	Modern Surveying technique for topographic survey using DGPS Equipment.	Conduct a topographic survey using DGPS Equipment to determine the coordinates, elevation and features of a given site.	DGPS Equipment

SAVITRIBAI PHULE PUNE UNIVERSITY (SPPU) ,

PUNE, MAHARASHTRA, INDIA

SE- Civil Engineering

Semester - II

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-206-CVL

Course: Fluid Mechanics

Teaching Scheme	Credit	Examination	
Theory: 3 hours / week	03	CCE ESE	30 marks 70 marks

Perquisites: Engineering Mathematics and Engineering Mechanics

Companion Course: Fluid mechanics Lab

Course Objectives:

1. To study fluid properties, fluid statics.
2. To study fluid kinematics.
3. To study & apply fluid dynamics equations.
4. To calculate different types of losses in pipes.
5. To study open channel flow with reference to energy-depth relationship and uniform flow.

Course Outcomes

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

1. Understand fluid properties and concepts of fluid statics and solve problems based on practical applications.
2. Understand fundamentals of fluid kinematics and apply it to solve fluid flow problems.
3. Solve fluid flow problems using Bernoulli's equation.
4. Calculate major and minor losses in the pipe network.
5. Apply the knowledge of uniform flow and depth-energy to solve problems on open channel flow.

COURSE CONTENTS

Unit I	Properties of Fluids and Fluid Statics	(08 hours)

Properties of fluids: basic definitions - fluid, fluid mechanics, ideal fluids, real fluids, mass density, specific weight, specific volume, specific gravity; viscosity- dynamic and kinematic, classification of fluids based on newton's law of viscosity (rheological diagram), surface tension, capillarity, vapour pressure, compressibility and elasticity.

Fluid statics: pressure and its measurement, fluid pressure at a point, pascal's law, hydrostatic law; concept of atmospheric, absolute, gauge and negative pressure; pressure measuring devices. Total pressure, intensity of pressure, center of pressure. Pressure on horizontal, vertical, inclined and curved surfaces.

Unit II	Fluid Kinematics	(08 hours)

Eulerian and Lagrangian approach, velocity and acceleration, and their components in Cartesian co-ordinates, Classification of flows, streamline, stream tube, path line, streak line, control volume. Equation of continuity for 3-D flow in Cartesian coordinates, components of rotation, velocity potential, stream function, flow net and it's use.

Unit III	Fluid Dynamics	(08 hours)
Forces acting on fluid mass in motion, Euler's equation of motion along a streamline and its integration to get Bernoulli's equation and its limitations, Modified Bernoulli's equation, concept of HGL and TEL, Application of Bernoulli's equation: Venturimeter, Orifice meter, Rota-meter and Pitot tube.		
Unit IV	**Flow Through Pipes**	**(08 hours)**
Characteristics of laminar flow, laminar flow through a circular pipe: Hagen Poiseuille equation, Hazen-Williams formula. Characteristics of turbulent flow, Darcy-Weisbach Equation, Moody's diagram, Major and minor losses of energy in pipes, flow through pipes in simple and compound pipe,pipes in series, parallel,Dupit's equation, Introduction to pipe network and design: Hardy cross method.		
Unit V	**Open Channel Flow**	**(08 hours)**
Introduction to Open channel flow: Classification of channels, channel flows and geometric elements of channel, Velocity distribution in open channel flow and hydraulic jump. Uniform flow in open channels: Uniform flow formulae: Chezy's and Manning's formulae; Factors affecting Manning's roughness coefficient. Most efficient channel sections: rectangular, trapezoidal. Depth-Energy Relationships in Open Channel Flow: Specific energy and Specific force diagram, Depth discharge Diagram, Critical depth, Conditions for occurrence of critical flow; Froude's number, flow classification based on it, Introduction to channel transition.		

LEARNING RESOURCES

Text Books

1. A Text Book on Fluid Mechanics and Hydraulic Machines by Dr. R. K. Bansal Pub: Laxmi Publications (P),Ltd. New Delhi
2. A Text Book of Fluid Mechanics and Hydraulic Machines- by Dr. R K Rajput Pub: S Chand and Co Ltd. New Delhi
3. A Text Book on Fluid Mechanics and Hydraulic Machines by Sukumar Pati Pub: McGraw Hill, New Delhi

Reference Books

1. Hydraulics and Fluid Mechanics including Hydraulic Machine by Dr P. N. Modi & S. M. Seth Pub: Standard book house, Delhi
2. Flow in Open Channels by K Subramanya, Tata McGraw Hill, New Delhi
3. Engineering Fluid Mechanics by R. J. Garde and A. J. Mirajgaonkar, SCITECH Publications(India)Pvt. Ltd, Chennai
4. Fluid Mechanics and its Applications, Vijay Gupta, Santosh K Gupta, New Age international pvt. Ltd, New Delhi,
5. Fluid Mechanics, Fundamentals and applications by Yunus. A Cengel and John. M Cimbala, Mc Graw Hill International, New Delhi.
6. Fluid Mechanics by Streeter, Wylie and Bedford , McGraw Hill International, New Delhi.
7. Open Channel Hydraulics by Ven Tee Chow,McGraw- Hill Book Company- Koga.

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-207-CVL

Course: Structural Analysis

Teaching Scheme	Credit	Examination	
Theory: 3 hours / week	03	CCE ESE	30 marks 70 marks

Perquisites, if any: Fundamentals Mathematics , Engineering Mechanics and Mechanics of Structures

Companion Course, if any

Course Objectives:

1. This course aims to develop a solid understanding of the fundamental concepts of structural forms and indeterminacy, enabling students to classify structures and determine their degrees of freedom.
2. It introduces the analysis of statically indeterminate beams, frames, and trusses using methods such as consistent deformation and unit load method, considering various effects like external loads, support settlements, temperature changes, and fabrication errors.
3. The course covers approximate methods for analyzing multi-storey , two-bay rigid frames using Cantilever and Portal methods.
4. This will explore classical techniques such as the slope-deflection method and moment distribution method for analyzing indeterminate beams and frames, including sway and non-sway conditions.
5. This will introduce matrix-based analysis using the stiffness method, focusing on structural and member approaches for analyzing beams and rigid frames with limited degrees of indeterminacy.

Course Outcomes

Upon successful completion of this course, students will be able to:

1. Classify different types of structures and determine static and kinematic indeterminacy of beams, frames, and trusses.
2. Analyze statically indeterminate beams, frames, and trusses using the consistent deformation method and unit load method for various loading and support conditions.
3. Apply approximate methods such as Cantilever and Portal methods to analyze multi-storey, two-bay rigid frames.
4. Apply slope-deflection and moment distribution methods to analyze indeterminate beams and rigid jointed frames, including both sway and non-sway conditions.
5. Apply the stiffness method (structure approach) to analyze beams and rigid frames using matrix formulation for systems with up to three degrees of indeterminacy.

COURSE CONTENTS

Unit I	Fundamentals of Structure and Analysis of Redundant Beams	(08 hours)

Types and classification of structures based on structural forms, concept of indeterminacy: static and kinematic indeterminacy.

Analysis of propped cantilever, fixed beam and continuous beams within determinacy up to second degree by consistent deformation method.

Unit II	Analysis of Redundant Frames	(08 hours)
Analysis of redundant trusses by unit load method for external loading ,lack of fit, sinking of support and temperature changes (indeterminacy up to second degree). Approximate methods of analysis of upto two-storied two-bay, 2-D rigid jointed frames by Cantilever and Portal method.		
Unit III	**Slope-Deflection Method**	**(08 hours)**
Slope-deflection equations, equilibrium equation of slope-deflection method, application of slope deflection method to beams with and without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, shear force and bending moment diagram. Sway analysis of rigid jointed portal frames (Involving not more than three unknowns).		
Unit IV	**Moment Distribution Method**	**(08 hours)**
Stiffness factor, carry over factor, distribution factor, application of moment distribution method to beams with and without joint translation and yielding of support. Application to non- sway rigid jointed rectangular portal frames, shear force and bending moment diagram. Sway analysis of rigid jointed portal frames (Involving not more than three unknowns).		
Unit V	**Stiffness Method**	**(08 hours)**
Fundamental concepts of matrix methods: flexibility and stiffness. Stiffness method of analysis: Structure approach & Member approach. Application to beams by structure approach (Involving not more than three unknowns). Application to rigid jointed portal frames by structure approach (Involving not more than three unknowns).		

LEARNING RESOURCES

Text Books

1. Theory of Structures by S.Ramamrutham and R.Narayan, Dhanpat Rai Publishing Company (P) Ltd.
2. Structural Analysis-I & II by S. S. Bhavikatti, Vikas Publishing House Pvt. Ltd.
3. Mechanics of Structures Vol. II (Theory and AnalysisofStructures) by Dr. H. J. Shahand S.B.Junnarkar Charotar Publishing House Pvt .Ltd.
4. Structural Analysis: A Matrix Approach by G.S.Pandit and S.P.Gupta, Tata McGraw Hill Education Pvt. Limited.

Reference Books

1. Intermediate Structural Analysis by C.K.Wang,Tata McGraw Hill Education Pvt.Ltd.
2. Basic Structural Analysis by C.S.Reddy,Tata McGraw Hill EducationPvt.Ltd.
3. Structural Analysis by R.C.Hibbler ,Pearson Education.
4. Structural Analysis by Aslam Kassimali, Cengage Learning India Private Limited
5. Matrix Analysis of Framed Structures by William Weaver Jr. and James M.Gere, Springer

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-208-CVL

Course: Concrete Technology

Teaching Scheme	Credit	Examination	
Theory: 3 hours / week	03	CCE ESE	30 marks 70 marks

Perquisites: Engineering Chemistry

Companion Course: Concrete Technology Lab

Course Objectives

To introduce students to the fundamental concepts of concrete technology, including the properties of constituent materials, behavior of fresh and hardened concrete, and concrete mix design. The course also aims to develop understanding of durability concerns, deterioration mechanisms, and modern concrete types, thereby enabling students to apply this knowledge in construction practices and future professional roles.

Course Outcomes

1. Describe the composition, properties, and functions of various ingredients of concrete.
2. Understand standard tests on fresh and hardened concrete and interpret results related to workability, strength, and durability.
3. Design concrete mixes using IS 10262 for various applications, including performance based requirements.
4. Analyze durability concerns in concrete and recommend suitable preventive or mitigation measures.
5. Compare and evaluate advanced concrete, sustainable materials, and smart technologies for modern construction.

COURSE CONTENTS

Unit I	Fundamentals of Concrete Technology	(06 hours)

Introduction to concrete and its importance. Cement: Raw materials, manufacturing, composition, types, hydration, and properties. Aggregates: Types, properties, quality control, and recycled aggregates. Water: Quality requirements and its role. Admixtures: Types, functions, and modern admixtures. Fibers: Types, and functions.

Unit II	Properties of Fresh and Hardened Concrete	(06 hours)

Workability and factors affecting workability. Tests on fresh concrete: Slump, compaction factor, Vee-Bee, flow table test. Setting time and bleeding of concrete. Strength development: Compressive, tensile, flexural strength. Factors affecting strength and durability. Microstructure of hardened concrete. Permeability of concrete. Non-destructive testing of concrete: Rebound hammer, ultrasonic pulse velocity, penetration resistance, pull-out test.

Unit III	Concrete Mix Design	(06 hours)
Principles of mix design. Design mix, nominal mix, methods of concrete mix design. Batching, mixing, transportation, placement, compaction, curing. IS 10262 method of concrete mix design. Case studies of concrete failure due to improper mix design. Introduction and mix design of High Strength Concrete, Ultra High Performance concrete (UHPC)		
Unit IV	**Durability and Sustainability of Concrete**	**(06 hours)**
Importance of durability. Causes and mechanisms of deterioration: Sulphate attack, chloride ingress, alkali-silica reaction. Corrosion of reinforcement: Mechanism and prevention. Permeability, porosity, and water absorption. Sustainable concrete: Use of recycled aggregates, industrial by-products, and green cements. Introduction to life cycle analysis of concrete		
Unit V	**Advanced and Special Concretes**	**(06 hours)**
High performance concrete, self-compacting concrete, fiber reinforced concrete. Lightweight concrete, pervious concrete, high density concrete. 3D printed concrete and digital fabrication techniques. Smart concrete: Self-healing concrete, sensor embedded concrete. Nano technology in concrete. Green concrete. Composite concrete.		

LEARNING RESOURCES

Text Books

1. Concrete Technology, Adam M. Neville, J. J. Brooks, Pearson Education
2. Concrete Technology, M. Gambhir, Tata McGraw-Hill Publishing Company

Reference Books

1. Properties of Concrete, A. M. Neville, Pearson Education.
2. Concrete: Microstructure, Properties, and Materials, P. Kumar Mehta and Paulo J.M. Monteiro, McGraw Hill Education.

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-209-CVL

Course Name: Concrete Technology Lab

Teaching Scheme	Credit	Examination	
Practical: 2 hours / week	01	TW OR	25 marks 25 marks

LIST OF PRACTICALS

1) Tests on cement

Determination of fineness, standard consistency, initial and final setting time and soundness of cement. Compressive strength of cement.

2) Tests on aggregates

Determination of specific gravity, water absorption, and sieve analysis of fine and coarse aggregates. Combined grading of fine and coarse aggregates. Alkali aggregate reaction.

3) Concrete mix design by IS code method and casting of Blocks as per Mix Design.

4) Tests on concrete

a)Fresh concrete

- Slump cone, compaction factor, Vee-Bee test for standard concrete
- Slump flow, L-Box, and V-funnel tests for self-compacting concrete

b)Hardened concrete

- Compressive strength, in-direct tensile strength and flexural strength of concrete
- In-direct tensile strength and flexural strength of fiber reinforced concrete

c)Durability tests on concrete

Rapid chloride penetration test, total chloride content, water permeability test, shrinkage test on concrete.

d)Non-destructive tests on concrete

Rebound hammer test, ultrasonic pulse velocity test.

5) Technical visits

Visit to one or more of the following: (a) Cement manufacturing plant, (b) Ready-mix concrete (RMC) plant, (c) Construction site involving advanced concreting practices, (d) Technical exhibitions (related to materials or construction).

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: PCC-210-CVL

Course: Fluid Mechanics Lab

Teaching Scheme	Credit	Examination	
Practical: 2 hours / week	01	TW	25 marks

LIST OF PRACTICALS

The Term work shall consist of the following

A) Experiments B) Assignments and C) Site visit

A) Any five experiments from Sr. No. 1- 8 and any three experiments from Sr. No. 9-12.

1. Measurement of viscosity of fluid by using Viscometer.
2. Drawing flow net by Electrical Analogy method / Study of flow pattern using Heleshaw's apparatus.
3. Experimental verification of Bernoulli's theorem with reference to loss of energy.
4. Calibration of Venturimeter / Orificemeter.
5. Determination of Darcy-Weisbach friction factor (*f*) for a given pipe and study of variation of*f* with Reynolds Number (Re).
6. Study of Uniform Flow Formulae for Open channel.
7. Velocity Distribution in Open Channel Flow.
8. Calibration of Rectangular / Triangular Notch.
9. Measurement of Pressure using different Pressure Measuring Devices (including pressure transducers).
10. Determination of Minor Losses in pipes.
11. Study of pressure distribution around Aerofil / Cylinder by wind tunnel.
12. Determination of Stability of Floating Bodies using Ship Model.

B) Assignments:
Analysis of pipe network using Hardy Cross Method (minimum two loops) – both by hand calculations and using any Computer Language / Software Solution.

C) Site visit to any Hydraulic Structures / Flow Measuring Devices/ Hydraulic Research center.

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: VSE-270-CVL

Course: Vocational Skill Course: Applications of Python

Teaching Scheme	Credit	Examination	
Practical: 2 hours / week	01	TW OR	25 marks 25 marks

Perquisites: Fundamentals of Python

Companion Course, if any

Course Objectives:

The objective of this course is to equip learners with practical programming skills in Python, specifically tailored to solve real-world problems in civil engineering. The course aims to bridge the gap between theoretical civil engineering concepts and modern computational tools, enhancing learners' employability and technical competence in the field.

Course Outcomes

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

1. **Apply Python programming to problems in Mechanics of Structures, Fluid Mechanics, and Concrete Technology** by computing structural responses, analyzing fluid flow parameters, and performing statistical and graphical analysis of material properties.
2. **Develop Python-based estimators and validation tools in Building Construction and Materials** to calculate quantities of materials, verify building dimensions, and simulate construction-related calculations based on IS codes and best practices.
3. **Use Python for surveying computations and plotting** by implementing algorithms for traverse adjustment, contour generation, and curve setting-out, and for economic analysis in Civil Engineering Economics through break-even analysis, NPV calculation, and simulation methods.
4. **Automate project planning and predictive modeling in Project Management and General Applications** by generating Gantt charts, identifying critical paths, and building regression models to forecast key civil engineering parameters like strength, deflection, and pressure loss.

COURSE CONTENTS

Part A	Exercise 1: Revision	(04 hours)

Revision: Introduction to python: Script Model Programming, Understanding Python variables, basic Operators, Numeric data types, string data type and string operations, defining list and list slicing, List manipulation using in build methods, Use of Tuple data type, Dictionary manipulation. Python Program Flow Control, functions, and packages: Conditional blocks using if, else and elif, Simple for loops in python, for loop

using ranges, string, list and dictionaries, Use of loops in python. Programming using string, list and dictionary in build functions. Functions, Understanding Packages, Lambda function, modules, and external packages. NumPy and Matplotlib: Arrays, Array indexing, Matplotlib -Plotting, subplots and images Python file operation: Reading config files in python, writing log files in python, Understanding read and Write functions. Programming using file operations. Library, Package, Module.

Part B	**Applications of Python**

Any two exercises from A to H.

A. Exercise in Mechanics of Structures:

1. Calculate bending moments and shear forces at multiple points along a simply supported beam subjected to multiple concentrated and uniformly distributed loads, then summarize the results in a formatted table.
2. Generate a stress-strain curve for an elastic material up to yield strain using loops.
3. Calculation of strain energy
4. Buckling load on column using Euler's theory
5. Compute Deflection at Points on Beam using Macaulay's Method

B. Exercise in Building Construction and Materials:

1. Design a program to estimate the number of bricks, mortar, and volume of masonry for a given wall using IS specifications.
2. Calculate the total material requirement through multiple rooms and estimate total flooring and wall area.
3. Validate given building plan against minimum room dimensions
4. Estimate number of risers, treads, and total concrete volume for staircase

C. Exercise in Economics for Civil Engineers:

1. Plot break-even points for 3 different construction materials
2. Generate NPV at multiple discount rates and analyze
3. Perform Monte Carlo simulations
4. Cost-Benefit Analysis for Multiple Projects

D. Exercise in Surveying:

1. Contour Plotter using CSV Data: prepare the elevation data in csv format and use matplotlib or any suitable library to plot contour
2. Develop a program to adjust a compass traverse by correcting for local attraction and computing the true bearings and coordinates of traverse stations.
3. Implement Bowditch's method to adjust a closed traverse measured with a theodolite, ensuring the sum of latitudes and departures equals zero.
4. Create a program to compute horizontal distances and elevations using the principle of stadia tacheometry, fixed hair method
5. Implement calculations for designing simple circular curves and generate setting out data using deflection angles.

E. Exercise in Concrete Technology:

1. Statistical Analysis of Cement and Aggregate Properties including sieve analysis: Analyze data (e.g., specific gravity, sieve analysis, strength tests etc.) using Python's numpy and scipy for mean, standard deviation, and classify materials.
2. Python programming to design mix design for concrete: Steps of Mix design using IS10262:2019
3. Simulation of Admixture Effects on Workability: Create a small program to model how different dosages of admixtures affect workability parameters (slump, flow) based on lab data (Can use regression using library).
4. Stress-Strain Curve Plotter: Use Python to plot and analyze stress-strain curves from compression tests to find modulus of elasticity, peak stress, and toughness.

F. Exercise in Fluid Mechanics:

1. Calculate surface tension, capillary rise for various fluid heights and tube radii.
2. Calculate discharge for varying pressure drops and throat diameters using Bernoulli's principle [Loop over pressure drops ΔP and throat diameters d. Use Bernoulli and continuity to find velocity and discharge.]
3. Turbulent flow through pipe in series
4. Turbulent flow through pipe in parallel
5. Calculate Reynolds and Froude numbers for different velocities and characteristic lengths.
6. Calculate friction factor for a range of Reynolds numbers (laminar + turbulent) and total head loss in pipes with minor losses.
7. Create a grid with streamlines and equipotential lines crossing at right angles

G. Exercise in Project Management:

1. Plot a simple Gantt chart using matplotlib for project activities with start and duration. [Visualize project schedule showing start times and durations of activities. Can use Loops for data processing, matplotlib for plotting horizontal bar charts]
2. Calculate early/late start/finish times, float, and identify critical path. [Loops and dictionaries for dependency handling]
3. Calculate expected time and variance for project activities using optimistic, pessimistic, and most likely times.
4. Classify items into A, B, and C categories based on annual consumption value.
5. Calculate the minimum crashing cost to reduce project duration.

H. General:

1. Predict the strength of concrete using mix design parameters and linear regression
2. Estimate pressure drop (ΔP) in a pipe based on input parameters like fluid velocity, diameter, viscosity, and pipe length using a regression model.
3. Predict the maximum deflection in a simply supported beam using regression, based on load, span, material properties, and cross-section.

LEARNING RESOURCES

Text Books

1. Supercharged Python: Take your code to the next level, Overland 2.
2. Learning Python, Mark Lutz, O'reilly

Reference Books

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson 3.
3. Programming with Python, A User‘s Book, Michael Dawson, Cengage Learning, India Edition
4. Think Python, Allen Downey, Green Tea Press

e-Books

1. Python for Civil and Structural Engineers, Lora V,
2. Introduction to Python for Civil Engineers: a Beginner’s Guide, by Amir Hossein Roodpeyma (Author), Reza Arghand (Author), Ziba Hosseini (Author)
3. a production rate of any equipment available on site.
4. Assignments on each unit.

Links to online SWAYAM/NPTEL Courses: Programming in python- NPTEL https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: EEM-241-CVL

Course: Project Management

Teaching Scheme	Credit	Examination	
Theory : 1 hours / week Practical :2 hours / week	02	TW	25 marks

Perquisites: Fundamentals of management, Indian construction industry, construction materials

Companion Course, if any

Course Objectives:

1. Describe the various concepts involved in project management.
2. Explain scientific methods of planning and management.
3. Segregate the materials as per their annual usage and explain process to find production rate of construction equipment
4. Demonstrates methods of manpower planning and use various project monitoring methods
5. Differentiate and apply methods of project selection

Course Outcomes:

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

1. Describe project life cycle and the domains of project management.
2. Explain networking methods and their applications in planning and management.
3. Categorize the materials as per their annual usage and also calculate production rate of construction equipment.
4. Demonstrates resource allocation techniques and apply it for manpower planning.
5. Apply the methods of project selection and recommend the best economical project.

COURSE CONTENTS

Unit I	**Introduction to Project Management**	**(03 hours)**

Importance, objectives & functions of management, principles of management, categories of project, project failure, project life cycle concept and cost components, project management book of knowledge (PMBOK)- different domain areas, project management institute and certified project management professionals (PMP), Importance of organizational structure in management- authority / responsibility relationship

Unit II	**Project Planning and Scheduling**	**(03 hours)**

WBS – Work breakdown structure, Gantt / Bar chart & its limitations, network planning, network analysis, C. P. M.- Activity on Arrow (A.O.A.), critical path and type of floats, precedence network analysis (A.O.N), types of Precedence Relationship, P. E. R.T. Analysis

Unit III	**Project Resources and Site Planning**	**(03 hours)**

Objectives of materials management – primary and secondary, material procurement procedures, record

keeping- use of excel sheets, ERP software, inventory control-ABC analysis, EOQ technique, introduction to equipment management-productivity studies, site layout and planning, safety norms-measures and precautions on site, implementation of safety programs

Unit IV	**Project Monitoring, Control and Appraisal**	**(03 hours)**

Resource allocation-resource smoothening and leveling, network crashing – time- cost relationship -resource optimization, project monitoring - methods, updating and earned value analysis, introduction to use of project management software's-MS project / Primavera.Types of appraisals such as political, social, environmental, technical, financial and economical, study of project feasibility report and detailed project report (DPR), role of project management consultants

Assignments for Termwork Assessment

1. Activities to be conducted shall be from the following list
   a) Quiz on each unit.
   b) Presentation on any topic from each unit.
2. Application of MS project / Primavera software for scheduling of a small construction project with min. 25 activities.
3. Visit any construction site, prepare site layout of it and understand material purchasing, record keeping, storage etc. done on site. Write a report.
4. Assignment on each unit.(Min. 3 questions on each unit).
5. A case study report on Material Management by using ERP.

LEARNING RESOURCES

Text Books

1. Project planning and Control with PERT and CPM, Dr. B.C. Punmia and K.K. Khadelwal, Firewall Media, Laxmi publication New Delhi
2. Project management Principles and Techniques, B.B. Goel, Deep and Deep publisher.
3. Construction Engineering and Management, Dr S. Seetharaman, Umesh publication

Reference Books

1. Construction Project Management-Planning, Scheduling and Controlling, K. K. Chitkara, Tata McGraw Hill Publishing Company, New Delhi.
2. Construction Management and Planning, B. Sengupta and H. Guha, Tata McGraw Hill Publishing Company, New Delhi
3. Construction planning, equipment and methods, Robert L Peurifoy, Mc Graw Hill publication
4. The Essentials of Project Management, Dennis Lock, Gower Publishing Ltd. UK
5. Total Quality Management, Dr. S. Rajaram and Dr. M. Sivakumar, Biztantra publication

Savitribai Phule Pune University
SE (Civil Engineering) 2024 Pattern

Course Code: VEC-251-CVL

Course: Environmental Awareness

Teaching Scheme	Credit	Examination	
Theory: 2 hours /week	02	CCE ESE	15 marks 35 marks

Perquisites: Basic Biology and Geography

Companion Course, if any

Course Objectives:

1. To explain concepts of sustainable development, components of the environment, and analyze ecosystem dynamics including biotic and abiotic factors, food chains, food webs, and energy flow.
2. To identify and evaluate conservation methods for renewable and nonrenewable resources, and to understand the value of biodiversity with current conservation efforts at national and local levels.
3. To provide a comprehensive understanding of environmental pollution, its monitoring and control technologies, and examine real-world environmental issues through scientific theory and field-based examples.
4. To understand the evolution of environmental policies and laws, and explore the interrelationship between environment and development within a regulatory and sustainability context

Course Outcomes:

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

1. Apply an integrative and sustainable approach to environmental issues, including understanding organism roles in ecosystem energy transfers.
2. Differentiate renewable and nonrenewable resources, assess personal resource consumption, and identify biodiversity threats with strategies for conservation policy.
3. Understand environmental pollution, related scientific principles, relevant laws, and identify violations by industries.
4. Analyze human impacts on the environment, assess conservation challenges, and apply research skills to address real-world environmental issues.

COURSE CONTENTS

Unit I	Fundamentals of Environmental Studies and Natural Resources	(6 hours)

Introduction to Environmental Studies: Multidisciplinary nature, components of the environment (atmosphere, hydrosphere, lithosphere, biosphere), scope and importance, sustainability and sustainable development. Ecosystems: Structure and function, energy flow (food chains, food webs, ecological succession), case studies: forest, grassland, desert, and aquatic ecosystems (ponds, lakes, rivers, oceans, estuaries).Natural Resources:Land use change, land degradation, soil erosion, desertification; deforestation and its impacts (mining, dams); water use and over-exploitation, floods, droughts, inter/intra-state water conflicts; air circulation, precipitation; renewable and non-renewable energy, alternate sources, energy needs.

Unit II	Biodiversity and its Conservation	(06 hours)

Levels of Biodiversity: Genetic, species, and ecosystem diversity; biogeographic zones of India; global biodiversity hotspots; India as a mega-biodiversity nation. Biodiversity in India:Endangered and endemic species; threats to biodiversity – habitat loss, poaching, invasive species, man-wildlife conflict.Conservation and Value of Biodiversity:In-situ and ex-situ conservation methods; biodiversity and ecosystem services – ecological, economic, social, ethical, aesthetic, and informational value.

Unit III	Environmental Pollution and Climate Issues	(06 hours)

Types, causes, effects, and control of pollution: air, water, soil, chemical, noiseNuclear hazards and health risks, Solid waste management: urban and industrial wasteCase studies on pollutionClimate change, global warming, ozone depletion, acid rain – impacts on human health and agricultureEnvironmental laws: Environment Protection Act, Air and Water Acts, Wildlife Protection Act, Forest Conservation ActInternational agreements: Montreal Protocol, Kyoto Protocol, Convention on Biological Diversity (CBD), Chemical Weapons Convention (CWC)Nature reserves, tribal rights, human-wildlife conflicts.

Unit IV	Human and Social Aspects of Environment	(06 hours)

Human population growth and its impact on environment and health,Carbon footprint and environmental ethics,Resettlement and rehabilitation of displaced populations – case studies,Disaster management: floods, earthquakes, cyclones, landslides,Environmental movements: Chipko, Silent Valley, Bishnois of Rajasthan,Role of religions and cultures in conservation,Environmental communication and public awareness – case studies (e.g., CNG in Delhi).

LEARNING RESOURCES

Text Books and Reference Books:

1. Environmental Studies by Erach Bharucha, Universities Press
2. Environmental Science by P.D. Sharma, Rastogi Publications
3. A Textbook of Environmental Studies by Suresh K. Dhameja, S. Chand Publishing
4. Environmental Studies by Anubha Kaushik and C.P. Kaushik, New Age International Publishers
5. Environmental Studies: From Crisis to Cure by R. Rajagopalan, Oxford University Press
6. Textbook of Environmental Science and Technology by M. Anji Reddy, SciTech Publications

Note: Comprehensive Continuous Evaluation (CCE) of 15 marks based on all the Units of course syllabus to be scheduled and conducted at institute level. To design a Comprehensive Continuous Evaluation (CCE) scheme for a theory subject of 15 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr. No.	Parameter	Marks	Coverage of Units
1	Unit Test	10	Units 1 & Unit 2 (5 Marks/Unit)
2	Seminar Presentation / Open Book Test/ Assignments / Case Study	05	Units 3 & Unit 4