SEMESTER 4

CIVIL ENGINEERING

SEMESTER S4

MATHEMATICS FOR PHYSICAL SCIENCE – 4

(Group C)

Course Code	**GCMAT401**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	Basic calculus.	**Course Type**	Theory

Course Objectives:

1. To familiarize students with the foundations of probabilistic and statistical analysis mostly used in varied applications in engineering and science.
2. To provide the students with the basics of various numerical methods to develop problem solving skills used in various engineering disciplines.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Random variables, Discrete random variables and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, Binomial distribution, Poisson distribution, Poisson distribution as a limit of the binomial distribution, Joint pmf of two discrete random variables, Marginal pmf, Independent random variables, Expected value of a function of two discrete variables. **[Text 1: Relevant topics from sections 3.1 to 3.4, 3.6, 5.1, 5.2]**	**9**
2	Continuous random variables and their probability distributions, Cumulative distribution function, Expectation, Mean and variance, Uniform, Normal and Exponential distributions, Joint pdf of two Continuous random variables, Marginal pdf, Independent random variables, Expectation value of a function of two continuous variables. **[Text 1: Relevant topics from sections 3.1, 4.1, 4.2, 4.3, 4.4, 5.1, 5.2]**	**9**

3	Confidence Intervals, Confidence Level, Confidence Intervals and One-side confidence intervals for a Population Mean for large and small samples (normal distribution and *t*-distribution), Hypotheses and Test Procedures, Type I and Type II error, *z* Tests for Hypotheses about a Population Mean (for large sample), *t* Test for Hypotheses about a Population Mean (for small sample), Tests concerning a population proportion for large and small samples. **[Text 1: Relevant topics from 7.1, 7.2, 7.3, 8.1, 8.2, 8.3, 8.4]**	**9**
4	Newton-Raphson Method, Gauss Elimination Method ,Gauss - Jordan Method, Numerical solution of ordinary differential equations-Euler's method, Modified Euler's method, Runge - Kutta method of 2nd Order, Numerical solution of Laplace equation –Jacobi's Method, Curve Fitting by Method of Least Squares - Straight lines, Parabola. **(Text 2: Relevant topics from sections 2.5, 4.2, 7.5, 8.4, 8.5, 9.4)**	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the concept, properties and important models of discrete random variables and to apply in suitable random phenomena.	**K3**
CO2	Understand the concept, properties and important models of continuous random variables and to apply in suitable random phenomena.	**K3**
CO3	Estimate population parameters, assess their certainty with confidence intervals, and test hypotheses about population means and proportions using *z*-tests and the one-sample *t*-test.	**K3**
CO4	Apply numerical methods to find solutions of linear system of equations, ordinary differential equations and Laplace equations.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO4	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Probability and Statistics for Engineering and the Sciences	Devore J. L	Cengage Learning	9th edition, 2016
2	Introductory Methods of Numerical Analysis	S S Sastry	PHI Learning Pvt Limited	5th edition, 2012

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Probability, Random Variables and Stochastic Processes,	Papoulis, A. & Pillai, S.U.,	McGraw Hill.	4th edition, 2002
2	Introduction to Probability and Statistics for Engineers and Scientists	Ross, S. M.	Academic Press	6th edition, 2020
3	Numerical methods for Engineers	Steven C. Chapra, Raymond P. Canale	McGraw Hill Education	8th edition, 2021

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/117/105/117105085/
2	https://archive.nptel.ac.in/courses/117/105/117105085/
3	https://archive.nptel.ac.in/courses/117/105/117105085/
4	https://archive.nptel.ac.in/courses/111/107/111107105/

SEMESTER S4

SOIL MECHANICS

(Common to Civil Engineering Branches)

Course Code	**PCCET402**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PCCET205 or equivalent	**Course Type**	Theory

Course Objectives:

1. To understand the fundamental concepts of index and engineering properties of soil
2. To study laboratory methods to find soil characteristics
3. To study stress distribution in soil
4. To study shear, compaction and consolidation characteristic of soil

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Nature of soil and functional relationships** : Introduction to geotechnical engineering– Soil types – Major soil deposits of India - 3 phase system – Basic soil properties : Void ratio, porosity, degree of saturation, air content, water content, specific gravity, unit weight - Relationship between basic soil properties, Relative Density- Numerical problems. Determination of Water content by oven drying, Specific gravity using pycnometer & specific gravity bottle - Determination of Field density by sand replacement method and Core Cutter method - Numerical problems. Soil Structure and their effects on the basic soil properties –Basic structural units of clay minerals (introduction only)	**12**

2	**Index properties**: Sieve analysis, Hydrometer analysis-strokes law, calibration of hydrometer, corrections to hydrometer readings, gradation of soil, combined sieve and hydrometer analysis, limitations, [no derivation required for percentage finer and diameter]. Consistency – Atterberg Limits and indices – Plasticity charts – activity of soil-laboratory tests for Liquid Limit (Casagrande's apparatus and cone penetrometer), Plastic Limit and Shrinkage Limit - Numerical problems IS classification of soil . **Permeability of soils** : Darcy's law – Factors affecting permeability – Laboratory tests: Constant head and variable head permeability tests - Average permeability of stratified deposits - Numerical problems	**12**
3	**Principle of effective stress** - Total, neutral and effective stress – Pressure diagrams in layered soil with water table, saturated by capillary action, subjected to surcharge load – Numerical problems- Quick sand condition – Critical hydraulic gradient **Stress distribution** : Introduction - Boussinesq's equations for vertical pressure due to point loads and line loads – Assumptions and Limitations - Numerical problems - Vertical pressure due to uniformly distributed loads beneath strip, circular [no derivation required] - Numerical problems. Vertical pressure due to loading on rectangular area and Fadum's chart (Brief description only) Approximate methods for vertical stress: Equivalent Point Load method & 2:1 Distribution Method - Numerical problems - Pressure Isobars - Pressure bulbs. distribution of contact pressure beneath footings : **Compaction Tests** – OMC and MDD, Zero Air voids line, IS Light & Heavy- Factors affecting compaction-Numerical problems - Field compaction methods-compaction control –Proctor needle.	**10**
4	**Consolidation -** Definition – Concepts of Coefficient of compressibility and volume compressibility - e-log p curve - Compression index, Recompression index and Pre-consolidation Pressure - Normally consolidated, over consolidated and under consolidated soils - Terzaghi's theory of one-dimensional consolidation with its assumptions (no derivation required) - average degree of consolidation – Time factor - Coefficient of consolidation - Numerical problems - Laboratory consolidation test – Determination of Coefficient of Consolidation - Difference between consolidation and compaction . **Shear strength of soils**- Practical Applications - Mohr-Coulomb failure criterion - Mohr circle method for determination of principal planes and	**10**

	stresses– relationship between shear parameters and principal stresses - Numerical problems - Brief discussion of Laboratory tests - Triaxial compression test - UU, CU and CD tests - Total and effective stress strength parameters - Unconfined compression test, Direct shear test and vane shear test	

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Evaluate the basic soil properties based on tests and functional relationships	**K3**
CO2	Classify soils based on index properties	**K3**
CO3	Compute stresses developed in soil under different loading and hydraulic conditions	**K3**
CO4	Identify and explain various tests to assess the engineering properties of soil.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										2
CO2	3	3										2
CO3	3	3										2
CO4	3	3										2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Soil Mechanics and Foundation Engineering	Dr. K. R. Arora	Standard Publishers and distributers	Seventh Edition, 2020
2	Basic and applied soil mechanics	Rangan G. and A.S.R. Rao	New Age International Private Limited	Fourth , 2022
3	Soil Mechanics and Foundations	Dr. B C Punmia, Er. Ashok Kumar, Dr. Arun Kumar Jain	Laxmi Publicationd (P) ltd	Eighteenth 2015
4	Principles of Geotechnical Engineering	Das B. M.	Cengage India Pvt. Ltd.	2010
5	Geotechnical Engineering	Venkatramaiah	Universities Press	2000

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Soil Mechanics and Foundation Engineering,	Purushothamaraj P.	Dorling Indersley (India) Pvt. Ltd.	2013
2	Numerical Problems, Examples and Objective questions in Geotechnical Engineering,	A V Narasimha Rao and C Venkatramaiah	Universities Press (India) Ltd.,	2000
3	Soil Mechanics in Engineering Practice	Terzaghi K. and R. B. Peck	John Wiley	1967
4	Fundamentals of Soil Mechanics	Taylor D.W.	Asia Publishing House	1948

Video Links (NPTEL, SWAYAM…)	
Sl.No.	**Link ID**
1	https://archive.nptel.ac.in/courses/105/101/105101201/ https://archive.nptel.ac.in/courses/105/105/105105168/

SEMESTER S4

STRUCTURAL ANALYSIS - II

(Common for Civil Engineering Branches)

Course Code	**PCCET403**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	**ESE Marks**	60
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PCCET303/ Equivalent	**Course Type**	Theory

Course Objectives:

1. To introduce classical and matrix methods of structural analysis and understand the behaviour of statically indeterminate structures.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Concept of displacement approach to structural analysis:** Introduction to displacement methods of analysis. Kinematic indeterminacy **Slope Deflection Method:** Introduction, sign convention, development of slope deflection equation; Analysis of continuous beams including settlement of supports; Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 2 **Moment Distribution method:** Concept and derivation of basic equation, Analysis of beams and non-sway frames; analysis of sway frames (Illustration only)	**11**

2	**Approximate Methods of Analysis of Multi-storeyed Frames:** Analysis for vertical loads-substitute frames-loading condition for maximum hogging and sagging moments in beams and maximum bending moment in columns. Analysis for lateral loads – portal method, cantilever method. **Plastic Theory:** Introduction – plastic hinge concepts – plastic modulus – shape factor – redistribution of moments – collapse mechanisms – Plastic analysis of beams and portal frames by equilibrium and mechanism methods. (single storey and single bay frames only)	**11**
3	**Matrix analysis of structures:** **Flexibility method:** Definition of flexibility influence coefficients - Concepts of physical approach. Flexibility matrices for truss and frame elements-load transformation matrix- development of total flexibility matrix of the structure-analysis of simple structures (determinate & indeterminate)-plane truss and plane frame-nodal loads and element loads	**10**
4	**Stiffness method:** Definition of stiffness influence coefficients - Concepts of physical approach. Development of stiffness matrices by physical approach-stiffness matrices for truss and frame elements-displacement transformation matrix-analysis of simple indeterminate structures-plane truss and plane frame-nodal loads and element loads. Introduction to direct stiffness method- stiffness matrix of beam elements, assembly of load vector and stiffness matrix, solution of two span continuous beams.	**12**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	15	10	10	40

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Apply displacement methods of analysis for indeterminate structures.	**K3**
CO2	Apply approximate methods for analysis of multi-storeyed framed structures	**K3**
CO3	Understand the principles of plastic theory and apply the same for limit analysis of steel structures.	**K3**
CO4	Apply the principles of matrix methods of structural analysis.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										2
CO2	3	3										2
CO3	3	3										2
CO4	3	3										2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Mechanics of Structures Vol I & II	S.B. Junnarkar & H.J. Shah	Charotar Publishing House,	2015
2	Structural Analysis	Devdas Menon	Narosa Publishers, NewDelhi	3rd edition 2023
3	Structural Analysis	R.C. Hibbler	Pearson Education	10 th edn. 2022

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Intermediate Structural Analysis,	C.K. Wang	Tata McGraw Hill Publishers	2017
2	Elementary Structural Analysis	J.B. Wilbur, C.H. Norris, and S. Utku	McGraw Hill, NewYork	2006
3	Matrix Analysis of Framed Structure	Weaver, W. Jr. and Gere, J.M	CBS Publishers, NewDelhi	2000
4	Matrix Methods of Structural Analysis	Praveen Nagarajan	CRC Press, Taylor & Francis	2019

Video Links (NPTEL, SWAYAM…)	
Sl. No	**Link ID**
1	https://nptel.ac.in/courses/105105166
2	https://nptel.ac.in/courses/105106050
3	https://nptel.ac.in/courses/105105109

SEMESTER S4

DESIGN OF CONCRETE STRUCTURES

Course Code	**PBCET404**	**CIE Marks**	60
Teaching Hours/Week (L: T:P: R)	3:0:0:1	**ESE Marks**	40
Credits	4	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	(PCCEL208 and PCCET303) or equivalent	**Course Type**	Theory

Course Objectives:

1. Analyse reinforced concrete sections for the purpose of design
2. Design of structural members ensuring safety and serviceability
3. Prepare structural drawings of various elements of a framed structure
4. Analyse and design of a framed RCC structure using software
5. Solve a real field structural design problem

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Properties of Concrete and Steel, Philosophies of Design by Limit State Method, Introduction of IS 456:2000 design provisions Limit State of Collapse in Flexure - Singly Reinforced Rectangular Beams Computation of Parameters of Governing Equations Determination of Neutral Axis Depth and Computation of Moment of Resistance- Numerical Problems Limit State of Collapse in Shear - Numerical Problems Bond, Anchorage, Development Length and Splicing Torsion in Beams - Limit State of Collapse Numerical Problems on design and analysis of Singly Reinforced Rectangular Beams	**9**

2	Doubly Reinforced Beams - Theory and Problems Flanged Beams - Theory and IS Code provisions only One-way slabs - Basic Principles, Theory and design - Numerical Problems Design of Two-way Slabs - Numerical Problems	**9**
3	Limit State of Serviceability - Introduction to IS code provisions only Compression members - Definitions, Classifications, Guidelines and Assumptions - modes of failure. Analysis of Short Axially Loaded Compression Members under Axial Load with Uniaxial Bending & Biaxial bending - Numerical Problems Design of Short Columns under Axial Load with Uniaxial Bending & Biaxial bending - Numerical Problems.	**9**
4	Foundations - Shallow foundations- isolated foundations – Design of square and rectangular foundation.- Numerical Problems (Only axially loaded condition is expected) Modelling and design of a simple framed structure in any structural analysis and design software. (Example: A double storied structure with three rooms in GF and FF)	**9**

Course Assessment Method
(CIE: 60 marks, ESE: 40 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Project	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**30**	**12.5**	**12.5**	**60**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 2 marks **(8x2 =16marks)**	• Each question carries 6 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 2 sub divisions. **(4x6 = 24 marks)**	**40**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Analyse reinforced concrete sections for the purpose of design	**K3**
CO2	Design of structural members ensuring safety and serviceability	**K3**
CO3	Analyse and design of a framed RCC structure using software	**K3**
CO4	Prepare structural drawings of various elements of a framed structure	**K4**
CO5	Solve a real field structural design problem	**K6**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2	3	3						2				2
CO3	3	3			3			2				3
CO4	3	3	2		3			2	3	3		2
CO5	3	3	3	3	3	2		3	3	3		3

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Limit Sate Design of Reinforced Concrete	B.C Punmia, Ashok Kumar Jain, Arun Kumar Jain	Laxmi Publications	10th Edition, 2015
2	Reinforced Concrete Design	Ravi Kumar Sharma, Rachit Sharma	BS Publications	2021
3	Design of Concrete Structures	J N Bandyopadhyay	PHI Learning Private Limited	2008

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Reinforced Concrete Design – Principles and Practice	N Krishna Raju, R N Pranesh	New Age International Publishers	2007
2	Design of Reinforced Concrete Structures	M L Gambhir	PHI Learning Private Limited	4th Edition, 2011
3	Limit State Design of Concrete Structures	Ramchandra, Virendra Gehlot	Scientific Publishers (India)	3rd Edition, 2018
4	Limit State Design of Reinforced Concrete	P C Varghese	PHI Learning Private Limited	2008
5	Limit State Design of Reinforced Concrete Structures	P Dayaratnam	CBS Publishers	2017
6	Design of concrete structures	Arthur H Nilson, David Darwin, Charles William Dolan	McGraw Hill	2010
7	Design of reinforced concrete structures	N. Subramanian	Oxford university press	2013
8	Relevant IS Codes: IS 456, IS 875, SP 16, SP34 etc. (Refer the latest updates and download from the official website of bureau of Indian standards)			

Video Links (NPTEL, SWAYAM…)	
Sl.No.	**Link ID**
1	https://archive.nptel.ac.in/courses/105/105/105105105/

PBL Course Elements

L: Lecture (3 Hrs.)	**R: Project (1 Hr.), 2 Faculty Members**		
	Tutorial	**Practical**	**Presentation**
Lecture delivery	Project identification	Simulation/ Laboratory Work/ Workshops	Presentation (Progress and Final Presentations)
Group discussion	Project Analysis	Data Collection	Evaluation
Question answer Sessions/ Brainstorming Sessions	Analytical thinking and self-learning	Testing	Project Milestone Reviews, Feedback, Project reformation (If required)
Guest Speakers (Industry Experts)	Case Study/ Field Survey Report	Prototyping	Poster Presentation / Video Presentation: Students present their results in a 2 to 5 minutes video

Assessment and Evaluation for Project Activity

Sl. No	**Evaluation for**	**Allotted Marks**
1	Project Planning and Proposal	**5**
2	Contribution in Progress Presentations and Question Answer Sessions	**4**
3	Involvement in the project work and Team Work	**3**
4	Execution and Implementation	**10**
5	Final Presentations	**5**
6	Project Quality, Innovation and Creativity	**3**
Total		**30**

Project Assessment and Evaluation criteria (30 Marks)

1. **Project Planning and Proposal (5 Marks)**

   - Clarity and feasibility of the project plan
   - Research and background understanding
   - Defined objectives and methodology

2. **Contribution in Progress Presentation and Question Answer Sessions (4 Marks)**

   - Individual contribution to the presentation
   - Effectiveness in answering questions and handling feedback

3. **Involvement in the Project Work and Team Work (3 Marks)**

   - Active participation and individual contribution
   - Teamwork and collaboration

4. **Execution and Implementation (10 Marks)**

   - Adherence to the project timeline and milestones
   - Application of theoretical knowledge and problem-solving
   - Final Result

5. **Final Presentation (5 Marks)**

   - Quality and clarity of the overall presentation
   - Individual contribution to the presentation
   - Effectiveness in answering questions

6. **Project Quality, Innovation, and Creativity (3 Marks)**

   - Overall quality and technical excellence of the project
   - Innovation and originality in the project
   - Creativity in solutions and approaches

SEMESTER S4

ADVANCED SOLID MECHANICS

(Common to Civil Engineering branches)

Course Code	**PECET411**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	(PCCET205) or equivalent	**Course Type**	Theory

Course Objectives:

1. To explain three-dimensional state of stress, strain and strain energy stored in Elastic body
2. To explain behaviour of curved beams, thick cylinders and compound cylinders
3. To explain fracture mechanics and mechanics of composite materials.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Elementary concept of elasticity, stresses in three dimensions, Principal Stresses, Stress Invariants, Mohr's Circle for 3-D state of stress, Octahedral Stresses, State of pure shear, plane stress. Differential equations of equilibrium, plane stress problems and plane strain problems comparison.	**9**
2	Analysis of strain, State of strain at a point, Strain Invariant, Principal Strains, Plane state of strain, Strain measurements. Compatibility conditions. **Energy Methods:** Work done by forces and elastic strain energy stored. Reciprocal relations, Theorem of virtual work.	**9**
3	**Bending of beams:** Asymmetrical bending, Shear centre, Bending of curved beams, Stress distribution in beam with rectangular, circular and trapezoidal cross- section, Deflection of thick curved bars. **Axisymmetric problems:** Thick walled cylinder subjected to internal and external pressures, Compound cylinders, Shrink fit,	**9**

4	**Introduction to Mechanics of Composite Materials:** Lamina and Laminates, Micromechanics of FRP Composites. **Introduction to Fracture Mechanics:** Basic modes of fracture, Fracture toughness evaluation.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	To explain the three-dimensional state of stress in a body and methods to reduce computational effort.	**K3**
CO2	To explain the state of strain in a body and establish relation between elastic strain energy stored.	**K3**
CO3	To explain stress distribution in curved beams of various cross-sections and thick-walled cylinders subjected to internal and external pressure.	**K3**
CO4	To explain the mechanics of composite materials.	**K2**
CO5	To explain basic modes of fracture and fracture toughness	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2								1		
CO2	3	2								1		
CO3	3	1								1		
CO4	3	1								1		
CO5	3	2								1		

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Advanced Mechanics of Materials	Arthur P. Boresi, Richard J. Schmidt	John Wiley & Sons	6th, 2022
2	Advanced Mechanics of Solids	L. S. Srinath	McGraw Hill Education	3rd, 2017
3	Mechanics of Composite Material	Robert M. Jones	CRC Press	2nd, 1998
4	Fracture Mechanics: Fundamentals and Application	T. L. Anderson	CRC Press	4th, 2017
5	Computational elasticity	Mohammed Ameen	Narosa publishing house	2008

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Solid Mechanics: Fundamentals and Applications	A.R. Ragab, and S.E.Bayoumi	CRC Press,	1999
2	"Elasticity: Theory, Applications and Numerics",	M.H.Sadd	Academic Press	2006
3	Engineering Mechanics of Solids	Egor P Popov	Pearson Education India	2016

Video Links (NPTEL, SWAYAM…)	
Sl. No.	**Link ID**
1	https://archive.nptel.ac.in/courses/105/106/105106049/

SEMESTER S4

CONCRETE TECHNOLOGY

Course Code	**PECET412**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	**3:0:0:0**	**ESE Marks**	60
Credits	**3**	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	**None**	**Course Type**	Theory

Course Objectives:

1. To understand the characteristics of aggregates and additives, as well as various cement kinds according to their uses in various fields
2. To know the concrete tests conducted in the fresh and hardened stages, as well as the behavior of concrete structures
3. To comprehend the intended use and design economic conditions for concrete mix proportions.
4. To have knowledge on special concrete.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Cement** - chemical composition, Bogue's compounds, hydration, hydrated structure, various types of cement, testing of cement as per Indian standard – standard consistency, setting times, fineness, specific gravity. **Aggregates** - Utility in concrete, fine and coarse aggregates, effect of geometry & texture, strength, mechanical properties, moisture content, water absorption, bulking of sand, deleterious substances, sieve analysis, aggregate grading and gradation curves - testing as per Indian Standards **Admixtures** - types, necessity and benefit . Mineral admixture - Fly ash, silica fume, blast furnace slag, and agro waste based pozzolans. Chemical admixtures - Accelerator, retarder, plasticizer and superplasticizer, their functions and dosage.	**9**

2	**Properties of fresh concrete**- factors affecting workability , slump test compacting factor test,Vee Bee consistometer test, flow test. **Properties of hardened concrete** – modulus of elasticity, compressive strength, split tensile strength, flexural strength. effect of water cement ratio on properties of concrete. Maturity of concrete (concept only). Creep - factors affecting creep - effect of creep Shrinkage- factors affecting and types. **Non-destructive testing of concrete**- surface hardness test- ultrasonic pulse velocity method, pull-out test- core test, measuring reinforcement cover.	**9**
3	Mix proportioning- Mix design ,nominal mix, design mix , concept of mix design, variables of proportioning - general considerations. Various methods of mix design - design of concrete mix as per IS 10262-2019 Statistical quality control of concrete, mean strength, standard deviation, coefficient of variation, sampling and testing, acceptance criteria. **Special concrete** - lightweight concrete, heavy weight concrete ,high strength concrete, high performance concrete, self compacting concrete, roller compacted concrete, fibre reinforced concrete - polymer concrete-pumped concrete - ready mix concrete -geopolymer/alkali activated concrete.	**9**
4	Durability of concrete, factors affecting durability, permeability, cracking, reinforcement corrosion, carbonation, chloride penetration, sulphate attack, acid attack, fire resistance, frost damage, alkali silica reaction. 3D concrete printing, underwater concrete, mass concrete; slip form construction, Sprayed Concrete.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Learn how to apply engineering concepts to the application of concrete materials in the construction fields.	**K2**
CO2	Understand the behaviour of concrete and relevant tests, at its fresh and hardened state.	**K2**
CO3	Understand the factors influencing concrete mix & know the BIS method of mix design.	**K3**
CO4	Differentiate special concrete from conventional concrete along with their applications for practical purpose	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3											3
CO3	3	2										3
CO4	3						2					3

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Properties of Concrete	Neville A.M	Pearson Education India.	5e, 2012
2	Concrete Technology	R. Santhakumar	Oxford Universities Press,	2018
3	Concrete Technology	Shetty M. S.	S. Chand & Co.,	2018

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Concrete Technology	M.L. Gambhir. –	Tata Mc. Graw Hill Publishers, New Delhi	5e 2017
2	Concrete microstructure properties and materials	P. Kumar Mehta, Paulo J.M.Monteiro	Tata Mc. Graw Hill Publishers, New Delhi	4e 2017
3	IS 10262-2019 concrete mix proportioning -guidelines			

Video Links (NPTEL, SWAYAM…)	
Sl. No.	**Link ID**
1	https://nptel.ac.in/courses/105102012
2	https://nptel.ac.in/courses/105104030
3	https://nptel.ac.in/courses/105106225
4	https://nptel.ac.in/courses/105106176

SEMESTER S4

MECHANICS OF FLUID FLOW

(Common for Civil Engineering Branches)

Course Code	**PECET413**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PCCET 302	**Course Type**	Theory

Course Objectives:

1. To understand the basic principles of Fluid Mechanics and will be able to apply the basic principles to analyze fluid mechanical systems.
2. To understand the basic fundamentals of boundary layer theory, turbulent flow and dimensional analysis

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Concepts and Fundamentals: Fluid statics, Cartesian Tensors, Fluid Kinematics, and Description of fluid motion –Types of motion of fluid elements, Vorticity and circulation– Concept of rotational and irrotational flows. Equation of motion of forced and free vortex flow. Stream function and its relation with velocity field. ∇^2 – Relation between stream function and velocity potential for a 2-D irrotational and incompressible flow.	**9**
2	Pipe Flow: Viscous flow: Reynolds experiment to classify laminar and turbulent flows, significance of Reynolds number, critical Reynolds number, shear stress and velocity distribution in a pipe, Hagen Poiseuille equation. Turbulent flow:, Chezy's equation Moody's chart, siphon, transmission of power through pipes, efficiency of transmission, Water hammer, real life problems causing water hammer, Cavitation.on	**9**
3	Concept of Boundary Layer : Growth of boundary layer over a flat plate and definition of boundary layer thickness, displacement thickness, momentum thickness and energy thickness, laminar and turbulent boundary layers,	**9**

	laminar sub layer, velocity profile, Von- Karman momentum integral equations for the boundary layers, calculation of drag, separation of boundary and methods of control.	
4	Dimensional Analysis and Hydraulic similitude: Dimensional analysis, Buckingham's theorem, important dimensional numbers and their significance, geometric, Kinematic and dynamic similarity, model studies. Froude, Reynold, Weber, Cauchy and Mach laws- Applications and limitations of model testing, simple problems only.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe the concept of potential flow theory	**K2**
CO2	Demonstrate the concept of viscosity on flow characteristics in diverse fluid flow problems	**K2**
CO3	Use dimensional analysis to design physical or numerical experiments and to apply dynamic similarity	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3	1	1									
CO3	3	1	2									

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	A Text Book of Fluid Mechanics and Machines	Bansal R. K	Laxmi Publications	2010
2	Fluid Mechanics	Cengel	McGraw Hill Education India	2014
3	Fluid Mechanics	Douglas J. F	Pearson Education	2005
4	Mechanics of Fluids,	Shames I. H	McGraw Hill	1992

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Boundary Layer Theory	Schlichting H., K. Gersten ,	Springer	2000.
2	Fluid Mechanics	Streeter V. L., E. B. Wylie and K. W. Bedford,	Tata McGraw Hill, Delhi	2010

SEMESTER S4

CARTOGRAPHY AND GIS

(Common to Civil Engineering Branches)

Course Code	**PECET414**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PBCET304	**Course Type**	Theory

Course Objectives:

1. Develop a comprehensive understanding of maps, map scales, projections, and GIS principles.
2. Gain practical skills in map interpretation, design, and production using modern cartographic methods.
3. Acquire skills in acquiring, managing, and analysing spatial data using GIS software and spatial databases.
4. Explore applications of geospatial technologies in revisualization, multimedia cartography, and location-based services.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Maps and Scale: Map - types of maps - interpreting maps - map scale: plain linear, statement, diagonal and comparative, representative fraction. Map Projections: General principles of map projections – classification – cylindrical, conical, and zenithally projections – coordinate systems - UTM – choice of projections.	**9**
2	Map Layout and Map Production: Data acquisition –Spatial and Non-Spatial Data -Mechanics of map construction -Map design and layout - map reproduction methods: tradition and modern - Cartographic Publication	**9**

	Modern Cartography: Theories - Geodata Infrastructures - Geovisualization – Visual Data Analytics - Location based services - Multimedia Cartography - Georelief – Mobile Cartography	
3	Introduction: Nature of GIS – Real world and representations: Modelling, Maps, Databases and Spatial Databases - Geographic phenomena: fields, objects and boundaries - Data types: nominal, ordinal, interval and ratio - Attribute data. Data Representation: Tessellations and vector approaches - Topology and spatial relationships - Scale and resolution - Representations of geographic fields and objects - Temporal dimension.	**10**
4	Data Management: GIS software - Spatial Data Infrastructure - Spatial data handling - Database management systems – GIS and spatial databases - Data Input: Spatial data input –Data quality - Data preparation – Point data transformation	**8**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Identify and interpret different types of maps effectively and choose appropriate map projections for different mapping needs	**K2**
CO2	Apply techniques and tools in map design to produce, and publish visually effective maps using both traditional and contemporary methods.	**K3**
CO3	Understand modern cartography theories and geovisualization techniques to represent spatial data.	**K2**
CO4	Understand the principles, data handling, and spatial analysis techniques to effectively apply GIS in various real-world scenarios.	**K2**
CO5	Understand techniques to acquire, store, and manage spatial data using GIS software and database systems, ensuring data quality and optimizing data handling processes for various applications	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2								1		
CO2	3	2	2		2					3		
CO3	3	2			2					2		3
CO4	3	2		3	3					2		3
CO5	3	2	2	3	3					2		3

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Elements of Cartography	Robinson, A.H. et al.	John Wiley & Sons, U.S.A.	1995
2	Fundamentals of Cartography	Misra, R.P. and Ramesh, A.	Concept Publishing Company	1986
3	Cartography: A Compendium of Design Thinking for Mapmakers	Kenneth Field	ESRI Press	2018
4	Concept and Techniques of geographic Information System	Albert K.W Yeung	PHI Learning private limited New Delhi	Second Edition 2012
5	Introduction to Geographic Information Systems.	Chang, K. T	Tata McGrawHill	2006

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Thematic Cartography and Geovisualization	Terry A. Slocum, Robert B. McMaster, Fritz C. Kessler, and Hugh H. Howard	CRC Press, London	Fourth Edition 2022
2	GIS: Fundamentals Applications and Implementations	Elangovan K	New India Publishing Agency	2020
3	GIS and Cartographic Modeling	C. Dana Tomlin	ESRI Press	2012
4	Web Cartography: Map Design for Interactive and Mobile Devices	Ian Muehlenhaus	CRC Press, London	2014

Useful Links	
Sl. No.	**Link ID**
1	https://archive.nptel.ac.in/courses/105/107/105107206/
2	www.esri.com
3	www.natmo.gov.in
4	www.surveyofindia.gov.in
5	www.gsi.gov.in
6	www. nbsslup.icar.gov.in

SEMESTER S4

ENGINEERING GEOLOGY

Course Code	**PECET416**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None/ (Course code)	**Course Type**	Theory

Course Objectives:

1. To give the basics knowledge of Geology that is required for constructing various Civil Engineering Structures - surface changes, earth materials etc.,
2. To focus on the core activities of engineering geologists –geologic hazard identification and mitigation, ground water problems, geological structures. Planning and construction of major Civil Engineering projects.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Relevance of Geology in Civil Engineering, Branches of Geology. **Surface Processes of the earth**-Weathering -Types of weathering, Products of weathering. Geological processes by rivers. Geological work by Sea waves and currents and coastal protection measures. Landslides-types, causes and controlling measures. **Internal Processes of the earth-** Earthquakes- Causes and effects, Seismic waves, concept of intensity and magnitude of earthquake, Seismic zones of India. Basics of seismic safety factor.	**11**
2	**Mineralogy-**Physical properties of minerals, physical properties and chemical composition of minerals like quartz, orthoclase, plagioclase, biotite, muscovite, hornblende, augite, hypersthene, calcite, gypsum. **Petrology-** Igneous rocks - Chemical and mineralogical classification, structures & textures. Sedimentary rocks-types based on mode of formation and structures. Metamorphic rocks-structures only. Megascopic study of granite, dolerite, basalt, sandstone, limestone, shale, gneiss, marble and charnockite, Rock types of Kerala.	**11**

3	**Hydrogeology-** Origin & Occurrence of groundwater, vertical distribution of groundwater. Aquifers and types of aquifers. Porosity and Permeability/hydraulic conductivity, Darcy's Law. Electrical resistivity survey for groundwater exploration. Seawater intrusion in Coastal area, Ghyben-Herzberg relation. Problems created by groundwater to civil engineering structures, Methods to control groundwater problems.	**9**
4	**Structural Geology–** Attitude of rocks – Dip and Strike. Terminology, brief classification and engineering significance of folds, faults and joints. **Engineering Geology** -Significance of geological Investigations for civil engineering projects. Geological part of site investigation for the construction of dams & reservoirs, tunnels and highways.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	To understand the dynamic nature of earth, the associated surface and subsurface processes	**K2**
CO2	To understand basic knowledge about different minerals, various rocks and their classification & identification and their significance in civil engineering.	**K2**
CO3	To apply basic knowledge about ground water and identify the problems created by ground water for civil engineering projects.	**K3**
CO4	To analyse the process involved in rock deformation and formation of various geological structures such as folds, faults, joints unconformities and their critical aspects in stability of civil engineering structures.	**K4**
CO5	To evaluate geological knowledge in planning, designing and construction of various civil projects	**K5**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2											
CO2	3											
CO3	3	3					3					
CO4	3											
CO5	3	3										

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Geology	S.K. Duggal, H.K. Pandey, & N. Rawat	McGraw Hill Education (India) Private Limited.	1st Edition - 2016
2	Engineering Geology	D. Venkat Reddy	Vikas Publishing House Pvt. Ltd.	2nd Edition – 2016
3	Textbook of Engineering Geology	N. Chenna Kesavulu	Macmillan India Limited	2nd Edition -2009
4	Engineering Geology	B.S. Sathya Narayanaswami	Dhanpat Rai & Co.	1st Edition - 2000
5	Engineering and General Geology	Parbin Singh	S. K. Kataria & Sons	8th Edition - 2008
6	Principles of Engineering Geology	K.V.G.K. Gokhale	BSP Books	1st Edition - 2019
7	Engineering Geology	Subinoy Gangopadhyay	Oxford University Press	1st Edition - 2013

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Principles Of Physical Geology	Arthur Homes	Springer	4th Edition – 1993
2	Dana's Textbook Of Mineralogy	William E. Ford	CBS	4th Edition - 2006
3	Rutley's Elements Of Mineralogy	C.D. Gribble	CBS	27th Edition - 2005
4	The Principles Of Petrology	Tyrrell G.W.	Springer Science & Business Media	2012
5	Petrology: The Study of Igneous, Sedimentary and Metamorphic Rocks	Loren A. Raymond	Waveland Pr Inc	2nd Edition - 2007
6	Groundwater Hydrology	David Keith Todd & Larry W. Mays	Wiley India Pvt Ltd	3rd Edition - 2011
7	Structural Geology	Marland P. Billings	Pearson Education	3rd Edition- 2016

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/105/105/105105106/

SEMESTER S4

NUMERICAL METHODS FOR ENGINEERS

(Programme Elective for Civil Engineering Branches)

Course Code	**PECET417**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None/	**Course Type**	Theory

Course Objectives:

1. To apply numerical methods to solve Civil Engineering problems

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Introduction to numerical methods - Errors in numerical computation System of linear algebraic equations –Ill-conditioned systems – Symmetric and Banded systems. Elimination methods –Gauss Elimination (review), Gauss Seidel iteration, Factorization method-Choleski's method. System of non-linear equations – Newton-Raphson method. Eigen value problems - largest and smallest Eigen values- Power method, Jacobi's transformation	**9**
2	Approximation - Lagrangian and Hermite interpolation, Spline interpolation - Quadratic and Cubic splines (example of equal intervals). Data smoothing by least squares criterion- non-polynomial models like exponential model and power equation, Multiple linear regression. Numerical integration - Newton–Cotes open quadrature formulae, Trapezoidal rule, Simpson's rules (Review).	**9**
3	Solution of first-order ordinary differential equations - stability of solution, Use of Taylor series, Euler's method, Modified Euler's method, Fourth order Runge-Kutta method. Higher order equations of initial value type by Runge-Kutta method. Ordinary differential equations of the boundary value type – Finite difference solution.	**9**

4	Partial differential equations in two-dimension - types, Laplace Equation and Poisson's equation. Parabolic equations – Explicit finite difference method – Bender-Schmidt method. Crank-Nicholson implicit method. Elliptic equations - Finite difference method. Weighted residual methods for initial value problems and boundary value problems – Collocation method, Method of least squares, Galerkin's method.	**9**

Applications of the methods shall be based on Civil Engineering problems such as Structural analysis problems to determine member forces, traffic simulations, weather prediction, water flow estimation, fluid dynamics simulations, and geotechnical modelling of groundwater movement.

Course Assessment Method (CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Describe and apply basic numerical methods to obtain approximate solutions of mathematical problems.	**K3**
CO2	Obtain numerical solution of linear and nonlinear algebraic equations.	**K3**
CO3	Perform numerical integration for Civil Engineering problems	**K3**
CO4	Apply numerical solutions of differential equations to Civil Engineering problems	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2			3							1
CO2	2	2			3							1
CO3	2	2			3							1
CO4	2	2			3							1

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Numerical Methods for Engineering Problems	N Krishna Raju, K U Muthu	Macmillan Publishers India Limited	2000
2	Numerical Methods for Engineers & Scientists	Grewal B. S	Khanna Publishers	
3	Numerical Methods in Science and Engineering	Rajasekharan S	S Chand & Company	2003
4	Numerical methods	Babu Ram	Pearson	2010

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Numerical Methods for Engineers	Chapra S. C. and R. P. Canale,	McGraw Hill,	2006
2	Numerical solutions for Differential Equations	Smith G. D.	McGraw Hill.	
3	Modern Methods for Engineering Computations	Ketter and Prawel,	McGraw Hill	
4	Numerical Methods for Initial and Boundary value problems	Rajasekharan S.	Khanna Publishers	1989

SEMESTER S4

ENVIRONMENTAL LAW AND POLICY

(Common for Civil Engineering Branches)

Course Code	**PECET418**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	**ESE Marks**	60
Credits	3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. To explain the role of law, policy and institutions in the conservation and management of natural resources as well as pollution control.
2. To introduce the laws and policies both at the national and international level relating to environment
3. To equip the students with the skills needed for interpreting laws, policies and judicial decisions
4. To familiarise students in the concept of international environmental law

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Concepts in Environmental Law: An introduction to the legal system; Constitution, Acts, Rules, Regulations; Indian Judiciary, Doctrine of precedents, judicial review, Writ petitions, PIL–liberalization of the rule of locus standi, Judicial activism. Introduction to environmental laws in India; Constitutional provisions, Stockholm conference; Bhopal gas tragedy; Rio conference. General principles in Environmental law: Precautionary principle; Polluter pays principle; Sustainable development; Public trust doctrine. Overview of legislations and basic concepts	**9**
2	Forest, Wildlife and Biodiversity related laws :Evolution and Jurisprudence of Forest and Wildlife laws; Colonial forest policies; Forest policies after independence 2 Statutory framework on Forests, Wildlife and Biodiversity: IFA, 1927; WLPA, 1972; FCA, 1980; Biological Diversity Act, 2002; Forest Rights Act, 2006. Strategies for conservation–Project Tiger, Elephant, Rhino, Modulew leopard.	**9**

3	Air, Water and Marine Laws: National Water Policy and some state policies Laws relating to prevention of pollution, access and management of water and institutional mechanism: Water Act, 1974; Water Cess Act, 1977, EPA, 1986. Pollution Control Boards Ground water and law Judicial remedies and procedures Marine laws of India; Coastal zone regulations. Legal framework on Air pollution: Air Act,1981; EPA, 1986	**9**
4	Hazardous Substances and Activities Legal framework: EPA and rules made thereunder; PLI Act, 199 Principles of strict and absolute liability; International Environmental law : An introduction to International law; sources of international law; law of treaties; signature, ratification Evolution of international environmental law: Customary principles; Common but differentiated responsibility, Polluter pays.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Familiar with the laws, policies and institutions in the field of environment	**K1**
CO2	Acquire the skills needed for interpreting laws, policies and judicial decisions in a holistic perspective	**K2**
CO3	Acquire the ability to evaluate the role of law and policy in conservation and management of natural resources and prevention of pollution	**K2**
CO4	Familiar with the concept of international environmental law	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2				2	2	1		1		2
CO2	2	2				2	2	1		1		2
CO3	3	3				2	2	1		2		2
CO4	2	3				2	2	1		1		2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Environmental Law and Policy in India	Divan S. and Rosencranz A.	Oxford, New Delhi	2022
2	Environmental Law in India	Leelakrishnan P	Lexis Nexis, India. .	6TH ed.2022
3	International Law and the Environment	Birnie P	Oxford.	3rd ed. 2009

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Hand Book on Environmental Law- Forest Laws, Wildlife Laws and the Environment; Vols. I, II and III	Upadhyay S. and Upadhyay V	Lexis Nexis-Butterworths-India, New Delhi.	2002
2	Principles of International Environmental Law	Sands P	Cambridge	2003

Video Links (NPTEL, SWAYAM…)	
Sl No.	**Link ID**
1	https://onlinecourses.swayam2.ac.in/cec20_ge12/preview#:~:text=The%20course%20covers%20the%20following,responsibilities)%20Human%20rights%20to%20environment

SEMESTER S4

ARCHITECTURAL ENGINEERING

Course Code	PECET415	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	5/3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	PBCET304, PCCEL218 (or equivalent)	Course Type	Theory

Course Objectives:

1. To enable students to develop creative and sustainable building design and management solutions based on sound engineering principles and ethics.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Definition of architecture –Historical development of architecture. Principles of architectural composition – Unity/ harmony – character– balance – proportion – scale –rhythm — Accentuation and contrast. Organising principles in architecture – Symmetry – hierarchy – axis – linear – concentric, radial – and asymmetric grouping – primary and secondary masses. Form and Space in architecture – Positive and negative space – Defining space with horizontal and vertical elements -qualities of architectural space Architecture Design Process: The 7 phases : The pre-design phase: The schematic design phase: The design development phase: The construction documents phase: The building permit phase: The bidding and negotiation phase: The construction administration phase.	9
2	Acoustics, fundamentals: Intensity of sound- Watts/m2- Bel- Decibel scales-dBA-Phon. Addition of sound levels. Acoustical Defects- Echoes, Reverberation, Foci and Dead Spots, Loudness, Noise Acoustics, applications: Recommended sound levels for interiors - Air and structure born noises-Measures of noise control- Source-path and receiving end. TL value and computation of TL value, Flanking paths. Sound absorption-materials and fixings. Reverberation-Sabines formula-Eyrings modification.	9

	Natural lighting: Visual task requirements, Units of Light, Light, Vision and Buildings, Standards of Lighting and Visual comfort-The sky as a source of light, Daylight factor, Recommended daylight factors for interiors. Design of side-lit windows using Daylight factor graphs Artificial lighting: Artificial lighting- illumination requirements-lux meter – lamps and luminaries – polar distribution curves Design of artificial lighting – lumen method – point by point method.	
3	Thermal comfort: Factors affecting thermal comfort- effective Temperature Thermal comfort indices-ET-CET Charts- Bioclimatic chart- Psychrometry and Psycrometric chart. Earth-Sun relationship: Sun's apparent movement with respect to the earth. Solar angles Computation of solar radiation on different surfaces-solar path diagram-shadow-throw concept and design of shading devices Thermal design of buildings: Thermo physical properties of building materials and thermal control-. Concept for electrical load calculation of structures Basic concept of HVAC load calculation Functional protection: Causes of fire, Mechanism of fire spread in buildings, classification of fire-High temperature effects and combustibility of building materials and structure- Fire alarm system, and means of escape. Firefighting installations	**9**
4	Architecture Design aspect: basic anthropometrics- human functions and their implications for space requirements- movement and circulation diagrams-special interpretations- various activities and their relationship with spaces Perspective views of form: 2-point perspective and 3-point perspective Climate responsive architecture Traditional Architecture of Kerala- Scope of Vastuvidya Dimensional system in Vastuvidya – concept of selection of perimeter - proportions Energy efficiency in buildings – Energy assessment in buildings – Green building rating guidelines – case studies.	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	*Internal Ex*	*Evaluate*	*Analyse*	*Total*
5	**15**	**10**	**10**	**40**

Criteria for Evaluation(Evaluate and Analyse): 20 marks

Assignment

Students should Identify a real word requirement for a residential building. Develop detailed architectural drawing of it incorporating details, selecting a suitable site, using the concepts learned in the course. Finally, a complete file with documents ready to submit to the authorities and a drawing set which will give the client a 3D concept of the structure should be submitted.

Criteria for evaluation:

1. **Problem Definition (K4 - 4 points)**
   a. Clearly defines the requirements and constrains.
2. **Problem Analysis (K4 - 4 points)**
   a. Compare and justify the proposed schemes with evidence and logical reasoning.
3. **Evaluate (K5 - 4 points)**
   a. Thoroughly evaluate the proposed solutions.
   b. Compares trade-offs, advantages, and disadvantages.
   c. Considers feasibility, scalability, and practical implications.
4. **Design and drawing (K6 - 8 points)**
   a. Demonstrates proficiency in creating drawings for technical requirements including approval.
   b. Demonstrates proficiency in creating visually impressive presentation drawings for the clients

Scoring:

1. Accomplished (4 points): Exceptional analysis, clear implementation, and depth of understanding.
2. Competent (3 points): Solid performance with minor areas for improvement.
3. Developing (2 points): Adequate effort but lacks depth or clarity.
4. Minimal (1 point): Incomplete or significantly flawed.

End Semester Examination Marks (ESE):

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 3 sub divisions. Each question carries 9 marks. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Use principles of architectural composition and organization for development of building form and planning of functional spaces in buildings.	**K3**
CO2	Show good understanding of the comprehensive architectural design process, from the pre-design stage to construction management.	**K3**
CO3	Adopt principles of acoustics, lighting and thermal comfort for efficient functional design of buildings.	**K3**
CO4	Show good understanding of basic service load calculations and fire protection methods for efficient and safe function of buildings.	**K3**
CO5	Apply traditional, passive, climate conscious architectural principles for creating energy efficient buildings.	**K5/K6**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										2
CO2	2	1										2
CO3	2	1					2					2
CO4	2	1										2
CO5	3	2					2					2

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	A global history of architecture	Francis D. K. Ching , Mark M. Jarzombek , Vikramaditya Prakash	Wiley	3rd edition 2017
2	Architecture: Form, Space, and Order	Francis D. K. Ching	Wiley	5th edition 2023
3	Architecture And Town Planning	Satish Chandra Agarwala	Dhanpath Rai &Co	2018
4	Architectural Engineering Design: Mechanical Systems	Robert Butler Brown	Mc Graw Hill	1st edition
5	Building Services Engineering	David Chadderton	T&F India	6th Edition 2017
6	Architectural Acoustics	Marshall Long	Academic Press	2014
7	Lighting	Pritchard, D.C	Longman Scientific & Technical, Harlow	1995
8	Daylight in Architecture	Benjamin Evans	McGraw - Hill Book Company	1981
9	Building Environment	AjithaSimha.D	Tata McGraw Hill Publishing Co	1985
10	Design and Installation of Services in Building complexes &High Rise Buildings	Jain. V.K.,	Khanna Tech. Publishers	1986
11	A text book of Vastuvidya	A. Achyuthan, Balagopal. T.S. Prabhu	Vastuvidyaparatishthanam	1996
12	Manual of tropical Housing and Building Part I – Climatic design	Koenigseberger	Orient Longman	2011

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Architecture: From Prehistory to Climate Emergency	Barnabas Calder	Pelican	2021
2	Building construction illustrated	Francis D. K. Ching	**Wiley**	6th edition 2017
3	Architectural Engineering Design: Mechanical Systems	Robert Butler Brown	Mc Graw Hill	1st edition
4	Acoustical Design in Architecture	Knudsen V.O. and Harris C.M	John Wiley	1980
5	Energy Efficient Buildings: Architecture, Engineering, and Environment	Wayne Forster and Dean Hawkes	W.W. Norton Company Inc	2002
6	Bureau of Indian standards, Handbook on Functional Requirement of Buildings – SP:41(S and T)-1987			
7	National Building Code of India (latest revisions to be refered)			
8	Bureau of Energy Efficiency, India. Design Guidelines for Energy Efficient Multi-Storey Buildings,2014.			

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://archive.nptel.ac.in/courses/124/107/124107005/ https://nptel.ac.in/courses/124107012
2	https://archive.nptel.ac.in/courses/105/102/105102175/
3	https://archive.nptel.ac.in/courses/105/107/105107156/
4	https://nptel.ac.in/courses/101104065 https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ar03/

SEMESTER S4

ECONOMICS FOR ENGINEERS

(Common to All Branches)

Course Code	**UCHUT346**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	2:0:0:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2 Hrs. 30 min,
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Understanding of finance and costing for engineering operation, budgetary planning and control
2. Provide fundamental concept of micro and macroeconomics related to engineering industry
3. Deliver the basic concepts of Value Engineering.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Basic Economics Concepts - Basic economic problems – Production Possibility Curve – Utility – Law of diminishing marginal utility – Law of Demand - Law of supply – Elasticity - measurement of elasticity and its applications – Equilibrium- Changes in demand and supply and its effects Production function - Law of variable proportion – Economies of Scale – Internal and External Economies – Cobb-Douglas Production Function	**6**

2	Cost concepts – Social cost, private cost – Explicit and implicit cost – Sunk cost - Opportunity cost - short run cost curves - Revenue concepts Firms and their objectives – Types of firms – Markets - Perfect Competition – Monopoly - Monopolistic Competition - Oligopoly (features and equilibrium of a firm)	**6**
3	Monetary System – Money – Functions - Central Banking –Inflation - Causes and Effects – Measures to Control Inflation - Monetary and Fiscal policies – Deflation Taxation – Direct and Indirect taxes (merits and demerits) - GST National income – Concepts - Circular Flow – Methods of Estimation and Difficulties - Stock Market – Functions- Problems faced by the Indian stock market-Demat Account and Trading Account – Stock market Indicators-SENSEX and NIFTY	**6**
4	Value Analysis and value Engineering - Cost Value, Exchange Value, Use Value, Esteem Value - Aims, Advantages and Application areas of Value Engineering - Value Engineering Procedure - Break-even Analysis - Cost-Benefit Analysis - Capital Budgeting - Process planning	**6**

Course Assessment Method
(CIE: 40 marks , ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Case study/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
10	**15**	**12.5**	**12.5**	**50**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• Minimum 1 and Maximum 2 Questions from each module. • Total of 6 Questions, each carrying 3 marks **(6x3 =18marks)**	2 questions will be given from each module, out of which 1 question should be answered. Each question can have a maximum of 2 sub divisions. Each question carries 8 marks. **(4x8 = 32 marks)**	**50**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Understand the fundamentals of various economic issues using laws and learn the concepts of demand, supply, elasticity and production function.	**K2**
CO2	Develop decision making capability by applying concepts relating to costs and revenue, and acquire knowledge regarding the functioning of firms in different market situations.	**K3**
CO3	Outline the macroeconomic principles of monetary and fiscal systems, national income and stock market.	**K2**
CO4	Make use of the possibilities of value analysis and engineering, and solve simple business problems using break even analysis, cost benefit analysis and capital budgeting techniques.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	1	-	-	-	-	1	-
CO2	-	-	-	-	-	1	1	-	-	-	1	-
CO3	-	-	-	-	1	-	-	-	-	-	2	-
CO4	-	-	-	-	1	1	-	-	-	-	2	-

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Managerial Economics	Geetika, Piyali Ghosh and Chodhury	Tata McGraw Hill,	2015
2	Engineering Economy	H. G. Thuesen, W. J. Fabrycky	PHI	1966
3	Engineering Economics	R. Paneerselvam	PHI	2012

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Economy	Leland Blank P.E, Anthony Tarquin P. E.	Mc Graw Hill	7^{TH} Edition
2	Indian Financial System	Khan M. Y.	Tata McGraw Hill	2011
3	Engineering Economics and analysis	Donald G. Newman, Jerome P. Lavelle	Engg. Press, Texas	2002
4	Contemporary Engineering Economics	Chan S. Park	Prentice Hall of India Ltd	2001

SEMESTER S3/S4

ENGINEERING ETHICS AND SUSTAINABLE DEVELOPMENT

Course Code	**UCHUT347**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	2:0:0:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None	**Course Type**	Theory

Course Objectives:

1. Equip with the knowledge and skills to make ethical decisions and implement gender-sensitive practices in their professional lives.
2. Develop a holistic and comprehensive interdisciplinary approach to understanding engineering ethics principles from a perspective of environment protection and sustainable development.
3. Develop the ability to find strategies for implementing sustainable engineering solutions.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Fundamentals of ethics** - Personal vs. professional ethics, Civic Virtue, Respect for others, **Profession and Professionalism,** Ingenuity, diligence and responsibility, Integrity in design, development, and research domains, Plagiarism, a balanced outlook on law - challenges - case studies, **Technology and digital revolution**-Data, information, and knowledge, Cybertrust and cybersecurity, Data collection & management, **High technologies: connecting people and places**-accessibility and social impacts, **Managing conflict**, Collective bargaining, **Confidentiality**, Role of confidentiality in moral integrity, **Codes of Ethics**. **Basic concepts in Gender Studies** - sex, gender, sexuality, gender spectrum: beyond the binary, gender identity, gender expression, gender stereotypes, **Gender disparity and discrimination in education**, employment and everyday life, History of women in Science &	**6**

	Technology, Gendered technologies & innovations**, Ethical values and practices in connection with gender** - equity, diversity & gender justice, **Gender policy and women/transgender empowerment initiatives.**	
2	**Introduction to Environmental Ethics:** Definition, importance and historical development of environmental ethics, key philosophical theories (anthropocentrism, biocentrism, ecocentrism). **Sustainable Engineering Principles:** Definition and scope, triple bottom line (economic, social and environmental sustainability), life cycle analysis and sustainability metrics. **Ecosystems and Biodiversity:** Basics of ecosystems and their functions, Importance of biodiversity and its conservation, Human impact on ecosystems and biodiversity loss, An overview of various ecosystems in Kerala/India, and its significance. **Landscape and Urban Ecology:** Principles of landscape ecology, Urbanization and its environmental impact, Sustainable urban planning and green infrastructure.	**6**
3	**Hydrology and Water Management:** Basics of hydrology and water cycle, Water scarcity and pollution issues, Sustainable water management practices, Environmental flow, disruptions and disasters. **Zero Waste Concepts and Practices:** Definition of zero waste and its principles, Strategies for waste reduction, reuse, reduce and recycling, Case studies of successful zero waste initiatives. **Circular Economy and Degrowth:** Introduction to the circular economy model, Differences between linear and circular economies, degrowth principles, Strategies for implementing circular economy practices and degrowth principles in engineering. **Mobility and Sustainable Transportation:** Impacts of transportation on the environment and climate, Basic tenets of a Sustainable Transportation design, Sustainable urban mobility solutions, Integrated mobility systems, E-Mobility, Existing and upcoming models of sustainable mobility solutions.	**6**
4	**Renewable Energy and Sustainable Technologies:** Overview of renewable energy sources (solar, wind, hydro, biomass), Sustainable technologies in energy production and consumption, Challenges and opportunities in renewable energy adoption. **Climate Change and Engineering Solutions:** Basics of climate change science, Impact of climate change on natural and human systems, Kerala/India and the Climate	**6**

	crisis, Engineering solutions to mitigate, adapt and build resilience to climate change. **Environmental Policies and Regulations:** Overview of key environmental policies and regulations (national and international), Role of engineers in policy implementation and compliance, Ethical considerations in environmental policy-making. **Case Studies and Future Directions:** Analysis of real-world case studies, Emerging trends and future directions in environmental ethics and sustainability, Discussion on the role of engineers in promoting a sustainable future.	

Course Assessment Method
(CIE: 50 marks , ESE: 50)

Continuous Internal Evaluation Marks (CIE):

Continuous internal evaluation will be based on individual and group activities undertaken throughout the course and the portfolio created documenting their work and learning. The portfolio will include reflections, project reports, case studies, and all other relevant materials.

- The students should be grouped into groups of size 4 to 6 at the beginning of the semester. These groups can be the same ones they have formed in the previous semester.
- Activities are to be distributed between 2 class hours and 3 Self-study hours.
- The portfolio and reflective journal should be carried forward and displayed during the 7th Semester Seminar course as a part of the experience sharing regarding the skills developed through various courses.

Sl. No.	Item	Particulars	Group/ Individual (G/I)	Marks
1	Reflective Journal	Weekly entries reflecting on what was learned, personal insights, and how it can be applied to local contexts.	I	5
2	Micro project (Detailed documentation of the project, including methodologies, findings, and reflections)	1 a) Perform an Engineering Ethics Case Study analysis and prepare a report 1 b) Conduct a literature survey on 'Code of Ethics for Engineers' and prepare a sample code of ethics	G	8
		2. Listen to a TED talk on a Gender-related topic, do a literature survey on that topic and make a report citing the relevant papers with a specific analysis of the Kerala context	G	5
		3. Undertake a project study based on the concepts of sustainable development* - Module II, Module III & Module IV	G	12

3	Activities	2. One activity* each from Module II, Module III & Module IV	G	15
4	Final Presentation	A comprehensive presentation summarising the key takeaways from the course, personal reflections, and proposed future actions based on the learnings.	G	5
		Total Marks		**50**

*Can be taken from the given sample activities/projects

Evaluation Criteria:

- **Depth of Analysis**: Quality and depth of reflections and analysis in project reports and case studies.
- **Application of Concepts**: Ability to apply course concepts to real-world problems and local contexts.
- **Creativity**: Innovative approaches and creative solutions proposed in projects and reflections.
- **Presentation Skills**: Clarity, coherence, and professionalism in the final presentation.

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Develop the ability to apply the principles of engineering ethics in their professional life.	**K3**
CO2	Develop the ability to exercise gender-sensitive practices in their professional lives	**K4**
CO3	Develop the ability to explore contemporary environmental issues and sustainable practices.	**K5**
CO4	Develop the ability to analyse the role of engineers in promoting sustainability and climate resilience.	**K4**
CO5	Develop interest and skills in addressing pertinent environmental and climate-related challenges through a sustainable engineering approach.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						3	2	3	3	2		2
CO2		1				3	2	3	3	2		2
CO3						3	3	2	3	2		2
CO4		1				3	3	2	3	2		2
CO5						3	3	2	3	2		2

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Ethics in Engineering Practice and Research	Caroline Whitbeck	Cambridge University Press & Assessment	2nd edition & August 2011
2	Virtue Ethics and Professional Roles	Justin Oakley	Cambridge University Press & Assessment	November 2006
3	Sustainability Science	Bert J. M. de Vries	Cambridge University Press & Assessment	2nd edition & December 2023
4	Sustainable Engineering Principles and Practice	Bhavik R. Bakshi,	Cambridge University Press & Assessmen	2019
5	Engineering Ethics	M Govindarajan, S Natarajan and V S Senthil Kumar	PHI Learning Private Ltd, New Delhi	2012
6	Professional ethics and human values	RS Naagarazan	New age international (P) limited New Delhi	2006.
7	Ethics in Engineering	Mike W Martin and Roland Schinzinger,	Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi	4" edition, 2014

Suggested Activities/Projects:

Module-II

- Write a reflection on a local environmental issue (e.g., plastic waste in Kerala backwaters or oceans) from different ethical perspectives (anthropocentric, biocentric, ecocentric).
- Write a life cycle analysis report of a common product used in Kerala (e.g., a coconut, bamboo or rubber-based product) and present findings on its sustainability.
- Create a sustainability report for a local business, assessing its environmental, social, and economic impacts
- Presentation on biodiversity in a nearby area (e.g., a local park, a wetland, mangroves, college campus etc) and propose conservation strategies to protect it.
- Develop a conservation plan for an endangered species found in Kerala.
- Analyze the green spaces in a local urban area and propose a plan to enhance urban ecology using native plants and sustainable design.
- Create a model of a sustainable urban landscape for a chosen locality in Kerala.

Module-III

- Study a local water body (e.g., a river or lake) for signs of pollution or natural flow disruption and suggest sustainable management and restoration practices.
- Analyse the effectiveness of water management in the college campus and propose improvements - calculate the water footprint, how to reduce the footprint, how to increase supply through rainwater harvesting, and how to decrease the supply-demand ratio
- Implement a zero waste initiative on the college campus for one week and document the challenges and outcomes.
- Develop a waste audit report for the campus. Suggest a plan for a zero-waste approach.
- Create a circular economy model for a common product used in Kerala (e.g., coconut oil, cloth etc).
- Design a product or service based on circular economy and degrowth principles and present a business plan.
- Develop a plan to improve pedestrian and cycling infrastructure in a chosen locality in Kerala

Module-IV

- Evaluate the potential for installing solar panels on the college campus including cost-benefit analysis and feasibility study.
- Analyse the energy consumption patterns of the college campus and propose sustainable alternatives to reduce consumption - What gadgets are being used? How can we reduce demand using energy-saving gadgets?

- Analyse a local infrastructure project for its climate resilience and suggest improvements.
- Analyse a specific environmental regulation in India (e.g., Coastal Regulation Zone) and its impact on local communities and ecosystems.
- Research and present a case study of a successful sustainable engineering project in Kerala/India (e.g., sustainable building design, water management project, infrastructure project).
- Research and present a case study of an unsustainable engineering project in Kerala/India highlighting design and implementation faults and possible corrections/alternatives (e.g., a housing complex with water logging, a water management project causing frequent floods, infrastructure project that affects surrounding landscapes or ecosystems).

SEMESTER S4

MATERIALS TESTING LAB (GROUP C)

Course Code	PCCEL407	CIE Marks	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	ESE Marks	50
Credits	2	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	PCCET205/ Equivalent	Course Type	Lab

Course Objectives:

1. To provide hands-on experience for the students to determine the material properties
2. To impart the knowledge of material properties to identify and make use of it in various fields of engineering

Expt. No.	Experiments
1	Test on stress-strain characteristics of mild steel and Tor Steel by conducting uniaxial tension test on rod specimens
2	Shear test on mild steel rod (Compression Testing Machine and Shear Shackle)
3	Flexural behaviour of steel by conducting a bending test on Rolled steel sections (I cross section)
4	Torsional behaviour and estimation of modulus of rigidity of steel by conducting torsion test on rod specimens
5	Estimation of modulus of rigidity of steel and brass / copper materials utilizing the principles of torsional vibrations – Torsion Pendulum.
6	Estimation of toughness of steel specimens by conducting (a) Izod & (b) Charpy impact tests.
7	Estimation of hardness properties of engineering materials such as brass, aluminium, copper, steel etc.by performing Brinell hardness test
8	Estimation of Hardness properties of engineering materials such as brass, aluminium, copper, steel etc.by performing (a) Rockwell hardness test (b) Vicker's hardness test
9	Estimation of modulus of rigidity of steel by performing tension and compression tests on spring specimens.

10	Flexural behaviour of timber material by performing bending tests on beam specimens.
11	Estimation of compressive strength of timber specimen.
12	Experiment on verification of Maxwell's reciprocal theorem
13	Demonstration of Fatigue Test
14	Study/demonstration of Strain Gauges and load cells
15	Bend & Rebend test on M S Rods
16	Tensile behaviour of polymeric membranes, textiles, fibres etc.
17	Digital Image Correlation Techniques for the study of material behaviour under various loading conditions

* A minimum of 12 experiments is to be completed.

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	**25**	**20**	**50**

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	**15**	**10**	**10**	**5**	**50**

- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Identify the behaviour of engineering materials under various forms and stages of loading	**K3**
CO2	Characterize the elastic properties of various materials.	**K3**
CO3	Evaluate the strength and stiffness properties of engineering materials under various loading conditions	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2							2			2
CO2	3	2							2			2
CO3	3	2							2			2

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	History of Strength of Materials	S.P. Timoshenko	Dover publications	2003
2	Engineering Mechanics of Solids	Egor P. Popov	Pearson	2015

References	
SL No	**Title Edition and Year**
1	IS 1608 : Part 1 : 2022 Metallic materials - Tensile testing - Part 1 : Method of test at room temperature
2	IS 1598 (1977): Method for Izod Impact test of Metals, (Reaffirmed 2020)
3	IS 1757 Part:1(2020) : Metallic materials – Charpy Pendulum Impact test Method
4	IS 5242 (1979) Method of Test for determining Shear Strength of Metals, (Reaffirmed 2022)
5	IS 1500 Part:1 (2019): Metallic materials – Brinnel Hardness test Part 1 Test method
6	IS 1500 Part:4 (2019): Metallic materials – Brinnel Hardness test Part 4 table of hardness values
7	IS 1501 Part 1 (2020) : Metallic materials – Vickers Hardness test Part 1 Test method
8	IS 1501 Part 4 (2020) : Metallic materials – Vickers Hardness test Part 4 table of hardness values
9	IS 1586 Part 1 (2018) : Metallic materials – Rockwell Hardness test Part 1 Test method
10	IS 1586 Part 3 (2018) : Metallic materials – Rockwell Hardness test Part 3 Calibration of reference blocks (Scale A, B, C, D, E, F, G, H, K, N, T)
11	IS 1717 (2018): Metallic Materials – Wire – Simple Torsion Test
12	IS 883 (2016): Design of Structural Timber in Building- Code of Practice. (Reaffirmed 2021)
13	IS 13325 (1992) Determination of Tensile Properties of Extruded Polymer Geogrids Using the Wide Strip - Test Method (Reaffirmed Year : 2019)
14	IS17415(2023) Metallic Materials torsion test at room temperature.

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	www.sm-nitk.vlab.ac.in
2	www.eerc01-iiith.vlabs.ac.in

Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 Marks)**

    - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
    - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. **Conduct of Experiments (7 Marks)**

    - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
    - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
    - Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (6 Marks)**

    - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
    - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. **Viva Voce (5 Marks)**

    - Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. **Conduct of Experiment/Execution of Work/Programming (15 Marks)**

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. **Result with Valid Inference/Quality of Output (10 Marks)**

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. **Viva Voce (10 Marks)**

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. **Record (5 Marks)**

- Completeness, clarity, and accuracy of the lab record submitted

SEMESTER S4

CIVIL ENGINEERING MODELLING LAB

(Common to C Group)

Course Code	**PCCEL408**	**CIE Marks**	50
Teaching Hours/Week (L: T:P: R)	0:0:3:0	**ESE Marks**	50
Credits	2	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	PCCEL208 / Equivalent	**Course Type**	Lab

Course Objectives:

1. The course is designed to introduce the fundamentals of Civil Engineering Drawing and understand the principles of planning.
2. The students will be able to learn the drafting of buildings manually and using drafting software such as AutoCAD.

Expt. No.	Experiments
1	Review of drafting software: Plan a single storeyed residential building with flat roof for given requirements and draw the site plan, plan, section and elevation.
2	Plan a double storeyed residential building with sloped roof for a set of given requirements for a given plot and draw the site plan, plan, section and elevation. Prepare a file with hardcopies of drawings ready to submit for approval from the authorities.
3, 4	Plan a public building–office complex, public health centre, commercial, educational, post office, bank and draw the plan, section and elevation: Any two.
5	Plan and prepare plumbing and sanitary drawings of a building.
6	Plan and prepare electrical drawings of a building.
7	Introduction to BIM Software: Draw plan, section & elevation of a single storied residential building (Expt 1or 2)
8	Introduction to Project Planning Software: Schedule the construction sequence of a single storied residential building
9	Preparation of a contour map of a site from the provided total station survey data
10	Earthwork estimation from the provided total station survey data
11	Simulation of a small water supply pipe network using EPANET
12	Land use data preparation using GIS

- Do a minimum of 10 experiments. All experiments are expected to be completed with the help of computers.

Course Assessment Method
(CIE: 50 marks, ESE: 50 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Preparation/Pre-Lab Work experiments, Viva and Timely completion of Lab Reports / Record (Continuous Assessment)	Internal Examination	Total
5	25	20	50

End Semester Examination Marks (ESE):

Procedure/ Preparatory work/Design/ Algorithm	Conduct of experiment/ Execution of work/ troubleshooting/ Programming	Result with valid inference/ Quality of Output	Viva voce	Record	Total
10	15	10	10	5	50

- ***Submission of Record: Students shall be allowed for the end semester examination only upon submitting the duly certified record.***
- ***Endorsement by External Examiner:*** *The external examiner shall endorse the record*

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Illustrate the ability to organize civil engineering drawings systematically and professionally.	**K3**
CO2	Apply the building bye-laws and principles of planning for residential and public building design.	**K3**
CO3	Apply the learned skills to Plan and prepare drawings of building services like plumbing, wiring etc.	**K3**
CO4	Utilize computer aided techniques for civil engineering applications including survey, pipe network simulations, planning etc.	**K3**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO- PO Mapping (Mapping of Course Outcomes with Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2								2		2
CO2	3	3	3					3		2		2
CO3	3	3	3					2		2		2
CO4	3	3	3		3					2	2	2

1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Building Drawing and Detailing	Dr. Balagopal T.S. Prabhu	Spades Publishers, Calicut	Revised Edition 2022
2	Building Drawing With An Integrated Approach to Built Environment	Shah, M.G., Kale, C. M. and Patki, S.Y.	Tata McGraw Hill Publishing Company Limited, New Delhi	5th edition 2017
3	Building Planning and Drawing	M.V. Chitawadagi S.S. Bhavikatti	Dreamtech Press	2019

Sl. No	**References**
1	National Building Code of India (refer the latest updates)
2	Kerala panchayat building rules (refer the latest updates)
3	Kerala Municipality building rules (refer the latest updates)

Continuous Assessment (25 Marks)

1. **Preparation and Pre-Lab Work (7 Marks)**

    - Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
    - Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

2. **Conduct of Experiments (7 Marks)**

    - Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
    - Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
    - Teamwork: Collaboration and participation in group experiments.

3. **Lab Reports and Record Keeping (6 Marks)**

    - Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
    - Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

4. **Viva Voce (5 Marks)**

    - Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

Final Marks Averaging: The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.

Evaluation Pattern for End Semester Examination (50 Marks)

1. **Procedure/Preliminary Work/Design/Algorithm (10 Marks)**

- Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
- Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
- Algorithm Development: Correctness and efficiency of the algorithm related to the experiment.
- Creativity and logic in algorithm or experimental design.

2. **Conduct of Experiment/Execution of Work/Programming (15 Marks)**

- Setup and Execution: Proper setup and accurate execution of the experiment or programming task.

3. **Result with Valid Inference/Quality of Output (10 Marks)**

- Accuracy of Results: Precision and correctness of the obtained results.
- Analysis and Interpretation: Validity of inferences drawn from the experiment or quality of program output.

4. **Viva Voce (10 Marks)**

- Ability to explain the experiment, procedure results and answer related questions
- Proficiency in answering questions related to theoretical and practical aspects of the subject.

5. **Record (5 Marks)**

- Completeness, clarity, and accuracy of the lab record submitted