

Semester- I

STATISTICS AND OPTIMIZATION TECHNIQUES			
Course Code	22UCT11	CIE Marks	50
Teaching Hours/Week (L:P: SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy:	40 Hours	Total Marks	100
Credits	3	Exam Hours	3
<p>Course Objectives:: This course will enable the students:</p> <ul style="list-style-type: none"> • To understand the techniques of numerical methods for estimating high accuracy in finding the roots and, in solving differential equations and their applications. • To introduce matrix algebra in a best suitable approach for solving large number of equations using transformation methods. • To enable learning integration and solution of ODE's numerically. • To understand the concept of Probability distribution function and their applications in civil engineering. • To enable learning concepts of statistical mathematics and their implication in Construction Engineering 			
Module-1 Solution of System of Linear Equations:			
Rank of the matrix, Echelon form, Linearly dependent and independent equations, Solutions for linear equations, Gauss Seidel method, Partition method, Croute's Triangularisation method. Jacobi method, Givens method for symmetric matrices			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		
Module-2 Roots of the equations			
Simple fixed point iteration methods. Newton Rapson method, Secant Method, Muller "s method, Graeffe "s Roots Squaring Method. Aitkin "s Method,			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		
Module-3 Numerical solution for Differential and Integral Equations			
<p>Solution of Ordinary differential equations: Euler's method, Euler's modified method, and Ranga Kutta 3rd and 4th order method, Taylor"s series method, Milne"s Predictor-corrector method.</p> <p>Solutions for Integral Equations:, Trapezoidal rule, Simpson"s 1/3rd and 3/8th rule, and Weddle"s Rule.</p>			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		
Module-4 Probability			
Conditional Probability, Random variables and expectations, Binomial Distributions, Poisson Distribution, Normal Distribution, Uniform distribution, Exponential distribution, Joint distribution.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		
Module-5 Statistics			
Hypothesis testing and p -values; Bayesian inference; Statistical decision theory, Density curves, ANOVA, Sampling, Designing of Experiments (Inference for the Mean of a Population, Sample Proportions, Inference for a Population, Proportion Comparing, Two Means, Comparing Two Proportions, Goodness of Fit Test Two way Tables.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of 20 Marks
2. Two assignments each of 20 Marks or one Skill Development Activity of 40 marks

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2016.
2. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44rd Ed., 2017.
3. C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics", 6th Edition, McGraw- Hill, 2012.
4. M K Jain, S.R.K Iyengar, R K. Jain, Numerical methods for Scientific and Engg.
5. Computation, New Age International, 2003.

Reference Books:-

1. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th Ed., McGraw-Hill Edition, 2015.
2. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers", 7th Edition, McGraw-Hill Edition, 2015.
3. Steven C Chapra and Raymond P Canale, "Numerical Methods for Engineers," 7th Ed., McGraw-Hill Edition, 2015

Web links and Video Lectures (e-Resources):

1. <http://nptel.ac.in/courses.php?disciplineId=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://ocw.mit.edu/courses/mathematics>

Skill Development Activities Suggested

- To identify various iterative methods for solving system of linear equations up to required accuracy.
- To identify various method of approximation of roots of equation
- Interpret the probability concepts in Civil engineering
- To learn methods for the experiments and civil engineering projects

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Apply the knowledge of direct methods and iterative methods for solving system of linear equations up to required accuracy	L2,L3,L4,L5
CO2	Acquire the idea of significant figures, method of approximation of roots of equation.	L1,L2,L3,L6
CO3	Understand numerical methods/linear programming techniques to various root finding/for differential and integral equations	L1,L2,L3,L6
CO4	Interpret the probability concepts in Civil engineering	L2,L4,L5,L6
CO5	Learn the applications of statistical methods for the experiments and civil engineering projects	L2,L4,L5,L6

Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze direct methods and iterative methods for solving system of linear equations up to required accuracy	1
2	Design and manage the idea of significant figures, method of approximation of roots of equation	4
3	Analyze numerical methods/linear programming techniques to various root finding/for differential and integral equations	5
4	Analyze probability concepts in Civil engineering	6
5	Work and lead in statistical methods for the experiments and civil engineering projects	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester - I

SUSTAINABLE CONSTRUCTION MATERIALS			
Course Code	22UCT12	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	4	Exam Hours	3
Course Objectives: This course will enable students to 1. Understand the environmental issues due to building materials and the energy consumption in manufacturing building materials 2. Study the various masonry blocks and alternative building materials. 3. Study the properties of concrete making materials, special concretes and various methods for making concrete. 4. Understand the sustainable materials used in construction. 5. Understand the amount of energy required for building and use of Non-renewable sources.			
MODULE-1			
Introduction: Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings IGBC and LEED manuals – mandatory requirements, Rainwater harvesting & solar passive architecture. Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions			

Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry visits to understand Green building ratings system.
MODULE-2	
Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Construction site visits to understand the nature of Alternative Building Materials
MODULE-3	
Special Concretes: Definition & Introduction, General properties, Advantages, Disadvantages, Applications, High density concrete, Shrinkage compensating concrete, Mass concrete, Roller compacted concrete. Light weight concrete, High strength concrete, Ultra-high strength concrete(reactive powder concrete),High workability concrete/Self compacting concrete, Fiber reinforced concrete, Polymer-concrete composites	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Construction site visits to understand the nature of Special Concretes
MODULE-4	
Introduction and definition of Sustainability. Carbon cycle and role of construction material such as concrete and steel, etc. CO2 contribution from cement and other construction materials. Control of energy use in building, ECBC code, codes in neighboring tropical countries, features of LEED and TERI Griha ratings, Performance ratings of green buildings.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Construction site visits to understand the nature of Sustainable materials
MODULE 5	
Non-renewable sources of energy and Environmental aspects – energy norm, coal, oil ,natural gas, Nuclear energy, Global temperature, Green house effects, global warming. Acid rain - Causes, effects and control methods. Regional impacts of temperature change	
Teaching-Learning Process	Black board, LCD, Industry visits to understand Non-renewable sources of energy and Environmental aspects

PRACTICAL COMPONENT OF IPCC (*May cover all / major modules*)

Sl.NO	Experiments
1	Embodied energy and life-cycle energy
2	Green building ratings IGBC and LEED manuals – mandatory requirements, Rainwater harvesting
3	Lime, Pozzolana cements, Raw materials and its basics tests
4	Fiber reinforced plastics, and Fibres its engineering properties and basics tests
5	Special Concretes, workability test on the fly ash based concrete, and fibre reinforced concrete

6	Experimental strength test on various special concrete
7	Sustainable materials and its Importance, life cycle of various building materials
8	Performance ratings of green buildings
9	Non-renewable sources of energy and Environmental aspects
10	Global temperature, Green house effects, global warming. Acid rain - Causes
11	Can be Demo experiments for CIE
12	Can be Demo experiments for CIE

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

1. Two Tests each of 20 Marks
2. Two assignments each of 10 Marks/One Skill Development Activity of 20 marks
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to 30 marks.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course(CIE+SEE))

Suggested Learning Resources:

Text Books:

1. K. S. Jagadish, B. V. Venkatarama Reddy and KS Nanjunda Rao, “Alternative Building Materials and Technologies”, New Age International Publishers.
2. Gambhir M.L., “Concrete Technology”, McGraw Hill Education, 2006.
3. Shetty M.S., “Concrete Technology”, S. Chand and Company Ltd. Delhi, 2003.
4. M. L. Gambhir “Building Materials” Neha Jamwal, Tata McGraw Hill Publ.
5. C. J. Kibert (2008) “Sustainable Construction: Green Building Design and delivery”, 3rd Ed., John Wiley, Hoboken, New Jersey.

Reference Books:

1. RJS Spence and DJ Cook, “Building Materials in Developing Countries”, Wiley pub.
2. Mehta. P. K., and Paulo J.M. Monteiro, “Concrete- Microstructure, Properties and Materials”- (Indian Ed., Indian Concrete Institute), McGraw Hill.
3. National Building Code 2005, Part 0-10, Bureau of Indian Standards
4. G.T. Miller Jr. (2004) “Living in the Environment: Principles, Connections and Solutions”, 14th Ed., Brooks Cole, Pacific Grove, California, Washington DC, April 1989

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Green building ratings IGBC and LEED manuals – mandatory requirements, Rainwater harvesting
- Different types of Fibres its engineering properties and basics tests
- Special Concretes, and its fresh stage and harden stage tests and understanding
- Performance ratings of green buildings
- Global temperature, Green house effects, global warming. Acid rain - Causes

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Solve the problems of environmental issues concerned to building materials and cost effective building technologies	L2,L3,L4,L5
CO2	Analyze different alternative building materials, which will be suitable for specific climate and in sustainable manner	L1,L2,L3,L6
CO3	Recommend various types of alternative building materials, technologies and to design a energy efficient building by considering local climatic condition and building materials	L1,L2,L3,L6
CO4	Conduct the various tests on fresh and hardened concrete, special concrete and the methods of manufacturing of concrete	L2,L4,L5,L6
CO5	Know the idea of utilizing less carbon emission materials	L2,L4,L5,L6

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze problems of environmental issues concerned to building materials	1
2	Design and manage different alternative building materials, which will be suitable for specific climate	4
3	Analyze various types of alternative building materials, technologies and to design a energy efficient building	5
4	Analyze the results of fresh and hardened concrete, special concrete	6
5	Analyze the the idea of utilizing less carbon emission materials	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester- I

CONSTRUCTION QUALITY AND SAFETY			
Course Code	22UCT13	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40 Hours of teaching + 10-12 sessions of SDA	Total Marks	100
Credits	4	Exam Hours	3
Course Objectives: This course will enable the students to <ul style="list-style-type: none"> • Understand concept of quality management and its implications. • Understand the importance of quality certifications and application of TQM to the construction projects. • Understand concept of safety management and its implications • Study the relationship between quality and safety management. 			
Module-1			
Construction Quality Management- need and importance, Quality control and methods, Quality Assurance, Quality assurance plan, Inspection and Testing- Process, Inspection test report, concepts of quality policy, Quality standards, Quality manual			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		
Module-2			
Quality Certification for companies and laboratories (ISO Certification, NABL certification). Total Quality Management, Features and Elements of TQM, Critical factors of TQM, TQM in construction Projects. Benchmarking, Types of Benchmarking and process, Third Party			
Certification- Process involved			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		
Module-3			
Construction Safety-meaning and scope, Safety in construction- Technological aspects, organizational aspects and behavioral aspects, Safety in Project management, Education and training. Safety legislation and Standards, Contract conditions on safety in Civil Engineering projects			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		
Module-4			
SAFETY IN CONSTRUCTION: Causes, classification, cost and measurement of an accident, accident report. Safety information systems, safety programme for construction, Safety budgeting, Factors affecting safety, Strategic Planning for safety provisions, SOPs, PPE, Inspection.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		
Module-5			
Personal & Structural safety and Safety measure: a) For storage and handling of building materials. b) Construction of elements of a building c) During use of equipment d) In demolition of buildings- Safety lacuna in Indian scenario Site safety programmes - JSA, JHA, Safety audit, safety policy, manuals, training & orientation			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of 20 Marks
- Two assignments each of 20 Marks or one Skill Development Activity of 40 marks

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Text Books:

1. Logothetis, N. "Management for total quality." *ed: Prentice-Hall, Upper Saddle River, NJ (1997).*
2. David Gold Smith, "**Safety Management in construction and Industry**", McGraw Hill Publishers.
3. K N Vaid, "**Construction Safety Management**", NICMAR, Bombay.
4. D S Rajendra Prasad, "**Quality Management System in Civil Engineering**", Sapna Book House, Bangalore.

References:

1. Robert (QMP) "**Bench Marking**", "The search for industry Best Practices that led to superior performance" American Society of Quality 1995.
2. Break Joseph and Susan Joseph "**Total Quality Management**", Excel Books, New Delhi, 1995.
3. Juran Frank, J.M. and Gryna, F.M. "**Quality Planning and Analysis**", Tata McGraw Hill 2002.

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Visit industry to understand quality management and its implications
- Visit industry quality certifications and application of TQM to the construction projects
- Visit construction site to know the concept of safety management and its implications

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Gain the knowledge, Importance and necessity of quality management in construction	L2,L3,L4,L5
CO2	Learn and apply the importance of safety management in construction	L1,L2,L3,L6
CO3	Apply concept of safety management	L1,L2,L3,L6
CO4	Know the idea of relationship between quality and safety management	L2,L4,L5,L6
CO5	Apply the idea of structural safety and safety measure	L2,L4,L5,L6

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze the and necessity of quality management in construction	1
2	Design and manage safety management in construction industry	4
3	Analyze concept of safety management in the construction industry	5
4	Analyze the relationship between quality and safety management	6
5	Analyze the idea of structural safety and safety measure	7
6	Engage in critical thinking and provide solution for various civil engineering problems.	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester- 1

CONSTRUCTION PROJECT MANAGEMENT			
Course Code	20UCT14	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	3	Exam Hours	3
Course Objectives: This course will enable students to <ul style="list-style-type: none"> Understand the various management techniques for successful completion of construction projects. Understand the effect of management for project organization. 			
Module-1			
Introduction: Construction Projects-Concept, Project Categories, Characteristic of projects, project life cycle phase. Project Management- Project Management Function, Role of Project Manager. Organizing For Construction - Principles of organization, type of organization structure			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving		
Module-2			

Project Feasibility Reports: Introduction, Significance in feasibility report Technical analysis, Financial analysis, Economic analysis, Ecological analysis, Flow Diagram for feasibility study of a project. Project planning Scope: Planning Process, Objectives, Types of Project plans, Resource Planning Process.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving
Module-3	
Project management techniques: Bar charts, Milestone charts, work breakdown structure, PERT and CPM networks, elements of networks, network construction, numbering the events, time estimates, expected time, project duration, critical path and critical activities and related problems. Drawing A-O-N network from A-O-A network and related problems.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving
Module-4	
PERT networks: Event times, locating critical path using Slack values, Probability of meeting the scheduled time of completion and related problems.	
CPM networks: Activity times, criticality of an activity, locating critical path using Float values and related problems.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving
Module-5	
Time Cost relationship: Direct and indirect cost, steps in optimization of cost and related problems. Allocation of resources: Histograms, Resource smoothening, Resource leveling and related problems. Project updating using CPM network and related problems.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving
Assessment Details (both CIE and SEE)	
<p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ul style="list-style-type: none"> • Three Unit Tests each of 20 Marks • Two assignments each of 20 Marks or one Skill Development Activity of 40 marks <p>to attain the COs and POs</p> <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ul style="list-style-type: none"> • The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. • The question paper will have ten full questions carrying equal marks. <p>6. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-</p>	
Text Books:	
1. Chitkara, K.K. “Construction Project Management: Planning, Scheduling and Control” , Tata McGraw-Hill Publishing Company, New Delhi, 1998.	

2. Choudhury S, “**Project Management**”, McGraw-Hill Publishing Company, New Delhi, 1988.
 3. Chris Hendrickson and Tung Au, “**Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders**”, Prentice Hall, Pittsburgh, 2000. **Reference Books:**
 1. Srinath L.S, “**PERT and CPM**”, East West Press Pvt Ltd New Delhi.
 2. Frank Harris and Roland McCaffer, “**Modern Construction Management**”- 4th Ed. Blackwell Science Ltd.

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- **Visit industry to understand various Project management Techniques and its implications**
- **Visit industry to study the effect of management for the project organization**
- **Visit construction site to know the concept of safety management and its implications**

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Allocate the funds for each work and execute the same.	L2,L3,L4,L5
CO2	Calculate the total time required to complete the job without delay and delay in the project and also estimate the amount of additional funds may require to complete the job.	L1,L2,L3,L6
CO3	Apply concept of scheduling and networking	L1,L2,L3,L6
CO4	Know the idea of time and cost relationship	L2,L4,L5,L6
CO5	Apply the idea of line of Balance and Building Information Model	L2,L4,L5,L6

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze the funds for each work and execute the same	1
2	Design total time required to complete the job without delay and delay in the project	4
3	Analyze concept of scheduling and networking	5
4	Analyze the idea of time and cost relationship	6
5	Analyze the of line of Balance and Building Information Model	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- I

MECHANIZATION IN CONSTRUCTION			
Course Code	22UCT15	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching +10-12 sessions of SDA	Total Marks	100
Credits	3	Exam Hours	3
Course Objectives: This course will enable students to <ul style="list-style-type: none"> • Understand the various types of equipments used for construction. • Understand different construction methods. • Understand modern techniques used in construction. • Understand the environmental issues related to construction activities. 			
Module-1			
Introduction to mechanization: Definition, advantages and limitations of mechanization, Indian scenario and Global scenario. Mechanization through construction equipment: Equipment cost, Machine Power, Production cycle - Dozers, scrapers, excavators, Finishing equipment, Trucks and Hauling equipment, Hoisting equipment, Draglines and Clamshells			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit		
Module-2			
Mechanization in aggregate manufacturing: Flow chart of process of manufacturing of coarse aggregates, Different types of crushers used, process of screening and washing. Recycled aggregates: Types of recycled aggregates. Artificial aggregates: Types of artificial aggregates. Mechanization in concrete production (RMC plant): Flow chart of the process of concrete production. Methods of placing and compaction of concrete			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit		
Module-3			
Mechanization in rebar fabrication Mechanization through construction: formwork and scaffolding types, materials and design principles.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit		
Module-4			
Mechanization through construction methods/technologies: segmental construction of bridges/flyovers, box pushing technology for tunnelling, trench-less Technology. Pile Driving Equipment's. Underground & under water construction (problems encountered, under water drilling, Blasting & grouting.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit		
Module-5			

<p>Mechanization through construction methods of Drilling, Blasting and Tunnelling Equipment : Definition of terms, bits, Jack hammers, Drifters, wagon drills, chisel drills, piston drills, blast hole drills, shot drills, diamond drills, tunnelling equipment, selecting the drilling method equipment; selecting drilling pattern. Safety and Environmental issues in mechanization.</p>	
<p>Teaching-Learning Process</p>	<p>Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit</p>
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ul style="list-style-type: none"> • Three Unit Tests each of 20 Marks • Two assignments each of 20 Marks or one Skill Development Activity of 40 marks <p>to attain the COs and POs</p> <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ul style="list-style-type: none"> • The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. • Each full question will have a sub-question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module 	
<p>References :</p> <ol style="list-style-type: none"> 1. Mahesh Varma, "Construction Equipment and its Planning and Applications", Metropolitan Book Co.(P) Ltd., New Delhi. India. 2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, Delhi, 1988 3. "Construction Review" Published by Civil Engineering and Construction Review, New Delhi, 1991. 	
<p>Web links and Video Lectures (e-Resources):</p> <ul style="list-style-type: none"> • https://swayam.gov.in • https://nptel.ac.in • http://elearning.vtu.ac.in 	
<p>Skill Development Activities Suggested</p> <ul style="list-style-type: none"> • Visit industry to understand Mechanization and automation Techniques and its implications • Visit Aggregate industry to know production technique • Visit construction site building and infrastructure to study to latest mechanization and equipment technique 	

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Understand applications of different types of equipments/machineries used in construction industry	L2,L3,L4,L5
CO2	Understand use of modern tools and techniques	L1,L2,L3,L6
CO3	Know the methods of drilling and blasting.	L1,L2,L3,L6
CO4	Impact of different construction activities on environment	L2,L4,L5,L6
CO5	Apply the latest equipment technique in the construction industry	L2,L4,L5,L6

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze different types of equipments/machineries used in construction industry	1
2	Design modern tools and techniques	4
3	Analyze concept drilling and blasting	5
4	Analyze different construction activities on environment	6
5	Analyze the different equipment technique required in the construction industry	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

RESEARCH METHODOLOGY AND IPR

Course Code	20RMI17	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40 Hours of teaching	Total Marks	100
Credits	3	Exam Hours	03

Course Objectives: At the end of this course, students will be able :

- To give an overview of the research methodology and explain the technique of defining a research problem.
- To explain the functions of the literature review in research.
- To carry out a literature review, developing theoretical and conceptual frameworks.
- To explain the details of sampling designs, and also different methods of data collections.

- To explain the art of interpretation and the art of writing research reports.
- To explain various forms of the intellectual property, its relevance and business impact in the changing global business environment.
- To discuss leading International Instruments concerning Intellectual Property Rights

Module-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is Done, Research Process, Criteria of Good Research, and Problems Encountered by Researchers in India.

Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Module-2

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental

Module-3

Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multidimensional Scaling, Deciding the Scale. Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Module-4

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.

Module-5

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act 1999, Copyright Act, 1957, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of

Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.

Course outcomes:

At the end of the course the student will be able to:

- **Discuss research methodology and the technique of defining a research problem**
- **Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.**
- **Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.**
- **Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports**
- **Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning**

Question paper pattern:

- **The question paper will have ten questions.**
- **Each full question is for 20 marks.**
- **There will be 2full questions (with a maximum of four sub questions in one full question) from each module.**
- **Each full question with sub questions will cover the contents under a module.**
- **Students will have to answer 5 full questions, selecting one full question from each module.**

Textbooks

(1) Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018.

(2) Research Methodology a step-by-step guide for beginners. (For the topic Reviewing the literature under module 2), Ranjit Kumar, SAGE Publications, 3rd Edition, 2011.

(3) Study Material (For the topic Intellectual Property under module 5),

Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September 2013.

Reference Books

(1) Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.

(2) Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

ADVANCED MATERIAL TESTING LABORATORY			
Course Code	22UCTL17	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	01:00:02:00	SEE Marks	50
Credits	02	Exam Hours	100
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Learn principles and design the experiments. • Investigate the performance of various concrete. • Investigate in-situ bearing capacity of soil to decide the size of the foundation. 			
Sl.NO	Experiments		
1	In situ testing of concrete structures, test methods available, planning of in situ tests		
2	Surface hardness methods- Rebound Hammer equipment, its operation and procedure for testing, factors influencing rebound no.		
3	Different types of NDT Experiments and its calibration and interpretation of results, applications and limitations		
4	Mix design, casting and testing High Performance/Strength concrete		
5	Cylinders and Beams obtaining the stress-strain behavior (Modulus of Elasticity) under compressive loading		
6	Classification of soil by Hydrometer method		
7	Standard penetration test on soil sample		
8	Effect of Chemical admixtures on fresh & harden properties of concrete		
Demonstration Experiments (For CIE) if any			
9	Workability test on fly ash based concrete and fibre reinforced concrete		
10	Effect of mineral admixtures on fresh & harden properties of concrete		
11	Tests on Bitumen materials		
12	Bonding Patterns in Brick work (joints, alignments, level and Plumb maintenance)		
<p>Course outcomes (Course Skill Set): At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Achieve the Knowledge of design and development of experimental skills. • Understand the properties fresh and hardened concrete. • Understand the classification of soil and safe bearing capacity of soil in construction industry. 			

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination (SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Suggested Learning Resources:

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Semester- II

CONSTRUCTION ECONOMICS AND FINANCE			
Course Code	22UCT21	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy:	25 hours of teaching + 10-12 sessions of SDA	Total Marks	100
Credits	3	Exam Hours	3
Course Objectives: This course will enable students to			
<ul style="list-style-type: none"> • Understand importance of economics • Understand concept of financial management • Know the time value money and factors governing it. • Understand Working Capital Management. • Understand various risks and Uncertainties involved in construction 			
Module-1			
Economics; Definition and importance and scope Finance: Definition and scope, Sources of finance, Financial Management; Meaning and Scope, Supply and Demand Mechanism, Time value of money, discounted cash flow, NPV, ROR, Problems			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		
Module-2			
Pricing; objectives, determinants, absorption, marginal costing. Financial analysis, Process of Decision making: Capital Budgeting, budgetary control, standard costing and variance, investment appraisal. Practical problems.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		
Module-3			
Quantifying alternatives for decision making; Bases of comparison, Incremental analysis, Benefit-Cost analysis, Capital budgeting; Profit, loss and Break even analysis, Practical Problems.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		
Module-4			
Working capital cycle, Working capital management, Financial statements; Balance sheet and its components, profit & loss account, fund flow statement. Financial ratio and their importance. Project appraisal, project yield, taxation and inflation.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		
Module-5			
Risk and uncertainty-SWOT analysis, Turnkey activities; cost control, performance budgeting. Equipment economics: Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis, depreciation and amortization.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or one **Skill Development Activity of 40 marks**
- to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:Books

1. Peterson, H.C., Lewis, W.C. "Managerial Economics", Prentice Hall of India Pvt. Ltd., 2001
2. Parkin, M. & Bade R., "Modern Macroeconomics" 4th Edition, Prentice Hall, 1996.
3. Werther & Davis, "Human Resources & Personnel Management", McGraw Hill, 1996
4. Edwards, John et.al., 1983 "Manpower planning, John Wiley": New York
5. Anthony, R.N. Govindrajana, V., Irwin, "Management control systems", McGraw Hill Publications, 10th Edition, 2000

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- **Visit industry to understand automation Techniques and its implications**
- **Visit Aggregate industry to know production technique**
- **Visit construction site building and infrastructure to study to latest mechanization and equipment technique**

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	To understand the importance of economics and finance in civil engineering projects	L1, L2, L3
CO2	To understand and analyze financial statements	L1, L2, L3 L4,
CO3	To assess profit, loss and break-even point	L1, L2, L3 L4,
CO4	To develop a budget, manage and regulate it	L1, L2, L3 L4,
CO5	To analyse different risks and uncertainties	L1, L2, L3 L4,

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze economics and finance in civil engineering projects	1
2	Design and analyze financial statements	4
3	Analyze profit, loss and break-even point	5
4	Analyze budget, manage and regulate it	6
5	Analyze the different risks and uncertainties	7

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	-	×	×	×	-	-	-	×	×	×
CO2	×	×	×	×	×	×	×	×	×	×
CO3	×	×	-	×	×	×	×	×	-	×
CO4	×	×	-	-	-	-	×	×	-	-
CO5	×	×	-	-	-	-	×	×	-	-

Semester - II

PRE ENGINEERED CONSTRUCTION TECHNOLOGY			
Course Code	22UCT22	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:02:00	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	4	Exam Hours	3
<p>Course objectives: This course will enable students to</p> <ul style="list-style-type: none"> • Understand the type of prefabricated elements. • Understand the method of hoisting. • Understand the basic construction of the pre-engineered buildings. 			
MODULE-1			
<p>General Principles of Pre Fabrication : Comparison with monolithic construction, Types of prefabrication, site and plant prefabrication, Economy of prefabrication, Modular coordination, Standardization, Planning for Components of prefabricated structures, Disuniting of structures, Handling and erection stresses, Elimination of erection stresses(Beams, columns) Symmetrical frame</p>			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		
MODULE-2			
<p>Prefabricated Elements : Roof and floor panels, ribbed floor panels, wall panels, footings, Joints for different structural Connections, Effective sealing of joints for water proofing, Provisions for non-structural fastenings, Expansion joints in pre-cast construction. Construction of precast structural components (Purlins, Principal rafters, roof trusses, lattice girders, gable frames, Single span single storeyed frames, Single storeyed buildings – slabs, beams and columns. Construction and demolition wastes.</p>			
Teaching-Learning Process	. Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		
MODULE-3			
<p>Production and Hoisting Technology : Choice of production setup, Manufacturing methods, Stationary and mobile production, Planning of production setup, Storage of precast elements, Dimensional tolerances, Acceleration of concrete hardening. Equipment's for hoisting and erection, Techniques for erection of different types of members like Beams, Slabs, Wall panels and Columns, Vacuum lifting pad.</p>			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		
MODULE-4			
<p>Precast sandwich Panels ,Pre-stressed concrete solid flat slabs, Hollow core slab/panels, Pre-stressed concrete Double "T", Bridge, Precast segmental Box Girders, Specifications and design considerations.</p>			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		
MODULE 5			
<p>Pre-Engineered Buildings : Introduction, Advantages, Pre Engineered Buildings Vs. Conventional Steel Buildings, Design Consideration of Pre Engineered Buildings (PEB) – Applications.</p>			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit.		

PRACTICAL COMPONENT OF IPCC(May cover all / major modules)

Sl.NO	Experiments
1	Planning of Pre fabricated structures and its assembling using BIM
2	Handling and erection stress analysis in FEM
3	Different types of Joints and Connection (concrete and steel)
4	Frame structure Analysis in software
5	Design a module for Storage of precast elements
6	Preparation of types of members like Beams, Slabs, Wall panels and its strength test
7	Preparation of Precast sandwich Panels ,Pre-stressed concrete solid flat slabs and its strength test
8	Preparation of Hollow core slab/panels, Pre-stressed concrete Double “T and its strength test
9	Pre Engineered Buildings analysis in software
10	Compression of Pre Engineered Buildings and Conventional Building in software
11	Can be Demo experiments for CIE
12	Can be Demo experiments for CIE
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together</p> <p>CIE for the theory component of IPCC</p> <ul style="list-style-type: none"> • Two Tests each of 20 Marks • Two assignments each of 10 Marks/One Skill Development Activity of 20 marks • Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to 30 marks. <p>CIE for the practical component of IPCC</p> <ul style="list-style-type: none"> • On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 15 marks are for conducting the experiment and preparation of the laboratory record, the other 05 marks shall be for the test conducted at the end of the semester. • The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks. 	

- The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks.

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for 20 marks.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
- The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course(CIE+SEE))

Suggested Learning Resources:

Books

1. L. Mokka, "Prefabricated Concrete for Industrial and Public Structures" Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
2. T. Koncz, "Manual of Precast Concrete Construction", Vol. I, II, III & IV, Berlin, 1971.

Reference Books:

1. B. Lewicki, "Building with Large Prefabricates", Elsevier Publishing Company, Amsterdam, London, New York, 1998.
2. Structural Design Manual, Precast Concrete Connection Details, Society for the Studies in the use of Precast Concrete, Netherland BetorVerlag, 2009.
3. Hass, A.M. Precast concrete design and Applications, Applied Science Publishers, 1983

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Visit industry to understand Mechanization and automation Techniques and its implications
- Visit Aggregate industry to know production technique
- Visit construction site building and infrastructure to study to latest mechanization and equipment technique

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	To design the pre-engineered structures and execute the same for a given structure.	L2,L3,L4,L5
CO2	To know the different types of stresses acting on the structures while lifting the prefabricated structures and type of equipment required to support such stresses	L1,L2,L3,L6
CO3	Know Production and Hoisting Technology	L1,L2,L3,L6
CO4	Impact of different Precast sandwich Panels .Pre-stressed concrete in construction industry	L2,L4,L5,L6
CO5	Apply the latest Pre-Engineered Buildings equipment technique in the construction industry	L2,L4,L5,L6

Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze different types of pre-engineered structures and execute the same for a given structure	1
2	Design equipment required to support stresses	4
3	Analyze Production and Hoisting Technology	5
4	Analyze different Impact of different Precast sandwich Panels	6
5	Analyze the different Pre-stressed concrete in construction industry	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- II

BUILDING SERVICES AND MAINTENANCE				
Course Code	22UCT231		CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02		SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching + 10-12 sessions of SDA		Total Marks	100
Credits	3		Exam Hours	3
Course Objectives: This course will enable the students to <ul style="list-style-type: none"> • Understand the importance of ventilation and their different types. • Understand the difference between electrical and plumbing layout. • Understand the various types of building services. • Understand the various methods of maintenance in construction industry. 				
Module-1				
Introduction to Building Services :Describe basics of building services. Apply various types of services as per needs of building. Classification of building services, Types of services and selection of services. Lighting and Ventilation provisions, Natural and artificial lighting principles and factors , Necessity of Ventilation, Types – Natural and Mechanical , Factors to be considered in the design of Ventilation.				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit			
Module-2				
Electrical services in the building, Technical terms and symbols for electrical installations and Accessories of wiring, Prepare electrical services requirement and Layout of a given building (Ex residence, small work shop, show room, school building) cold and hot water systems, Type, cold water distribution system as per NBC 2005.				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.			

Module-3	
Lift Definition, Types of Lifts, Design Considerations, Location, Sizes as per NBC 2005 , Elevators & Escalators, Different types of elevators and Escalators, conveyors Different types of Conveyors, Uses of different types of Conveyors. Standard fire, fire resistance, classification of buildings, means of escape, alarms, etc., provisions of NBC.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.
Module-4	
Building Maintenance, maintenance services, developing a repair plan, conducting the building and apartment condition survey, developing a repair budget, emergency repairs, preventive maintenance, cosmetic repairs, factors affecting maintenance, common building defects and their Symptoms	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.
Module-5	
Need for maintenance, classification of maintenance, planning of maintenance, scheduling and estimating of maintenance, Preventive and protective maintenance, Scheduled and contingency maintenance planning M.I.S. for building maintenance. Maintenance standards.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.
<p>Assessment Details (both CIE and SEE)</p> <p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ul style="list-style-type: none"> • Three Unit Tests each of 20 Marks • Two assignments each of 20 Marks or one Skill Development Activity of 40 marks • to attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ul style="list-style-type: none"> • The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. • The question paper will have ten full questions carrying equal marks. • Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. • Each full question will have a sub-question covering all the topics under a module. • The students will have to answer five full questions, selecting one full question from each module 	
<p>Suggested Learning Resources:</p> <p>Text Books:</p> <ol style="list-style-type: none"> 1. R. Udaykumar "A text book on Building Services ", Eswar Press, ISBN-13,9788178740638, Chennai. 2. S. M. Patil "Building Services", Seema Publication, ISBN-13,1234567121246, Mumbai Revised edition. 3. Dr. B. C. Punmia "Building Construction ", Laxmi Publications (P) Ltd., Edition 11-2017, New Delhi. 4. P. S. Gahlot "Building repair and Maintenance Management ", CBS Publishers & Distribution (P) Ltd, DEC-2010. <p>Reference Book.</p> <ol style="list-style-type: none"> 1. "National Building Code of India - 2005 ", Bureau of Indian Standards, BIS, New Delhi. 	

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Visit Construction site to understand Lighting and Ventilation provisions, Natural and artificial lighting
- Visit site to understand Electrical services in the building, Technical terms and symbols for electrical installations.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Manage the building services provisions in big construction sites	L2,L3,L4,L5
CO2	Synchronize the construction activities with installation of building services	L1,L2,L3,L6
CO3	Select the suitable electrical as well mechanical services for particular requirements of buildings	L1,L2,L3,L6
CO4	Select the appropriate type of maintenance depending upon necessity and requisite budget	L2,L4,L5,L6
CO5	Apply M.I.S. for building maintenance. Maintenance standards	L2,L4,L5,L6

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze different types building services provisions in big construction sites	1
2	Design construction activities with installation of building services	4
3	Analyze concept drilling and blasting	5
4	Analyze suitable electrical as well mechanical services for particular requirements of buildings	6
5	Analyze the appropriate type of maintenance depending upon necessity and requisite budget	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- II

GROUND IMPROVEMENT TECHNIQUES			
Course Code	22UCT232	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching + 10-12 sessions of SDA	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • Understand the fundamental concepts of ground improvement techniques • Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures. • Understand the concepts of grouting and other miscellaneous methods. • Understand the various methods of maintenance in construction industry 			
Module-1			
Compaction: Theory of compaction, Shallow Surface Compaction -Equipment, Placement water content, factors affecting shallow compaction; Deep compaction: Methods - Vibrofloatation, Terra probe method, Pounding, Blasting, Compaction piles; Compaction Control			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-2			
Vertical Drains: Sand drains, Sand wicks, Rope drains, Design of vertical drains, Stone columns, application of the techniques to Marine clays.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-3			
Stabilization: Introduction, objectives, Methods of stabilization –Mechanical, Cement, Lime, Bituminous, Calcium chloride; construction methods, factors affecting stabilization of soils; Deep Mixing methods –Soil lime Columns and Cement Lime Columns, applications.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-4			
Dewatering: Definition, necessity, Methods of dewatering – Interceptor ditch, Single, Multistage and Vacuum well points, Horizontal wells, Electroosmosis. Permanent drainage by Foundation drains and Blanket drains. Geosynthetics: Introduction, Geosynthetic types, properties of Geosynthetics – materials and fibre properties, Geometrical aspects, mechanical properties, Hydraulic properties, Durability ; Applications of Geosynthetics			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-5			
Grouting: Definition, Objectives of grouting, Grouts and their properties, Categories of Grouting, Grouting methods: Ascending, Descending and Stage Grouting in Soils, Hydro fracture, Grouting Equipment, Post grouting tests. In-situ Reinforcement: Ground Anchors, Tiebacks and Soil Nailing, Micro piles			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- 1 Three Unit Tests each of **20 Marks**
- 2 Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 2 The question paper will have ten full questions carrying equal marks.
- 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- 4 Each full question will have a sub-question covering all the topics under a module.
- 5 The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:**Books**

- 1 Ground Improvement Techniques by P. Purushothama Raj, Laksmi Publications, New Delhi.
- 2 R. M. Korner, Design with Geosynthetics, Prentice Hall, New Jersey, 3rd Edn. 2002
- 3 P. Purushothama Raj, Ground Improvement Techniques, Tata McGrawHill, New Delhi, 1995.
- 4 Dr. B.C.Chattopadhyay and J.Maity, Ground Control and Improvement Techniques, PEEDOT, Howrah, 2011.
- 5 G. V. Rao and G. V. S. Rao, Text Book On Engineering with Geotextiles, Tata McGraw Hill
- 6 Engineering Principles of Ground Modification by Monfred R Hausmann, McGraw Hill Publishing Co.
- 6 Reinforced Soil and Its Engineering Applications by Swami Saran, I.K. International Pvt. Ltd

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Visit Construction site to understand Compaction: Theory of compaction, Shallow Surface Compaction - Equipment, Placement water content
- Visit site to understand Design of vertical drains, Stone columns

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Give different solutions to solve various problems associated with soil formations having less strength	L2,L3,L4,L5
CO2	Use effectively the various methods of ground improvement techniques depending upon the requirements	L1,L2,L3,L6
CO3	utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures Program	L1,L2,L3,L6
CO4	Select the appropriate type of Dewatering technique and application of Geosynthetics	L2,L4,L5,L6
CO5	Apply Grouting technique for different site conduction	L2,L4,L5,L6

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze problems associated with soil formations having less strength	1
2	Design methods of ground improvement techniques depending upon the requirements	4
3	Analyze concept drilling and blasting	5
4	Analyze locally available materials and techniques for ground improvement	6
5	Analyze appropriate type of Dewatering technique and application of Geosynthetics	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- II

ADVANCED REINFORCED CONCRETE DESIGN				
Course Code	22UCT233		CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02		SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching + 10-12 sessions of SDA		Total Marks	100
Credits	3		Exam Hours	3
Course Learning objectives:				
<ul style="list-style-type: none"> Learn the principles of Structural Design. Design and detail the different types of structures. Understand the ductile detailing (Seismic Detailing) of RC Structures 				
Module-1				
Yield line method of design of slabs: Assumptions, Characteristic features, yield line patterns Derivation and Examples for different shapes of Slab.				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.			
Module-2				
Design of grid floors: Concept, Importance and Design Examples				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.			
Module-3				
Design of continuous beams : Concept of Moment Redistribution, Design Examples				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.			
Module-4				
Design of flat slabs : Importance of flat slabs, Flat slab with and without Column Head, Drops, Design Examples.				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit			
Module-5				
Art of detailing earthquake resistant construction –Ductile detailing (Seismic Detailing) considerations As Per IS 13920:Expansion and Construction joints				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit			

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- 1 Three Unit Tests each of **20 Marks**
- 2 Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 2 The question paper will have ten full questions carrying equal marks.
- 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- 4 Each full question will have a sub-question covering all the topics under a module.
- 5 The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:**Books**

- 1 S.S. Bhavikatti, "Advanced R C C Design (R C C Vol. 2)"-New Age International Private Limited Publishers, 3rd Edition: 2016.
- 2 P.C.Varghese, "Advanced Reinforced Concrete Design"- Prentice-Hall of India, New Delhi, 2005.
- 3 Punmia, B. C., Jain, A. K., & Jain, A. K. (1998). Comprehensive Rcc. Designs. Laxmi Publications.
- 4 Advanced Reinforced Concrete Design - N. Krishnaraju, CBS Publishers.
- 5 IITK-BMTPC Earthquake Tips
<https://www.nicee.org/EQTips.php>
- 6 IS 13920 (1993): Ductile detailing of reinforced concrete structures subjected to seismic forces - Code of practice.
- 7 "Current Literature"

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Visit Construction site Learn the principles of Structural Design
- Visit site to Understand the ductile detailing (Seismic Detailing) of RC Structures
- Visit construction office and site to understand the communication gap between office and site

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Give different solutions to solve various problems associated with soil formations having less strength	L2,L3,L4,L5
CO2	Use effectively the various methods of ground improvement techniques depending upon the requirements	L1,L2,L3,L6
CO3	utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures Program	L1,L2,L3,L6
CO4	Select the appropriate type of Dewatering technique and application of Geosynthetics	L2,L4,L5,L6
CO5	Apply Grouting technique for different site conduction	L2,L4,L5,L6

Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze problems associated with soil formations having less strength	1
2	Design methods of ground improvement techniques depending upon the requirements	4
3	Analyze concept drilling and blasting	5
4	Analyze locally available materials and techniques for ground improvement	6
5	Analyze appropriate type of Dewatering technique and application of Geosynthetics	7
6	Engage in critical thinking and provide solution for various civil engineering problems	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester- II

DESIGN CONCEPTS OF SUB-STRUCTURES				
Course Code	22UCT234		CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02		SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching + 10-12 sessions of SDA		Total Marks	100
Credits	3		Exam Hours	3
Course Learning objectives:				
<ul style="list-style-type: none"> To understand the importance of sub-soil exploration, bearing capacity of soil. To learn the design of shallow foundation and deep foundations in varies field conditions. To understand the importance of soil reinforcement in improving the soil characteristics 				
Module-1 : Soil Exploration and Bearing Capacity				
Soil Explorations: Objectives and importance, Disturbed, Undisturbed and representative samples, samplers, Geophysical methods, Geophysical exploration and Bore hole log. Bearing Capacity: Safe bearing capacity, Settlement pressure, allowable Bearing Capacity, Types of Foundations soil failure, Terzaghi's and BIS equation for Bearing capacity. Effect of water table and eccentricity. Field methods: Plate load test, standard penetration method, static and dynamics penetration tests. Introduction to bearing capacity of layered soils				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit			
Module-2 : Design of Shallow foundation				
Classification of foundation, classification of footing, objectives, importance and field suitability of each. Design of single column footing with and without eccentricity. Design of combined footing. (Using IS:456-2000).				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.			
Module-3 : Raft Foundation				
Design of Raft foundations- types of rafts, Bearing capacity of mat foundations, Mat settlements, Modulus of sub-grade reactions for mats and sub-grades, Numerical problems. Allowable soil pressures for rafts in cohesionless and cohesive soils, Design of raft by rigid beam method and Winkler method, Solution based on elastic half space and based on elastic theory				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit			

Module-4 : Deep foundations	
Deep Foundations: Load Transfer in Deep Foundations, Types of Deep Foundations, Ultimate bearing capacity of different types of piles in different soil conditions, Laterally loaded piles, tension piles & batter piles, Pile groups: Bearing capacity, settlement, uplift capacity, load distribution between piles, Proportioning and design concepts of piles.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.
Module-5 : Soil Reinforcements	
Geo-synthetics: Classifications, Properties, functions, Laboratory testings and construction details, metallic strips, metallic grids, geotextiles, geogrids, geomembranes and geocomposites, their functions and design principles. (No problems) Geo-textile: properties, testing methods, functions, design principles. Geo-synthetic clay liners	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit
Assessment Details (both CIE and SEE)	
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.	
Continuous Internal Evaluation:	
1 Three Unit Tests each of 20 Marks	
2 Two assignments each of 20 Marks or one Skill Development Activity of 40 marks	
to attain the COs and POs	
The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks	
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.	
Semester End Examination:	
1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.	
2 The question paper will have ten full questions carrying equal marks.	
3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.	
4 Each full question will have a sub-question covering all the topics under a module.	
5 The students will have to answer five full questions, selecting one full question from each module	
Suggested Learning Resources:	
Books	
1 Soil Dynamics and Machine Foundation (2010), Swami Saran, Galgotia Publications Pvt. Ltd.	
2 Foundation Engineering (2012), JE Bowles. McGraw Hill Book Company	
3 Analysis and Design of Foundations and Retaining Structures(1979)–S Prakash, SaritaPrakashana, Meerut	
4 Foundation design in practices (2010)-Kaurna Moy Ghosh. PHI	
5 Foundation Engineering (1998): Bajara M Das, John Wiley & Sons,	
6 Vibration Analysis and Foundation Dynamics(1998)-KameswaraRao, N. S. V., Wheeler Publication Ltd.,	
7 Soil Mechanics and Foundation Engineering – S K Garg, Khanna Publications	
8 Geotechnical Engineering – C Venkataramaiah, New Age International Publishers	
Web links and Video Lectures (e-Resources):	
<ul style="list-style-type: none"> • https://swayam.gov.in • https://nptel.ac.in • http://elearning.vtu.ac.in 	
Skill Development Activities Suggested	
<ul style="list-style-type: none"> • Visit Construction site Learn Soil Exploration and Bearing Capacity of Soil • Visit site to Understand the difference between Shallow foundation and raft foundation • Visit construction site to understand Deep foundation and necessity of soil Reinforcement 	

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Understand the importance of soil exploration; determine the Bearing capacity of the soil in various field conditions	L2,L3,L4,L5
CO2	Design the shallow foundations and raft foundation	L1,L2,L3,L6
CO3	Understand and solve the problems associated with pile foundations	L1,L2,L3,L6
CO4	Understand importance of geo-synthetics as soil reinforcement	L2,L4,L5,L6
CO5	Understand deep foundation and necessity of soil Reinforcement	L2,L4,L5,L6

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze Bearing capacity of the soil in various field conditions	1
2	Design methods for shallow foundations and raft foundation	4
3	Analyze the problems associated with pile foundations	5
4	Analyze geo-synthetics as soil reinforcement	6
5	Analyze deep foundation and necessity of soil Reinforcement	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester- II

BUILDING COST AND QUALITY MANAGEMENT			
Course Code	22UCT241	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching + 10-12 sessions of SDA	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • Prepare the Bill of Quantities (BOQ) of a given project. • Understand the qualities of materials used in the construction work. 			
Module-1			
Estimation of quantities for R.C.C. multi storeyed complex viz. earthwork, concrete in foundation, D.P.C., R.C.C. work, flooring and roofing, plastering and pointing etc., wood work, white washing.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-2			
Analysis of rates for multi storeyed building works – Brick work in foundations and Superstructure, cement concrete, R.C. C., Plastering, Flooring, Timber work etc. Checking of construction quality – various tests for bricks, cement, concrete, aggregates, and steel as per IS codes			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Preparation of bills for payment, measurement book, mode of payment, running account bill. Ledger and Cash book details, Arbitration.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-4			
Estimation of building services viz. Water supply works, electrification, sanitary fitting etc, and their cost analysis.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-5			
Elements of Valuation: methods, techniques and examples Completion report of the project; Checking of Plan, Details of various works, and issue of completion report of the project.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Assessment Details (both CIE and SEE)			
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.			
Continuous Internal Evaluation:			
<ol style="list-style-type: none"> 1 Three Unit Tests each of 20 Marks 2 Two assignments each of 20 Marks or one Skill Development Activity of 40 marks 			
to attain the COs and POs			
The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks			
CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.			
Semester End Examination:			
<ol style="list-style-type: none"> 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2 The question paper will have ten full questions carrying equal marks. 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4 Each full question will have a sub-question covering all the topics under a module. 			
The students will have to answer five full questions, selecting one full question from each module.			

Suggested Learning Resources:**Books**

- 1 B.N.Dutta “Estimating and Costing” UBSPublishers'Distributors PvtLtd,28thRevised Edition(2016).
- 2 G.S. Birdie “Estimating and Costing” DhanpatRai PublishingCompany.
- 3 Roshan N Namavati “Professional Practice”, Lakahni Book Depot, Mumbai

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Visit Construction site Learn Estimation of quantities for R.C.C. multi storied complex
- Visit site to Understand the Analysis of rates for multi storied building works
- Visit construction site to understand Deep foundation and necessity of soil Reinforcement

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	To prepare the quantities of work for a multi storied building.	L2,L3,L4,L5
CO2	To certify the valuation report on existing structures	L1,L2,L3,L6
CO3	To prepare the detailed bills for the on-going projects.	L1,L2,L3,L6
CO4	Understand Estimation of building services viz. water supply works, electrification, sanitary fitting	L2,L4,L5,L6
CO5	Understand Elements of Valuation: methods, techniques and examples	L2,L4,L5,L6

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze the quantities of work for a multi storied building	1
2	Design report on existing structures	4
3	Analyze the problems associated with pile foundations	5
4	Analyze geo-synthetics as soil reinforcement	6
5	Analyze deep foundation and necessity of soil Reinforcement	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester- II

PAVEMENT DESIGN AND CONSTRUCTION			
Course Code	22UCT242	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching + 10-12 sessions of SDA	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • Discuss the factors influencing design of pavements and compute stresses and deflections induced in flexible pavement under various design loads. • Understand the material specification and construction of different layers. • Understand the various types of equipment's used for road construction and pre construction methods. • Design the thickness of flexible pavements by different methods and as per IRC guidelines. • Design the thickness of concrete pavements and joints associated with CC pavements in addition to the computation of stresses in CC pavements 			
Module-1			
Pavement and its composition – Types of pavement, functions of various layers, choice of pavement type, Factors affecting design and performance of flexible and rigid pavements , Desirable characteristics of pavements. Design wheel loads – axle load distribution, ESWL, EWL, and VDF due to varying loads and CSA. Stresses and Deflections in Flexible Pavements: Application of elastic theory, stresses, deflections in single, and two layer system, Applications in pavement design. Problems.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Pavement construction-Different types of granular base course– WMM, CRM, WBM, specifications, construction method and quality control tests. Different types of bituminous layers for binder and surface courses, their Specifications (as per IRC and MORTH), construction method and quality control			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Plants and equipment's for road construction- Bituminous mixing plants, cement concrete mixers – various types, advantages and choice. Road construction equipment – different types of excavators, graders, soil compactors / rollers, pavers and other equipment for construction of different pavement layers – their uses and choice. Construction of embankments and cuts for roads, preparation of subgrade and quality control tests			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-4			
Design of Flexible Pavements: Factors effecting Design. Deflection studies in Flexible Pavements. Present Serviceability Index. IRC guidelines for Flexible Pavements. Pavement Performance and methods- AASHTO and Asphalt Institute Method. Need for Overlays, Overlays design methods for Flexible and Rigid pavements.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-5			
Design of rigid pavement -General design principle, stresses in rigid pavements (due to wheel loads and temperature variations), design of cement concrete pavements (joints and slab thickness) as per IRC guidelines. Design features of CRCP, SFRC and ICBP, Problems			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- 1 Three Unit Tests each of **20 Marks**
- 2 Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 2 The question paper will have ten full questions carrying equal marks.
- 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- 4 Each full question will have a sub-question covering all the topics under a module.
- 5 The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Books**

- 1 Yoder and Witczak, "Principles of Pavement Design"- John Wiley and sons Inc(second edition) 1975
- 2 Yang, "Design of functional pavements"- McGraw Hill BookCo.
- 3 Huang, "Pavement Analysis"- Elsevier Publications
- 4 David Croney, Paul Croney, "Design & Performance of Road Pavements"- McGraw hill Book Co.
- 5 W.RonaldHudson,RalphHaasandZeniswki"ModernPavementManagement"-McGraw Hill and Co
- 6 IRC 37-2001, IRC 81-1997, IRC 58 – 2002, IRC 59 – 1976, IRC 101-1988, Indian RoadsCongress
- 7 Khanna and Justo "Highway Engineering"- Nemchand& Bros, Roorkee

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Visit Construction site Learn Pavement and its composition
- Visit site to Understand Pavement construction

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain the various factors affecting design and performance of pavements	L1, L2, L3
CO2	Calculate the stresses and deflection in flexible and rigid pavements	L1, L2, L3, L4
CO3	Select suitable equipment for preparation of sub grade and preparation stages for base and sub base layers	L1, L2, L3
CO4	Design the thickness of flexible pavements by different methods under different exposure conditions and materials	L1, L2, L3, L4
CO5	Design the thickness of concrete pavements and joints associated with CC pavements in addition to the computation of stresses in CC pavements	L1, L2, L3, L4

Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze various factors affecting design and performance of pavements	1
2	Design rigid pavements and flexible pavement	4
3	Analyze sub grade and preparation stages for base and sub base layers	5
4	Analyze geo-synthetics as soil reinforcement	6
5	Analyze exposure conditions and materials required for pavement design	7
6	Engage in critical thinking and provide solution for various civil engineering problems.	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- II

EARTHQUAKE RESISTANT DESIGN OF STRUCTURE				
Course Code	22UCT243		CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02		SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching + 10-12 sessions of SDA		Total Marks	100
Credits	3		Exam Hours	3
Course Learning objectives:				
<ul style="list-style-type: none"> Learn the principles of engineering seismology. Design the reinforced concrete buildings for earthquake resistance structures. Evaluate the seismic response of the structures. 				
Module-1				
Introduction to engineering seismology, Geological and tectonic features of India, Origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments. Earthquake Hazards in India, Earthquake Risk Evaluation and Mitigation. Structural behaviour under gravity and seismic loads, Lateral load resisting structural systems, Requirements of efficient earthquake resistant structural system, damping devices, base isolation systems.				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit			
Module-2				
The Response history and strong motion characteristics. Response Spectrum – elastic and inelastic response spectra, tripartite (D-V-A) response spectrum, use of response spectrum in earthquake resistant design. Computation of seismic forces in multi-storied				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit			
Module-3				
Structural Configuration for earthquake resistant design, Concept of plan irregularities and vertical irregularities, Soft storey, Torsion in buildings. Design provisions for these in IS-1893. Effect of infill masonry walls on frames, modelling concepts of infill masonry walls. Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, Slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions				
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit			

Module-4		
Design of Reinforced concrete buildings for earthquake resistance-Load combinations, Ductility and energy absorption in buildings. Confinement of concrete for ductility, design of columns and beams for ductility, ductile detailing provisions as per IS1893. Structural behaviour, design and ductile detailing of shear walls.		
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit	
Module-5		
Seismic response control concepts – Seismic demand, seismic capacity, Overview of linear and Nonlinear procedures of seismic analysis. Performance Based Seismic Engineering methodology, Seismic evaluation and retrofitting of structures		
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit	
Assessment Details (both CIE and SEE)		
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.		
Continuous Internal Evaluation:		
1 Three Unit Tests each of 20 Marks		
2 Two assignments each of 20 Marks or one Skill Development Activity of 40 marks		
to attain the COs and POs		
The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks		
CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.		
Semester End Examination:		
1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.		
2 The question paper will have ten full questions carrying equal marks.		
3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.		
4 Each full question will have a sub-question covering all the topics under a module.		
5 The students will have to answer five full questions, selecting one full question from each module		
Suggested Learning Resources:		
Books		
1 Dynamics of Structures – Theory and Application to Earthquake Engineering 2nd ed. – Anil K. Chopra, Pearson Education.		
2 Earthquake Resistant Design of Building Structures, Vinod Hosur, WILEY (India) India.		
3 IS – 1893 (Part I): 2002, IS – 13920: 1993, IS – 4326: 1993, IS-13828: 1993		
4 Design of Earthquake Resistant Buildings, Minoru Wakabayashi, McGraw Hill Publishers		
Web links and Video Lectures (e-Resources):		
<ul style="list-style-type: none"> • https://swayam.gov.in • https://nptel.ac.in • http://elearning.vtu.ac.in 		
Skill Development Activities Suggested		
<ul style="list-style-type: none"> • Visit Gestation centres for studying seismic instruments. Earthquake Hazards in India Earthquake Risk • Visit site to Understand Design of Reinforced concrete buildings for earthquake resistance & Load combinations 		
Course outcome (Course Skill Set)		
At the end of the course the student will be able to :		
Sl. No.	Description	Blooms Level
CO1	Achieve Knowledge of design and development of problem solving skills	L1, L2, L3, L4
CO2	Understand the principles of engineering seismology	L1, L2, L3, L4
CO3	Design and develop analytical skills	L1, L2, L3, L4
CO4	Summarize the Seismic evaluation and retrofitting of structures	L1, L2, L3, L4
CO5	Understand the concepts of earthquake resistance of reinforced concrete buildings	L1, L2, L3, L4

Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze problem solving skills	1
2	Design principles of engineering seismology	4
3	Design and develop analytical skills	5
4	Analyze the Seismic evaluation and retrofitting of structures	6
5	Analyze the concepts of earthquake resistance of reinforced concrete buildings	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- II

STRUCTURAL MASONRY			
Course Code	22UCT244	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	02:00:02	SEE Marks	50
Total Hours of Pedagogy	25 Hours of teaching + 10-12 sessions of SDA	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • Characterize and evaluate the strength of masonry materials • Design masonry elements under different loads 			
Module-1			
Characterization of masonry materials: Materials for Masonry, Strength and elastic properties of masonry materials			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Characterization of masonry properties: Parameters influencing Masonry properties			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Behaviour of masonry: Masonry under shear, flexure, and axial loads (static and dynamic)			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-4			
Behaviour of masonry structures: Masonry arches, shells, reinforced masonry			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-5			
Design of masonry structures: Tutorial sessions on design problems of masonry structures			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Assessment Details (both CIE and SEE)			
<p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1 Three Unit Tests each of 20 Marks 2 Two assignments each of 20 Marks or one Skill Development Activity of 40 marks <p>to attain the COs and POs</p> <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2 The question paper will have ten full questions carrying equal marks. 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4 Each full question will have a sub-question covering all the topics under a module. 5 The students will have to answer five full questions, selecting one full question from each module 			
Suggested Learning Resources:			
Books			
<ol style="list-style-type: none"> 1 Hendry A W, “Structural Masonry” 			

2	Sven Sahlin, “Structural Masonry”	
3	Curtin, “Design of Reinforced and Pre-stressed Masonry”	
4	DayaratnamP, “Brick and Reinforced Brick Structures”-Oxford and IBH pub	
Web links and Video Lectures (e-Resources):		
<ul style="list-style-type: none"> • https://swayam.gov.in • https://nptel.ac.in • http://elearning.vtu.ac.in 		
Skill Development Activities Suggested		
<ul style="list-style-type: none"> • Brick manufacturing plant visit to study characterize and evaluate the strength of masonry materials • Use of Loading Frame to design masonry elements under different loads 		
Course outcome (Course Skill Set)		
At the end of the course the student will be able to :		
Sl. No.	Description	Blooms Level
CO1	Characterise strength of different masonry	L1, L2, L3
CO2	Evaluate masonry strength	L1, L2, L3
CO3	Design masonry elements for different loading conditions.	L1, L2, L3, L4
CO4	Behaviour of masonry structures: Masonry arches, shells	
CO5	Design of masonry structures	
Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze characterise strength of different masonry	1
2	Design evaluated masonry strength	4
3	Design masonry elements for different loading conditions	5
4	Analyze Behaviour of masonry structures: Masonry arches, shells	6
5	Analyze Masonry shells, reinforced masonry	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry and	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

SOFTWARE APPLICATION LABORATORY			
Course Code	22UCTL27	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	01:00:02:00	SEE Marks	50
Credits	02	Exam Hours	100
Course objectives:			
This course will enable students to			
<ul style="list-style-type: none"> • Plan and schedule multi storeyed building with various constraints. • Carry out estimation of buildings using softwares • Understand and apply project management techniques. 			
Sl.NO	Experiments		
1	Preparation of estimation of a structure using excel (6 hours).		
2	Construction management software (MS-PROJECTS /PRIMAVERA)		
3	Understanding basic features (3 hours)		
4	Create WBS, activities, and tasks and computation time using Excel spread sheet and transferring the same to MS project management software (6 hours).		
5	Identification of Predecessor and Successor activities with constraints (6 hours).		
6	Constructing Network diagram (AON Diagram) and analyzing for Critical path, Critical activities and other non-Critical paths, Project duration, Floats (6 hours).		
7	Study on various view options available (3 hours).		
8	Basic understanding about resource creation and allocation, resolving over allocation of activities (6 hours).		
Demonstration Experiments (For CIE) if any			
9	Splitting the activities, linking multiple activities, assigning constrains, merging multiple projects		
10	Baseline project and updating the project (6 hours).		
11	Hands on activities on STAAD Pro		
12	Hands on activities on BIM		
Course outcomes:			
<i>On completion of this course, students are able to:</i>			
<ul style="list-style-type: none"> • Achieve Knowledge of Design and development of soft skills. • Understand the application of planning and scheduling techniques to construction project. • Optimize time and cost for the construction project. 			
Assessment Details (both CIE and SEE)			
<p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40%of maximum marks in the semester-end examination(SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.</p>			

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Suggested Learning Resources:

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Semester- III

RESTORATION AND REHABILITATION OF THE STRUCTURES			
Course Code	22UCT31	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	50
Total Hours of Pedagogy:	40 Hours of Teaching+10-12 sessions of SDA	Total Marks	100
Credits	4	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • CO1: Learn the structural properties of different members and Identify the failure phenomenon of structure. • CO2: Understand the new approaches in the design aspects and Understand the concepts of serviceability and durability of structures 			
Module-1			
Restoration & Rehabilitation; Definition and importance components in services and testing of existing structures both destructive and non-destructive; Causes of deterioration; preventive measures and maintenance.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Principles of assessment of weathering and durability; Performance of construction materials and their Characteristics. Diagnosis of construction failures; Dealing with cracks; Methods of repair in concrete, Steel and timber structural components.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Corrosion of reinforcement in concrete; Process of corrosion, Causes, Effects, repair and preventive measures. Deterioration of Concrete; Causes of Efflorescence, Effects, Repair and Preventive measures. Grouting and shotcrete techniques. Surface coatings used in repair of structures. Leakage in slabs; Causes and Preventive measures to be taken to prevent during and after construction. Water proofing; Different techniques of water proofing.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-4			
Strengthening of existing structures; Different methods of strengthening the existing structural elements. Maintenance Inspection; Steps involved in Maintenance Inspection. Maintenance Budget and its importance			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		
Module-5			
Remedial measures and techniques for failures due to strength, deflection, cracking, chemical attack, weathering, fire, leakage, marine conditions. Demolition methods			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit.		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of 20 Marks
- Two assignments each of 20 Marks or one Skill Development Activity of 40 marks
- To attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Books**

1. Bhattacharjee, Concrete structures Repair, Rehabilitation and Retrofitting, CBS Publishers, 2017
2. B. Vidivelli, Rehabilitation of concrete Structures, standard Publishers and distributors, 2007
3. R T Allen, S C Edwards and D.N. Shaw, Repair of Concrete Structures, CRC press, 1992
4. A Technical Report on Learning of failures from Deficiencies in design, construction and Service, Raikar R. N., R & D Centre (SDCPL)

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Identifying different repair material, its use on the building, technology to apply
- Different retrofitting method, various reasons for damage of building structure
- Strengthening of the structure using locally available materials

Course outcome (Course Skill Set) At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Predict the failure modes in structures. And Design the structures to overcome the failure in construction activities	L1, L2, L3
CO2	Understand the deterioration of structures. and Suggest remedial measures for different types of failures	L1, L2, L3, L4,
CO3	Understand different methods of demolition	L1, L2, L3 L4,

Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze characterise strength of different Repair material	1
2	Design evaluated of strengthened structure	4
3	Design strengthened elements for different loading conditions	5
4	Analyze Behaviour of strengthened and retrofitted elements	6
5	Analyze retrofitted slab elements and beam elements	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- III

CONSTRUCTION CONTRACTS SPECIFICATION AND ESTIMATION			
Course Code	22UCT321	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy:	40 Hours of teaching	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • CO1: Summarize, analyze and evaluate the estimates, rate analysis and specifications. And Analyze, evaluate and design construction contract documents, tendering procedure • CO2: Summarize and analyze the, claims and dispute mechanisms. And Summarize and analyse the BOT, PPP, Concession contracts • CO3: Recognize and summarize the laws affecting engineers, relational contracts 			
Module-1 Estimation and Rate Analysis			
Estimation: Estimate, Data required to prepare estimate, Types of estimate, Report for estimate, Factors affecting estimation of major construction project. Analysis of Rates: Purpose of rate analysis, Procedure for rate analysis, Factors affecting rate analysis. Rate analysis for Lime concreting in foundation or floor, Cement concreting in foundation or floor, RCC work in beams, slabs & column, Reinforced brick work in slabs, First class brick work in foundation & superstructure, Coursed Rubble stone masonry in superstructure, Ashlar stone masonry in superstructure, Cement plastering & Pointing, Cement Concrete Floor, Mosaic or terrazzo Tile floor, white washing & distempering, Damp proof course, Painting, Varnishing, Earth work in excavation, centering, Shuttering, formwork for RCC beam, slab, Galvanized corrugated iron sheet roofing			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2 Construction Specifications			
General/brief specifications of a first class building, Second class building, Third class building, fourth class building. Detailed specifications for Earth work in excavation in foundation, Lime concrete in foundation, Cement concrete, Reinforced cement concrete, Damp proof course, Brick work first class, Reinforced brick work, Plastering, pointing, Cement concrete floor, Mosaic or terrazzo floor, White washing, Colour washing, Distempering, Painting, Varnishing, Wood work (carpenter's work), Doors and windows, Glazing, Centering and shuttering, Ashlar stone masonry, Coursed Rubble masonry, Galvanized corrugated iron sheet roofing			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3 Contracts, Tendering, Bidding & Contracting			
Contracts, Tendering, Bidding & Contracting Introduction to Contracts: Agreement, Contract, Essentials conditions of a Valid Contract, Terminologies of Contract, Distinction between Agreement and Contract, Types of Contracts, Indian Contract Act 1872..Tendering, Bidding & Contracting: Tender and Tender Documents, Tendering procedure, Tender Notice, Methods of Bidding/Tendering, Conditions of Contract, Securities/Guarantees in contract			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-4 Construction Claims and Dispute Resolution			
Construction Claims: Reasons for Claims in Construction Contracts, Types of Claims, Causes of claims, effects of claims Preparation And Presentation of Claims, Deviations/ Variations: Extraitem, Excess quantity, Deficit quantity, Price Escalation. Dispute Resolution: Dispute Resolution Mechanism, Types of Dispute Resolution: Arbitration, Mediation, Conciliation, Litigation, Dispute Resolution Board [DRB]			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		

Module-5 BOT Contract, Relational Contracts, Laws affecting Engineers	
BOT Contract: Types of contract, PPP framework, types of risk, concession agreement. Relational Contracts: Partnering, Alliancing. Laws affecting Engineers: LabourLaw, Sales Tax, VAT, Service Tax, Excise Duty	
Teaching Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit
Assessment Details (both CIE and SEE)	
<p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <ul style="list-style-type: none"> • Continuous Internal Evaluation: • Three Unit Tests each of 20 Marks • Two assignments each of 20 Marks or one Skill Development Activity of 40 marks • To attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2 The question paper will have ten full questions carrying equal marks. 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4 Each full question will have a sub-question covering all the topics under a module. 5 The students will have to answer five full questions, selecting one full question from each module . 	
Suggested Learning Resources:	
<p>Books</p> <ol style="list-style-type: none"> 1 B.N.Dutta, “Estimation and Costing in Civil Engineering”, 28th revised edition, UBS Publishers Distributors Pvt. Ltd., 2016. 2 Collier, K. (1982). “Managing Construction Contracts”, Reston Publishing Company. 3 S. RanagaRao Contract Management and Dispute Resolutions Engineering staff College of India January 2008. 4 C. J. Schexnayder and R. E. Mayo, “Construction Management Fundamentals”, McGraw Hill, New Delhi. 2003 5 General Conditions of Contract, Central Public Works Department, New Delhi, 2010 6 D.S. Berrie and B.c. Paulson, Professional construction management including C.M., Design construct and general contracting, McGraw Hill International, Third Edition 1992. 7 V. K. Raina, Construction & Contract Management Practices, SPD, New Delhi. 	
Web links and Video Lectures (e-Resources):	
<ul style="list-style-type: none"> • https://swayam.gov.in • https://nptel.ac.in • http://elearning.vtu.ac.in 	
Skill Development Activities Suggested	
<ul style="list-style-type: none"> • On Site calculation of the material, placing order of the different civil engineering material • Understanding different estimation and placing required order of the estimated materials • Different contracts related to civil engineering and case study 	

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Attain the knowledge on estimates, Develop and present rate analysis and specifications. And Develop and present the tender documents for the project	L1, L2, L3,L4
CO2	Attain the knowledge on tendering procedure, claims and dispute mechanisms. And Attain the knowledge on BOT, PPP, Concession contracts	L1, L2, L3
CO3	Attain the knowledge on laws affecting engineers, relational contracts	L1, L2, L3

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze different contracts related to civil engineering	1
2	Design an excel sheet for the various estimation	4
3	Design software for estimation of the materials	5
4	Analyze requirement of the estimated materials to different site	6
5	Analyze calculated material to required martial in the site and place the order	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester- III

CONSTRUCTION DEMOLITION AND WASTE MANAGEMENT			
Course Code	22UCT322	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy:	40 Hours of teaching	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • CO1: Focus on the principles of sustainable construction and demolition waste management and resource efficiency. • CO2: Examine the environmental impact of building materials, formulating and designing pre-construction and site waste management plans. 			
Module-1			
Environmental Impact of Building Materials, Embodied energy of materials; impact on the local environment; toxicity of the material; lifecycle assessment-examples. Nature and Source of Direct and indirect waste; site types and origins; composition; quantity; current recycling/reuse potential of building materials.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Construction and Demolition Waste Management Plans, International good practice; planning requirements; demolition plans; site implementation; supplier agreements; sub-contractor management; role of waste management contractor; training; auditing; current disposal options; health and safety; reporting to local authorities. Treatment of Construction and Demolition Waste, waste permits; waste licenses; waste transfer facilities; landfills; treatment technologies; hazardous waste facilities; reporting to EPA.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Designing for Waste Prevention and Minimization. Client, contractor and designer attitudes; proper maintenance of existing buildings; reuse of existing building structure; design flexibility; design for reuse and recycling; dimensional co-ordination and standardization; material selection and control.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-4			
Waste Forecasting Tools, Application of WRAP's, Procedure for designing out waste tool for buildings and civil engineering projects; WRAP net waste tool; BRESMART Waste; WRAP Site Waste Management Plan Tracker			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-5			
Future developments and potential future markets; Production of precast elements using demolished wastes. Significance of partial replacement or substitution of construction materials. Smart materials; Properties, components, classification, advantages and applications. Use of eco-materials; Properties and types.			
Teaching Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- 1 Three Unit Tests each of **20 Marks**
- 2 Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods/question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 2 The question paper will have ten full questions carrying equal marks.
- 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- 4 Each full question will have a sub-question covering all the topics under a module.
- 5 The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Books**

- 1 Stessel, R. I. Recycling and resource recovery engineering: principles of waste processing. Springer Science & BusinessMedia, (2012).
- 2 Greg Winkler, "Recycling Construction and Demolition waste: A LEED-Based Toolkit (Green Source) McGraw HillPublishers.
- 3 VMTam,ChiMingTam,"ReuseofConstructionandDemolitionWasteinHousingDevelopment", Nova SciencePublishers, 2008.
- 4 Nováková, I., &Mikulica, K. (2016). Properties of concrete with partial replacement of natural aggregate by recycled concreteaggregates from precast production. Procedia Engineering, 151, 360-367
- 5 Xiao, J. (2018). Reclaim of Waste Concrete. In Recycled Aggregate Concrete Structures (pp. 15-37).Springer, Berlin, Heidelberg

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Visit construction Demolition management company, classify various demolition waste
- Identify different materials to reuse, repair and recycle from the demolition waste
- Identify various screening methods to use demolition waste in construction

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Formulate, design, evaluate and review pre-construction and construction phase resource efficient waste management plans	L1, L2, L3
CO2	Evaluate, assess and recommend potential reuse/recycling/disposal options considering existing and potential future markets/use	L1, L2, L3

Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze different demolition waste materials	1
2	Design an screening technology to make use of demolition waste	4
3	Design protocol to repair, reuse and recycle technology	5
4	Analyze requirement of the raw materials for reuse of the demolition waste	6
5	Analyze various technique for recycling the construction defoliation waste	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- III

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES			
Course Code	22UCT323	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy:	40 Hours of teaching	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • CO1: To take the appropriate decision in respect of choice of Pre-stressed section over R.C.C. • CO2: To design the structures with various methods of pre-stressing. 			
Module-1			
Design of high strength concrete mixes. Loss of prestress in single span and continuous beams.			
Use of IS 1343-1980, Analysis Limit State Design of beams for Tension Type II and III problems, Cracking moment, untensioned reinforcement, Partial prestressing, Stress Corrosion. Transfer of prestress by bond, Transverse tensile stresses, Endzone reinforcement. Behaviour of Bonded and unbonded prestress concrete beams.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Deflection of Prestressed concrete members, short and long term control of deflections. Crack width considerations. Flexural strength of prestressed concrete sections: Types of flexural failures, Limit state concept			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Shear resistance of prestressed concrete members: Principal stresses and ultimate shear Resistance, Design of shear reinforcement, pre stressed concrete, members in Torsion, Design of reinforcement in torsion shear and bending.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-4			
Stress distribution in end block, Analysis and Anchorage Zone reinforcement. Composite Construction of prestressed precast and cast in situ concrete. Statically Indeterminate structures: Continuous beams, primary and secondary moments, Continuity, concordant cable profile, Analysis and Design of continuous beams.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-5			
Pre-stressed concrete pipes and poles. Design of Pre-stressed concrete tanks. Pre-stressing of dams and bridges: Method of construction. Stage prestressing, Dynamic and Fatigue behaviour of pre-stressed concrete.			
Teaching Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- 1 Three Unit Tests each of 20 Marks
- 2 Two assignments each of 20 Marks or one Skill Development Activity of 40 marks
- 3 To attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 2 The question paper will have ten full questions carrying equal marks.
- 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- 4 Each full question will have a sub-question covering all the topics under a module.
- 5 The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Books**

- 1 NigelRHewon :PrestressedConcreteBridge,DesignandconstructionThomasTelfordLondon2003
- 2 DevidA.Sheppard&WilliamR.PhillipsPlanCastPrecastandPrestressedconcrete(ADesignGuide)Mcgraw Hill PublicationCo. 1989.
- 3 N.KrishnarajuPrestressedConcreteTataMcGrawHill(ThirdEdition)1981.
- 4 Lin T.Y,Burns N.H. Design of Prestressed Concrete Structures. John Wiley & sons (Third Edition)1982

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Site Visit to pre stressed construction structures, infrastructure and buildings projects
- Understanding the difference between pre tension and post tension process in actual site
- Visit metro construction to understand various process of pre stressed concrete

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	To take the appropriate decision in respect of choice of Pre-stressed section over R.C.C	L1, L2, L3,L4
CO2	To design the structures with various methods of pre-stressing.	L1, L2, L3,L4

Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze different pre stressed structure	1
2	Design various pre and post tensioned structures	4
3	Design pre cast units	5
4	Analyze requirement of the raw materials for pre stressed structures	6
5	Analyze energy module in pre and post tensioned units	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester- III

ENERGY AND BUILDINGS			
Course Code	22UCT324	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy:	40 Hours of teaching	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • CO1: To understand the importance of energy conservation. • CO2: To understand importance of non-renewable resources. • CO3: To design energy efficient buildings 			
Module-1			
Conservation & energy efficiency concepts-overview of significance of energy use- RenewableandNonRenewable, energy and their significance, Global energy and environmental resources, Impact of temperature change, Energy crises Energy processes in buildings.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Solar energy fundamentals & practices in building design- solar astronomical relations and radiation physics and measurements, design decision for optimal orientation of building, shadow analysis.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Heating and ventilation design- Human thermal comfort, climatological factors, material specifications and heat transfer principles, thermal performance evaluation, Heat loss from buildings, design of artificial ventilation system, design of insulators			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		

Module-4	
Design audits & economic optimization- Concept of cost/benefit of energy conservation & carbon footprint estimation. Energy efficient lighting system design: Basic terminologies and standards, daylighting and artificial lighting design, auditing.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit
Module-5	
Computerenergysimulationprograms-Needforenergysimulationprogramsand its working, Energy simulation tools, Implementation of computer simulation programs	
Teaching Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit
Assessment Details (both CIE and SEE)	
<p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ul style="list-style-type: none"> • Three Unit Tests each of 20 Marks • Two assignments each of 20 Marks or one Skill Development Activity of 40 marks • To attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2 The question paper will have ten full questions carrying equal marks. 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4 Each full question will have a sub-question covering all the topics under a module. 5 The students will have to answer five full questions, selecting one full question from each module 	
Suggested Learning Resources:	
<p>Books</p> <ol style="list-style-type: none"> 1. MiliMajumdar, “Energy Efficient Buildings In India”, The Energy Research Institute. 2. LalJayamaha Energy-EfficientBuildingSystems,McGrawHillPublication. 3. J A Duffie& W A Beckman Solar Energy and thermal processes, John Wiley 4. Energy Conservation Building Code, 2007. 5. Handbook of functional requirement of buildings, SP: 41:1987 	
Web links and Video Lectures (e-Resources):	
<ul style="list-style-type: none"> • https://swayam.gov.in • https://nptel.ac.in • http://elearning.vtu.ac.in 	
Skill Development Activities Suggested	
<ul style="list-style-type: none"> • Understand the energy model in the buildings, and energy required in the various stages of the construction • Analyse life cycle of the Building materials and importance of sustainable technology 	

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Understand the importance of energy resource	L1, L2, L3
CO2	Design energy efficient buildings	L1, L2, L3

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze different energy module in the building	1
2	Design various steps in calculating energy required in the process	4
3	Design protocol for the energy calculation	5
4	Analyze requirement of the energy right from extraction till demolition of the building	6
5	Analyze energy module in the building	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- III

SUSTAINABILITY AND LIFE CYCLE ASSESSMENT			
Course Code	22UCT331	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy:	40 Hours of teaching	Total Marks	100
Credits	3	Exam Hours	3
<p>Course Learning objectives:</p> <ul style="list-style-type: none"> • CO1: Introduce the fundamental concepts related to interaction of industrial and environmental /ecological systems. • CO2: Exposure to sustainability challenges facing the current generation and systems-based approaches required to create sustainable solutions to society. • CO3: Understand the concepts and scientific methods of a systems-based, trans-disciplinary approach to sustainability. • CO4: Identify problems in sustainability and formulate appropriate solution based on scientific research, applied science, social and economic issues. • CO5: Basic concepts of Life Cycle Assessment(LCA) along with Life Cycle Inventory (LCI)and Life Cycle Impact Assessment(LCIA) including social and economic dimension 			
Module-1			
Introduction to Sustainability Concepts and Life Cycle Analysis (Introduction, Material flow and waste management, What it all means for an engineer? Water energy and food nexus).			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Risk and Life Cycle Framework for Sustainability (Introduction, Risk, Environmental Risk Assessment, Example Chemicals and Health Effects, Character of Environmental Problems).			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Environmental Data Collection and LCA Methodology (Environmental Data Collection Issues, Statistical Analysis of Environmental Data, Common Analytical Instruments, Overview of LCA Methodology -Goal Definition, Life Cycle Inventory, Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Software tools).			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-4			
Life Cycle Assessment – Detailed Methodology and ISO Framework (Detailed Example on LCA Comparisons, LCA Benefits and Drawbacks, Historical Development and LCA Steps from ISO Framework). Life Cycle Inventory and Impact Assessments (Unit Processes and System Boundary Data Quality, Procedure for Life Cycle Impact Assessment, LCIA in Practice with Examples, Interpretation of LCIA Results).			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		

Module-5	
Factors for Good LCA Study (ISO Terminologies, LCA Steps Recap, Chemical Release and Fate and Transport, and Green Sustainable Materials). Design for Sustainability (Environmental Design for Sustainability: Economic, Environmental Indicators, Social Performance Indicators, Sustainable Engineering Design Principles and Environmental Cost Analysis).	
Teaching Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit
Assessment Details (both CIE and SEE)	
<p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1 Three Unit Tests each of 20 Marks 2 Two assignments each of 20 Marks or one Skill Development Activity of 40 marks 3 To attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2 The question paper will have ten full questions carrying equal marks. 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4 Each full question will have a sub-question covering all the topics under a module. 5 The students will have to answer five full questions, selecting one full question from each module 	
Suggested Learning Resources:	
<p>Books</p> <ol style="list-style-type: none"> 1. “Essentials of bridge Engineering”, D.Johnson Victor,-Oxford, IBH publishing company, ISBN, 8120417178, 9788120417175. 2.“ Bridge Engineering”, Ponnuswamy-,1989, McGraw Hill Publication ISBN - 100070656959. 3. “Design of Concrete Bridges”, VaziraniRatwani&M.G.Aswani, 2004 –Khanna Publishers, New Delhi, ISBN-13. 978-81-7409-117-3. 4. “Design of Bridges”- Dr. Krishna Raju, Oxford, 2001 IBH Publishing company Limited, ISBN978-81-204-1741-0 788120 114 17410. 	
Web links and Video Lectures (e-Resources):	
<ul style="list-style-type: none"> • https://swayam.gov.in • https://nptel.ac.in • http://elearning.vtu.ac.in 	
Skill Development Activities Suggested	
<ul style="list-style-type: none"> • Identify the sustainability challenges facing the current generation • Analyse various sustainable solutions to society • Visit sustainable construction sites 	

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Conceptualise the fundamental concepts related to interaction of industrial and environmental /ecological systems..	L1, L2, L3.
CO2	Identify the sustainability challenges facing the current generation and to recommend systems-based approaches required to create sustainable solutions to society.	L1, L2, L3.
CO3	Identify problems in sustainability and formulate appropriate solution.	L1, L2, L3,L4.
CO4	Conceptualise LCA, LCI and LCIA.	L1, L2, L3.

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze industrial and environmental /ecological systems.	1
2	Design Environmental Data Collection and LCA Methodology	4
3	Design protocol for the energy calculation	5
4	Analyze Life Cycle Analysis of the building	6
5	Analyze energy module in the building	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- III

GREEN BUILDING TECHNOLOGY			
Course Code	22UCT332	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy:	40 Hours of teaching	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • CO1: To impart knowledge of the principles behind the green building technologies • CO2: To know the importance of sustainable use of natural resources and energy • CO3: To understand the principles of effective energy and resources management in buildings. • CO4: To bring awareness of the basic criteria in the green building rating systems • CO5: To understand the methodologies to reduce, recycle and reuse towards sustainability 			
Module-1			
Introduction to Green Buildings: Definition of green buildings and sustainable development, typical features of green buildings, benefits of green buildings towards sustainable development. Green building rating systems – GRIHA, IGBC and LEED, overview of the criteria as per these rating systems			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Site selection and planning: Criteria for site selection, preservation of landscape, soil erosion control, minimizing urban heat island effect, maximize comfort by proper orientation of building facades, day lighting, ventilation, etc. Water conservation and efficiency: Rainwater harvesting methods for roof& non-roof, reducing landscape water demand by proper irrigation systems, water efficient plumbing systems, water metering, waste water treatment, recycle and reuse systems			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Energy Efficiency: Environmental impact of building constructions, Concepts of embodied energy, operational energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air-conditioning systems in buildings, zero ozone depleting potential (ODP) materials, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings..			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-4			
Building materials: Methods to reduce embodied energy in building materials: (a) Use of local building materials (b) Use of natural and renewable materials like bamboo, timber, rammed earth, stabilized mud blocks, (c) use of materials with recycled content such as blended cements, pozzolana cements, fly ashbricks, vitrified tiles, materials from agro and industrial waste. (d) reuse of waste and salvaged materials Waste Management: Handling of construction waste materials, separation of household waste, on-site and off-site organic waste management			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-5			
Indoor Environmental Quality for Occupant Comfort and Wellbeing: Daylighting, air ventilation, exhaust systems, low VOC paints, materials & adhesives, building acoustics. Codes related to green buildings: NBC, ECBC, ASHRAE, UPC etc			
Teaching Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
- To attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

- 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 2 The question paper will have ten full questions carrying equal marks.
- 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- 4 Each full question will have a sub-question covering all the topics under a module.
- 5 The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Books**

- 1 IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian GreenBuilding Council Publishers.
- 2 GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment
- 3 Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. NanjundaRao.
- 4 Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers
- 5 Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Understand concepts of green building technologies through specie site
- Green building rating systems – GRIHA, IGBC and LEED, applying them in the local building
- Energy Efficiency and its importance through plant visit

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Define a green building, along with its features, benefits and rating systems	L1, L2, L3.
CO2	Describe the criteria used for site selection and water efficiency methods.	L1, L2, L3.
CO3	Explain the energy efficiency terms and methods used in green building practices.	L1, L2, L3.
CO4	Select materials for sustainable built environment & adopt waste management methods	L1, L2, L3.
CO5	Describe the methods used to maintain indoor environmental quality	L1, L2, L3.

Program Outcome of this course		
Sl. No.	Description	POs
1	Analyze Green building rating systems.	1
2	Design a green building, along with its features	4
3	Design energy efficiency in green building	5
4	Analyze Life Cycle Analysis of the building	6
5	Analyze energy module in the building	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester- III

DESIGN OF BRIDGES AND GRADE SEPARATORS			
Course Code	22UCT333	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy:	40 Hours of teaching	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • CO1: Describe the types and components of a bridge with specifications for designing them for highways. • CO2: Discuss the use of different types of bridge bearings, their installation and maintenance aspects under the action of vehicular loads. • CO3: Examine the design aspects of bridge approaches for RCC, PSC and Steel bridges • CO4: Analyse the loading conditions on the bridges and design the elements as per IRC load specifications • CO5: Identify the quality control measures during the execution of bridges both for substructure and super structure portions of the bridge 			
Module-1			
Introduction: Historical Developments, Site Selection for Bridges, Classification of Bridges and Forces on Bridges. Bridge substructures: Abutments, Wing walls, Approaches.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Box Culvert: Different Loading Cases IRC Class AA Tracked, Wheeled and Class A Loading, working out the worst combination of loading, Moment Distribution, Calculation of BM & SF, Structural Design of Slab Culvert, with Reinforcement Details.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		

Module-3	
T Beam Bridge Slab Design: Proportioning of Components Analysis of interior Slab & Cantilever Slab Using IRC Class AA Tracked, Wheeled Class A Loading, Structural Design of Slab, with Reinforcement Detail. T Beam Bridge Cross Girder Design: Analysis of Cross Girder for Dead Load & Live Load Using IRC Class AA Tracked, Wheeled Class A Loading A Loads, Structural Design of beam with Reinforcement Detail.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit
Module-4	
Bearings – Types of bearings, Bearings for slab bridges – Bearings for girder bridges – Design of Elastomeric bearing – Joints – Expansion joints, repair and rehabilitation of concrete bridges.	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit
Module-5	
PSC Bridges: Introduction to Pre and Post Tensioning, Proportioning of Components, Analysis and Structural Design of Slab, Analysis of Main Girder using COURBON's Method for IRC Class AA tracked vehicle, Calculation of pre-stressing force and eccentricity, cable profile and calculation of stresses, Design of End block and detailing of main girder.	
Teaching Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit
Assessment Details (both CIE and SEE)	
<p>The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.</p> <p>Continuous Internal Evaluation:</p> <ol style="list-style-type: none"> 1 Three Unit Tests each of 20 Marks 2 Two assignments each of 20 Marks or one Skill Development Activity of 40 marks 3 Tto attain the COs and POs <p>The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks</p> <p>CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.</p> <p>Semester End Examination:</p> <ol style="list-style-type: none"> 1 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. 2 The question paper will have ten full questions carrying equal marks. 3 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module. 4 Each full question will have a sub-question covering all the topics under a module. 5 The students will have to answer five full questions, selecting one full question from each module 	
Suggested Learning Resources:	
Books	
<ol style="list-style-type: none"> 1. "Essentials of bridge Engineering", D.Johnson Victor,-Oxford, IBH publishing company, ISBN, 8120417178, 9788120417175. 2."Bridge Engineering", Ponnuswamy-,1989, McGraw Hill Publication ISBN - 100070656959. 3. "Design of Concrete Bridges", VaziraniRatwani&M.G.Aswani, 2004 –Khanna Publishers, New Delhi, ISBN-13. 978-81-7409-117-3. 4. "Design of Bridges"- Dr. Krishna Raju, Oxford, 2001 IBH Publishing company Limited, ISBN978-81-204-1741-0 788120 114 17410. 	

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Site visits during the construction of various types of bridges in the local
- Understand the design concepts, Bridge substructures: Abutments
- Analyse the loading conditions on the bridges and design the elements through manual and software

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain the components of a bridge following the specifications for highways.	L1, L2, L3.
CO2	Compare different types of bridge bearings, their installation and maintenance aspects under the action of vehicular loads.	L1, L2, L3.
CO3	Analyse the IRC loading conditions for the design of bridges.	L1, L2, L3,L4.
CO4	Evaluate the design aspects of bridge approaches for RCC, PSC and Steel bridges.	L1, L2, L3,L4.

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze different load conduction coming on bridge structure.	1
2	Design steps of substructure, abutments of the bridge structure	4
3	Design main structure of the bridge	5
4	Analysis of interior Slab & Cantilever Slab	6
5	Analyze of Cross Girder for Dead Load & Live Load	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	x	x	x	-	-
CO2	x	x	x	x	x	x
CO3	x	x	-	x	x	x
CO4	x	x	-	-	-	-
CO5	x	x	-	-	-	-

Semester- III

REMOTE SENSING & GEOGRAPHIC INFORMATION SYSTEM			
Course Code	22UCT334	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy:	40 Hours of teaching	Total Marks	100
Credits	3	Exam Hours	3
Course Learning objectives:			
<ul style="list-style-type: none"> • CO1: To introduce remote sensing and GIS as a Vital tool for faster decision making. • CO2: The main aim of the course is to impart knowledge on the concepts and application of remote sensing and GIS for general and specific tasks. 			
Module-1			
Geodatabase: Types of geodatabase, Advantages of geodatabase, Basic geodatabase structure, Topology, Relational classes, geometric networks, raster data – Creating geodatabase, organizing data, defining database Structure - Understanding spatial reference in geodatabase - Modifying spatial domain, Simple feature creation in geodatabase, Creating and editing map topology , Types of geodatabase annotation - Adding behavior to a Geodatabase			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-2			
Multi-Criteria Decision Analysis and SDSS: Elements of multi-criteria decision analysis, classification of decision problems, evaluation criteria, hierarchical decision alternatives and constraints, alternatives and decision variables, deterministic variables, criteria weighting , estimation weights, ranking methods, decision rules, multi-attribute decision rules, sensitivity analysis, multi-criteria spatial decision support systems (SDSS). Cartography			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-3			
Advanced GIS Introduction to Geographic Resources Analysis Support System (GRASS) GIS Raster data handling Reclassification, recode map algebra Resampling and interpolation of raster data. Overlaying Spatial analysis Neighborhood analysis and cross-category statistics -buffering Cost surfaces --Terrain and watershed analysis -Modeling raster data-Vector data handling-Topological operations - Buffering -Overlay -Dissolve -clip, union intersect -Network analysis-Spatial			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-4			
Expert GIS: Introduction to concepts of Expert GIS, Data formats, Proprietary file formats, translator and Transfer formats, open formats, standards, metadata, standards gazetteer, XML and GML, Spatial databases, Relational databases, object databases, GIS and databases, advanced database technology, derived mapping.			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		
Module-5			
Enterprise GIS: User need assessment; old and new spatial database models, SDE layers, Geo database, Architecture design, capacity planning (Hardware), security planning, RDBMS software selection, GIS software selection, planning for migration. Enterprise GIS management, Case Studies			
Teaching Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry, site and skill development centers visit		

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
- To attain the COs and POs
The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom’s taxonomy as per the outcome defined for the course.

Semester End Examination:

- 6 The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- 7 The question paper will have ten full questions carrying equal marks.
- 8 Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- 9 Each full question will have a sub-question covering all the topics under a module.
- 10 The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:**Books**

1. S.C. Sharma, “Disaster Management” Khanna book publishing co., (2018, reprint 2019) ISBN 978-93-86173-38-6
2. Dr. Mrinalini Pandey, “Disaster management” , Wiley India pvt, (2014, reprint 2016)
3. Singhal J.P. “Disaster Management” , Laxmi Publications, 2010. ISBN- 10:9380386427 ISBN13:978-9380386423
4. Tushar Bhattacharya, “Disaster Science and Management” , McGraw Hill India Education Pvt. Ltd., 2012. ISBN -10:1259007367, ISBN 13:978-1259007361]

Web links and Video Lectures (e-Resources):

- <https://swayam.gov.in>
- <https://nptel.ac.in>
- <http://elearning.vtu.ac.in>

Skill Development Activities Suggested

- Site visits to learn Remote Sensing and GIS
- Understand different Geodatabase in India
- Analyse Multi-Criteria Decision

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain the principles of Geodatabase	L1, L2, L3.
CO2	Discuss the application of multicriteria decision analysis for various issues	L1, L2, L3.
CO3	Recognize the various advances in GIS, Applications of Expert GIS	L1, L2, L3,L4.
CO4	Discuss Enterprise GIS management, Case Studies	L1, L2, L3,L4.

Program Outcome of this course

Sl. No.	Description	POs
1	Analyze different Geo database	1
2	Design Multi-Criteria Decision	4
3	Design handling-Topological and buffering	5
4	Analysis standards gazetteer, XML and GML	6
5	Analyze derived mapping	7
6	Engage in critical thinking and provide solution for various civil engineering problems, in industry	8

Mapping of COS and POs

	PO1	PO4	PO5	PO6	PO7	PO8
CO1	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester III

PROJECT WORK PHASE – 1			
Course Code	22UCT34	CIE Marks	100
Number of contact Hours/Week	00:06:00	SEE Marks	--
Credits	03	Exam Hours	--
<p>Course objectives:</p> <ul style="list-style-type: none"> • Support independent learning. • Guide to select and utilize adequate information from varied resources maintaining ethics. • Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • Develop interactive, communication, organisation, time management, and presentation skills. • Impart flexibility and adaptability. • Inspire independent and team working. • Expand intellectual capacity, credibility, judgement, intuition. • Adhere to punctuality, setting and meeting deadlines. 			
<p>Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.</p> <p>Seminar: Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the selected project orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p>			
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Demonstrate a sound technical knowledge of their selected project topic. • Undertake problem identification, formulation, and solution. • Design engineering solutions to complex problems utilising a systems approach. • Communicate with engineers and the community at large in written and oral forms. 			

SOCIETAL PROJECT			
Course Code	22UCT35	CIE Marks	100
Number of contact Hours/Week	00:06:00	SEE Marks	--
Credits	03	Exam Hours	--
<p>Course objectives:</p> <ul style="list-style-type: none"> • Support independent learning. • Guide to select and utilize adequate information from varied resources maintaining ethics. • Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • Develop interactive, communication, organisation, time management, and presentation skills. • Impart flexibility and adaptability. • Inspire independent and team working. • Expand intellectual capacity, credibility, judgement, intuition. • Adhere to punctuality, setting and meeting deadlines. 			
<p>Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the societal Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.</p> <p>Seminar: Each student, under the guidance of a Faculty, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the selected societal project orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit two copies of the typed report with a list of references. <p>The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.</p>			
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Demonstrate a sound technical knowledge of their selected societal project topic. • Undertake problem identification, formulation, and solution. • Design engineering solutions to complex problems utilising a systems approach. • Communicate with engineers and the community at large in written and oral forms. 			

Semester III

INTERNSHIP			
Course Code	22UCTI36	CIE Marks	50
Number of contact Hours	06 Weeks	SEE Marks	50
Credits	06	Exam Hours	03
<p>Course objectives: Internship provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,</p> <ul style="list-style-type: none"> • To put theory into practice. • To expand thinking and broaden the knowledge and skills acquired through course work in the field. • To relate to, interact with, and learn from current professionals in the field. • To gain a greater understanding of the duties and responsibilities of a professional. • To understand and adhere to professional standards in the field. • To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality. • To identify personal strengths and weaknesses. • To develop the initiative and motivation to be a self-starter and work independently. 			
<p>Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.</p> <p>Seminar: Each student, is required to</p> <ul style="list-style-type: none"> • Present the seminar on the internship orally and/or through power point slides. • Answer the queries and involve in debate/discussion. • Submit the report duly certified by the external guide. • The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident. 			
<p>Course outcomes: At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Gain practical experience within industry in which the internship is done. • Acquire knowledge of the industry in which the internship is done. • Apply knowledge and skills learned to classroom work. • Develop a greater understanding about career options while more clearly defining personal career goals. • Experience the activities and functions of professionals. • Develop and refine oral and written communication skills. • Identify areas for future knowledge and skill development. 			

Semester IV

PROJECT WORK PHASE -2			
Course Code	22UCT41	CIE Marks	100
Number of contact Hours/Week	00:08:00	SEE Marks	100
Credits	18	Exam Hours	03
<p>Course objectives:</p> <ul style="list-style-type: none"> • To support independent learning. • To guide to select and utilize adequate information from varied resources maintaining ethics. • To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly. • To develop interactive, communication, organisation, time management, and presentation skills. • To impart flexibility and adaptability. • To inspire independent and team working. • To expand intellectual capacity, credibility, judgement, intuition. • To adhere to punctuality, setting and meeting deadlines. • To instil responsibilities to oneself and others. • To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas. 			
<p>Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.</p>			
<p>Course outcomes:</p> <p>At the end of the course the student will be able to:</p> <ul style="list-style-type: none"> • Present the project and be able to defend it. • Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task. • Habituated to critical thinking and use problem solving skills • Communicate effectively and to present ideas clearly and coherently in both the written and oral forms. 			

