

Semester - II

Title of the subject : Pre Engineered Construction Technology			
Course Code	MCCT201	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			
<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			
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			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit		
MODULE-2			
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			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit		
MODULE-3			
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			
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit		
MODULE-4			
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			

Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit
MODULE 5	
Pre-Engineered Buildings : Introduction, Advantages, Pre Engineered Buildings Vs. Conventional Steel Buildings, Design Consideration of Pre Engineered Buildings (PEB) – Applications	
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

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 **25 Marks**
2. Two assignments each of **25 Marks/One Skill Development Activity of 50 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 the 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:

Books

1. L. Makk, "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	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester - II

Title of the subject : Construction Materials			
Course Code	MCCT202	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	3	Exam Hours	3
<p>Course Objectives: This course will enable students to</p> <ol style="list-style-type: none"> 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			
<p>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</p>			
Teaching-Learning Process	<p>Black board, LCD, Skill enhancement through problem solving, Industry visits to understand Green building ratings system.</p>		
MODULE-2			
<p>Alternative Building Materials: Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibres- 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.</p>			
Teaching-Learning Process	<p>Black board, LCD, Skill enhancement through problem solving, Construction site visits to understand the nature of Alternative Building Materials</p>		
MODULE-3			
<p>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</p>			
Teaching-Learning Process	<p>Black board, LCD, Skill enhancement through problem solving, Construction site visits to understand the nature of Special Concretes</p>		
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
<p>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</p> <p>CIE for the theory component of IPCC</p>	

4. Two Tests each of **25 Marks**
5. Two assignments each of **25 Marks/One Skill Development Activity of 50 marks**
6. 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 the University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

5. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
6. The question paper will have ten questions. Each question is set for 20 marks.
7. 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.
8. The students have to answer 5 full questions, selecting one full question from each module.

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- 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 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- II

Title of the Subject: Restoration and Rehabilitation of the Structures			
Course Code	MCCT203	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy:	40 Hours	Total Marks	100
Credits	3	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
<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> <ol style="list-style-type: none"> Two Unit Tests each of 25 Marks Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs <p>The sum of two 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"> 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>Books</p> <ol style="list-style-type: none"> Bhattacharjee, Concrete structures Repair, Rehabilitation and Retrofitting, CBS Publishers, 2017 B. Vidivelli, Rehabilitation of concrete Structures, standard Publishers and distributors, 2007 R T Allen, S C Edwards and D.N. Shaw, Repair of Concrete Structures, CRC press, 1992 A Technical Report on Learning of failures from Deficiencies in design, construction and Service, Raikar R. N., R & D Centre SDCPL 	
<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"> 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	-	×	×	×	-	-
CO2	×	×	×	×	×	×
CO3	×	×	-	×	×	×
CO4	×	×	-	-	-	-
CO5	×	×	-	-	-	-

Semester- II

Title of the subject : Mechanization in Construction			
Course Code	MCCT204	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40Hours	Total Marks	100
Credits	3	Exam Hours	3
<p>Course Objectives: This course will enable students to</p> <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			
<p>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</p>			
Teaching-Learning Process	<p>Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit</p>		
Module-2			
<p>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</p>			
Teaching-Learning Process	<p>Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit</p>		
Module-3			
<p>Mechanization in rebar fabrication Mechanization through construction: formwork and Scaffolding types, materials and design principles</p>			
Teaching-Learning Process	<p>Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit</p>		
Module-4			
<p>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.</p>			

Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry and skill development centers visit
Module-5	
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	
Teaching-Learning Process	Black board, LCD, Skill enhancement through problem solving, Industry 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> <ol style="list-style-type: none"> Two Unit Tests each of 25 Marks Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs <p>The sum of two 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"> 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"> Mahesh Varma, “Construction Equipment and its Planning and Applications”, Metropolitan Book Co.(P) Ltd., New Delhi. India. Sharma S.C. “Construction Equipment and Management”, Khanna Publishers, Delhi, 1988 “Construction Review” Published by Civil Engineering and Construction Review, New Delhi, 1991. 	
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

- 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	8

Mapping of COS and POs

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

Semester- II

Title of the subject : Construction Economics and Finance			
Course Code	MCCT215A	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy:	40 Hours	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
<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> <ol style="list-style-type: none"> Two Unit Tests each of 25 Marks Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs <p>The sum of two 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"> 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>Books</p> <ol style="list-style-type: none"> 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 	
<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 	

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

Title of the subject : Building Services and Maintenance			
Course Code	MCCT215B	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy:	40 Hours	Total Marks	100
Credits	3	Exam Hours	3
<p>Course Learning objectives:This course will enable the students to</p> <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> <ol style="list-style-type: none"> Two Unit Tests each of 25 Marks Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs <p>The sum of two 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"> 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"> R. Udaykumar “A text book on Building Services”, Eswar Press, ISBN-13,9788178740638, Chennai. S. M. Patil “Building Services”, Seema Publication, ISBN-13,1234567121246, Mumbai Revised edition. Dr. B. C. Punmia “Building Construction”, Laxmi Publications (P) Ltd., Edition 11-2017, New Delhi. 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"> “National Building Code of India - 2005”, Bureau of Indian Standards, BIS, 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"> 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	PO's
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	8

Mapping of COS and POs

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

Semester- II

Title of the subject : Advanced Reinforced Concrete Design			
Course Code	MCCT215C	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy:	40 Hours	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. Two Unit Tests each of **25 Marks**

2. Two assignments each of **25 Marks** or **one Skill Development Activity of 50 marks** to attain the COs and POs

The sum of two 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	L2,L3,L4,L5
CO2	Use effectively the various methods of ground improvement techniques depending upon the requirements	L1,L2,L3,L6
CO3	Use effectively the various methods of ground improvement techniques depending upon the requirements	L1,L2,L3,L6
CO4	Select the appropriate type of Dewatering technique and application of Geosyntheics	L2,L4,L5,L6
CO5	Apply Grouting technique for different site conduction	L2,L4,L5,L6

Program Outcome of this course

Sl. No.	Description	PO's
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 Geosyntheics	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- II

Title of the subject : Building Cost and Quality Management			
Course Code	MCCT216A	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy:	40 Hours	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:

1. Two Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks** or **one Skill Development Activity of 50 marks** to attain the COs and POs

The sum of two 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 B.N.Dutta "Estimating and Costing" UBSPublishers'Distributors PvtLtd,28th Revised 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. sites	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	PO's
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

Title of the subject : Construction Quality and Safety			
Course Code	MCCT216B	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	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 to</p> <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 behavioural 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: 1. Two Unit Tests each of 25 Marks 2. Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs The sum of two 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. Logothetis, N. "Management for total quality." <i>ed: Prentice-Hall, Upper Saddle River, NJ (1997).</i> 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): <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 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, in industry	8

Mapping of COS and POs

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

Semester- II

Title of the subject : Earthquake Resistant Design of Structure			
Course Code	MCCT216C	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy:	40 Hours	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 behavior 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, modeling concepts of infill masonry walls. Behavior 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 behavior, 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)	
<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. Two Unit Tests each of 25 Marks 2. Two assignments each of 25 Marks or one Skill Development Activity of 50 marks to attain the COs and POs <p>The sum of two 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 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 centers 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	PO's
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	8

Mapping of COS and POs

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

Semester- II

SOFTWARE APPLICATION LABORATORY			
Course Code	MCCTL207	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	03	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 software's • Understand and apply project management techniques. 			
Sl.NO	Experiments		
1	Preparations 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)

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 an 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 01 tests for 100 marks, test shall be conducted after the 14th week of the semester.
- In 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 test marks are scaled down to 20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and marks of test 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 is 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>

Skill and Ability enhancement courses for PG Level Civil Engineering courses			
Course Code	MCCT258	CIE Marks	50
Credits	01	SEE Marks	50

Preamble

The Ability Enhancement and Skill Development Course at the postgraduate level is designed to strengthen students' core competencies and equip them with essential skills for academic and professional advancement. This course focuses on developing critical thinking, academic writing, research methodology, digital literacy, communication, and ethical reasoning to support advanced learning and scholarly engagement. It also emphasizes skill development in areas such as problem-solving, data analysis, entrepreneurship, project management, and the use of discipline-specific tools and technologies. Aligned with the objectives of the National Education Policy (NEP) 2020, the course aims to enhance employability, innovation capacity, and leadership qualities among postgraduate students.

Procedure to take up Skill and Ability enhancement courses for PG Level Civil Engineering courses

Students may opt the subjects from NPTEL (National Programme on Technology Enhanced Learning) online course list and VTU online courses offered during the current semester, subject to the approval of the Department and as per university regulations. The selected course must be relevant to the student's postgraduate program, contribute to academic or professional development, and not duplicate content already covered in the core curriculum. A NPTEL or VTU online course in the semester may be permitted for credit transfer or academic enrichment, provided the course includes assessments such as assignments and proctored examinations. Students must submit their course selection for departmental approval within the first two weeks of the semester. Successful completion of the course, including passing the final certification exam (online) will be required for academic credit or consideration under skill enhancement components.

Some of the Generalized Subjects but not limited for Skill Development Courses (SDC) and Ability Enhancement Courses (AEC)

- Environmental Data Analysis and Simulation Tools
- Disaster Risk Reduction and Management in Infrastructure
- Smart Infrastructure and IoT Applications in Civil Engineering
- Legal Aspects, Contracts, and Arbitration in Construction
- Technical Communication and Scientific Writing for Engineers
- Entrepreneurship and Innovation in Civil Engineering
- Project Formulation and Proposal Writing
- Digital Literacy and Software Tools for Engineering Research
- Intellectual Property Rights and Patent Drafting
- Leadership and Team Management in Engineering Contexts
- Other skill enhancement courses suggested by the respective programs