

**KONGU ENGINEERING COLLEGE**  
**PERUNDURAI ERODE – 638 060**  
**(Autonomous)**

**VISION**

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

**MISSION**

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

**QUALITY POLICY**

We are committed to

- Provide value based quality education for developing the student as a competent and responsible citizen.
- Contribute to the nation and beyond through the state-of-the-art technology.
- Continuously improve our services.

**DEPARTMENT OF CIVIL ENGINEERING**

**VISION**

To develop the department as a center of excellence to take care of the local and regional needs related to Civil Engineering and to meet acute needs of trained specialists in the diverse field of Civil Engineering.

**MISSION**

Department of Civil Engineering is committed to:

- MS1: Encourage students and faculty to undertake research programmes and projects of multi-disciplinary nature.
- MS2: Conduct summer and winter schools for faculty members and short-term course for technicians.
- MS3: Produce Engineers who can participate in technical advancement and social upliftment of the country and to meet the growing global challenges.
- MS4: Prosper in academic activities by continual improvement in teaching methods, laboratory facilities and research activities.
- MS5: Develop consultancy for various industries

**2018 REGULATIONS**

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

Graduates of Construction Engineering and Management will

- PEO1: Competent in construction management to apply engineering and management principles to address the global challenges.
- PEO2: Be able to plan and execute projects with optimum resources by the use of advanced management techniques.
- PEO3: Have commitment to engage in continual learning to fulfill the industrial and societal needs with professional ethics.

### MAPPING OF MISSION STATEMENTS (MS) WITH PEOs

MS\PEO	PEO1	PEO2	PEO3
MS1	3	2	1
MS2	3	1	1
MS3	2	2	3
MS4	1	3	3
MS5	3	2	3

1 – Slight, 2 – Moderate, 3 – Substantial

<b>PROGRAM OUTCOMES (POs)</b>	
<b>Construction Engineering and Management Post Graduates will be able to:</b>	
<b>PO1:</b>	Independently carry out research /investigation and development work to solve practical problems
<b>PO2:</b>	Write and present a substantial technical report/document
<b>PO3:</b>	Understand the requirement of the industry and perform effectively with the managerial skills
<b>PO4:</b>	Schedule construction projects with the aid of software's
<b>PO5:</b>	Apply advanced techniques and practices in construction projects

### MAPPING OF PEOs WITH POs

PEO\PO	PO1	PO2	PO3	PO4	PO5
PEO1	3	1	3	1	3
PEO2	2	1	3	3	3
PEO3	1	2	3	1	3

1 – Slight, 2 – Moderate, 3 – Substantial

### CURRICULUM BREAKDOWN STRUCTURE UNDER REGULATION 2018

Curriculum Breakdown Structure(CBS)	Curriculum content (% of total number of credits of the program)	Total number of contact hours	Total number of credits
Program Core(PC)	44.44	525	33
Program Electives(PE)	23.61	270	18
Project(s)/Internships(PR)/Others	29.16	600	21
<b>Total Credits</b>			<b>72</b>

## KEC R2018: SCHEDULING OF COURSES – ME(Construction Engineering and Management)

Sem.	Theory/ Theory cum Practical / Practical							Internship & Projects	Special Courses	Credits
	1	2	3	4	5	6	7			
I	18CMT11 Management Techniques in Construction (PC-3-1-0-4)	18CMT12 Functional Planning and Building Management (PC-3-0-0-4)	18CMT13 Advanced Construction Materials (PC-3-0-0-3)	18CMT14 Finance and Accounting for Management (PC-3-1-0-4)	18CMT15 Construction Equipment and Machineries (PC-3-1-0-4)	18GMT01 Introduction to Research (PC-3-0-0-3)	18CML11 Management Tools for Construction Engineers I (PC-0-0-2-1)			21
II	18CMT21 Advanced Techniques for Construction ((PC-3-0-0-3)	18CMT22 Construction Planning, Scheduling and Control (PC-3-1-0-4)	18CMT23 Contract Laws and Regulations (PC-3-1-0-4)	Professional Elective - I (PE-3-0-0-3)	Professional Elective - II (PE-3-0-0-3)	Professional Elective - III (PE-3-0-0-3)	18CML21 Management Tools for Construction Engineers II (PC-0-0-2-1)	18CMP21 Mini Project (PR-0-0-2-1)		23
III	Professional Elective - IV (PE-3-0-0-3)	Professional Elective - V (PE-3-0-0-3)	Professional Elective - VI (PE-3-0-0-3)					18CMP31 Project work Phase I (PR-0-0-2-1)	18CMI31 Industrial Training (PR-0-0-0-1)	16
IV								18CMP41 Project work Phase II (PR-0-0-2-1)		12

**Total Credits: 72**

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**M.E. DEGREE IN CONSTRUCTION ENGINEERING AND MANAGEMENT**

**CURRICULUM**

(For the candidates admitted from academic year 2018-19 onwards)

**SEMESTER – I**

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	<b>Theory/Theory with Practical</b>								
18CMT11	Management Techniques in Construction	3	1	0	4	50	50	100	PC
18CMT12	Functional Planning and Building Management	3	0	0	3	50	50	100	PC
18CMT13	Advanced Construction Materials	3	0	0	3	50	50	100	PC
18CMT14	Finance and Accounting for Management	3	1	0	4	50	50	100	PC
18CMT15	Construction Equipment and Machineries	3	0	0	3	50	50	100	PC
18GET01	Introduction to Research	3	0	0	3	50	50	100	PC
	<b>Practical</b>								
18CML11	Management Tools for Construction Engineers I	0	0	2	1	100	0	100	PC
	<b>Total</b>				<b>21</b>				

CA – Continuous Assessment, ESE – End Semester Examination, CBS – Curriculum Breakdown Structure

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**M.E. DEGREE IN CONSTRUCTION ENGINEERING AND MANAGEMENT**

**CURRICULUM**

(For the candidates admitted from academic year 2018-19 onwards)

**SEMESTER – II**

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	<b>Theory/Theory with Practical</b>								
18CMT21	Advanced Techniques for Construction	3	0	0	3	50	50	100	PC
18CMT22	Construction Planning, Scheduling and Control	3	1	0	4	50	50	100	PC
18CMT23	Contract Laws and Regulations	3	1	0	4	50	50	100	PC
	Elective - I	3	0	0	3	50	50	100	PE
	Elective - II	3	0	0	3	50	50	100	PE
	Elective - III	3	0	0	3	50	50	100	PE
	<b>Practical</b>								
18CML21	Management Tools for Construction Engineers II	0	0	2	1	100	0	100	PC
18CMP21	Mini Project	0	0	4	2	100	0	100	PR
	<b>Total</b>				<b>23</b>				

CA – Continuous Assessment, ESE – End Semester Examination, CBS – Curriculum Breakdown Structure

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**CURRICULUM**

(For the candidates admitted from academic year 2018-19 onwards)

**SEMESTER – III**

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	<b>Theory/Theory with Practical</b>								
	Elective - IV	3	0	0	3	50	50	100	PE
	Elective - V	3	0	0	3	50	50	100	PE
	Elective - VI	3	0	0	3	50	50	100	PE
	<b>Practical</b>								
18CMI31	Industrial Training	0	0	0	1	100	0	100	PR
18CMP31	Project Work Phase I	0	0	12	6	50	50	100	PR
	<b>Total</b>				<b>16</b>				

CA – Continuous Assessment, ESE – End Semester Examination, CBS – Curriculum Breakdown Structure

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**M.E. DEGREE IN CONSTRUCTION ENGINEERING AND MANAGEMENT**

**CURRICULUM**

(For the candidates admitted from academic year 2018-19 onwards)

**SEMESTER – IV**

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			CBS
		L	T	P		CA	ESE	Total	
	<b>Practical</b>								
18CMP41	Project Work Phase II	0	0	24	12	50	50	100	PR
	<b>Total</b>				<b>12</b>				

CA – Continuous Assessment, ESE – End Semester Examination, CBS – Curriculum Breakdown Structure

**Total Credits: 72**

**LIST OF PROFESSIONAL ELECTIVES**

Course Code	Course Title	Hours/Week			Credit	CBS
		L	T	P		
<b>SEMESTER II</b>						
18CME01	Material Management	3	0	0	3	PE
18CME02	Construction Project Management	3	0	0	3	PE
18CME03	Management Information Systems	3	0	0	3	PE
18CME04	Infrastructure Management	3	0	0	3	PE
18CME05	Construction Project Control and Organization	3	0	0	3	PE
18CME06	Building Information Management	3	0	0	3	PE
18CME07	Sustainable Engineering Systems for Buildings	3	0	0	3	PE
18CME08	Real Estate Development and Design	3	0	0	3	PE
18CME09	GIS in Construction Engineering and Management	3	0	0	3	PE
18CME10	Construction Personnel Management	3	0	0	3	PE
<b>SEMESTER III</b>						
18SEE16	Metro Transportation System and Engineering	3	0	0	3	PE
18CME11	Shoring, Scaffolding and Formwork	3	0	0	3	PE
18CME12	System Integration in Construction	3	0	0	3	PE
18CME13	Quality Control and Assurance in Construction	3	0	0	3	PE
18CME14	Resource Management and Control in Construction	3	0	0	3	PE
18CME15	IPR and Patenting	3	0	0	3	PE
18CME16	Thrust Areas in Construction	3	0	0	3	PE
18CME17	Project Safety Management	3	0	0	3	PE
18CME18	Maintenance and Rehabilitation of Structures	3	0	0	3	PE
18CME19	Green Building Management	3	0	0	3	PE

18CMT11 MANAGEMENT TECHNIQUES IN CONSTRUCTION					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
Preamble	To give knowledge of various scientific methods to help students in taking right decisions for various aspects of construction projects.				
Prerequisites	Nil				
<b>UNIT – I</b>	<b>9</b>				
<b>Operation Research:</b> Introduction to Operation Research - Structure of Mathematical Model - Limitations of Operation Research - Linear-Programming Problem - Requirements of LPP - Mathematical Formulation of LPP - Graphical Method - Simplex Method Penalty Cost Method.					
<b>UNIT – II</b>	<b>9</b>				
<b>Optimality Analysis:</b> Duality and Post - Optimality Analysis - Transportation Problem - Finding Basic Feasible Solution - Northwest Corner Rule - Least Cost Method - Vogel's Approximation Method - Optimality Test - The Stepping Stone Method - MODI Method - Assignment Problem.					
<b>UNIT – III</b>	<b>9</b>				
<b>Simulation:</b> Introduction - Methodology of Simulation - Basic Concepts - Simulation Procedure - Monte-Carlo Simulation- Applications of Simulation - Advantages of Simulation- Limitations of Simulation.					
<b>UNIT – IV</b>	<b>9</b>				
<b>Decision Theory:</b> Decision Theory - Decision Rules - Decision making under conditions of certainty, risk and uncertainty - Decision trees - Utility Theory - Cost Concepts – Break-even analysis – Pricing Techniques – Game theory Applications.					
<b>UNIT – V</b>	<b>9</b>				
<b>Inventory Models:</b> Deterministic and Probabilistic Inventory Models - ABC Analysis - XYZ Analysis - VED Analysis - Safety Stock - Quantity Discounts - Software Applications.					
<b>Lecture:45, Tutorial:15, Total: 60</b>					
<b>REFERENCES:</b>					
1.	Vohra N.D., "Quantitative Techniques in Management", 3 <sup>rd</sup> Edition, Tata McGraw-Hill Company Ltd., New Delhi, 2006.				
2.	Sehroeder R.G., "Operations Management", 7 <sup>th</sup> Edition, McGraw-Hill, New York, 2017.				
3.	Taha H.A., "Operations Research - An Introduction", 8 <sup>th</sup> Edition, Prentice Hall, 2011.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to					<b>BT Mapped (Highest Level)</b>
CO1:	solve linear problems				Applying (K3)
CO2:	determine the optimal solution for transportation and assignment problems				Applying (K3)
CO3:	apply the basic concepts of simulation				Applying (K3)
CO4:	make use of various decision theory in decision making				Applying (K3)
CO5:	practice various inventory models in inventory management				Applying (K3)
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	3		3		3
CO2	3		3		3
CO3	2		3		3
CO4	3		3		3
CO5	3		3	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CMT12 FUNCTIONAL PLANNING AND BUILDING MANAGEMENT					
		L	T	P	Credit
		3	0	0	3
Preamble	To enable the students to cognize the need for functional planning of buildings by adopting Salient features of Bye Laws				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Basics of Functional Planning of Buildings:</b> Occupancy classification of buildings - Site Planning Considerations - Building codes and rules - Design Guidelines - Ergonomics - Licensing of building works.					
<b>UNIT – II</b>					<b>9</b>
<b>Functional Planning of Multipurpose Buildings:</b> Principles of planning of buildings- Architectural Design Principles - Modular Planning Concept - Planning of residential, institutional, public, commercial, industrial Buildings, Requirements and constraints preparing sketch plan and working drawing site plans.					
<b>UNIT – III</b>					<b>9</b>
<b>Functional Performances of Buildings:</b> Introduction to Anthropometrics - Thermal behavior of buildings - Study of passive design measures - Role of Landscape in thermal performance of buildings – Climatology - Life cycle energy assessment - Carbon foot print of buildings - Lighting assessment - Lighting system planning and integration - Smart lighting.					
<b>UNIT – IV</b>					<b>9</b>
<b>Model Building Bye Laws:</b> Essentials of National Building Code (NBC) - Salient Features of MMBL - Jurisdiction and applicability of Building Documentation - Development Codes - Green Building and Sustainability provisions.					
<b>UNIT – V</b>					<b>9</b>
<b>Introduction to Building Management System (BMS):</b> Characteristics of BMS - Types of BMS - Components of BMS - Advantages and Applications of BMS - BMS System Software - Building Automation Systems - Role of Building Automation and Building performance enhancement - Concept of Intelligent Buildings.					
				<b>Total: 45</b>	
<b>REFERENCES:</b>					
1.	Brown G. Z., “Sun, Wind and Light: Architectural Design Strategies”, John Wiley and Sons, New York, 1985.				
2.	Moore F., “Environmental Control System”, McGraw-Hill, New York, 1994.				
3.	“Model Building bye-law”, Youngs Global Publications, 2016.				
4.	Philzito, “Building Automation Systems”, 1 <sup>st</sup> Edition, Create Space Independent Publications, 2016.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	apply the basics of functional planning of buildings	Applying (K3)			
CO2:	make use of functional planning designs in multipurpose buildings	Applying (K3)			
CO3:	execute the functional performance within buildings	Applying (K3)			
CO4:	categorize the existing laws for design of buildings	Applying (K3)			
CO5:	implement building automation systems in buildings	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		3
CO3	2		3		3
CO4	2		3		3
CO5	2		3	2	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CMT13 ADVANCED CONSTRUCTION MATERIALS					
		L	T	P	Credit
		3	0	0	3
Preamble	To identify advanced construction materials available in the market to perform a construction activity				
Prerequisites	Concrete Technology				
<b>UNIT – I</b>					<b>9</b>
<b>Special Concretes:</b> Translucent Concrete- SensiTile- Electrified Wood- Self-Repairing Cement- Self-Repairing Concrete- Carbon Fiber- Bendable Concrete- Concrete Canvas- Low-E Glass / Films- Condensed Silica Fume-Ternary Blends- Photo catalytic Cement- Advanced Composite Reinforcement- Application of Nano Technology.					
<b>UNIT – II</b>					<b>9</b>
<b>Metals And Alloy:</b> Types of structural steels, special steel, alloy steel, stainless steel, light gauge steel, Corrosion of concrete in various environments. Corrosion of reinforcing steel, methods/treatments to overcome the corrosion, Electro-chemical process. Ferro-cement, material and properties. fibers and composites, Architectural use and aesthetics of composites.					
<b>UNIT – III</b>					<b>9</b>
<b>Ceramic Materials:</b> Classification, Refractories, glass, glass wool, mechanical, thermal and electrical properties, fire resistant materials, Uses and application New types of floor finishes and tiling, liquid granite, lotuslan used in paints.					
<b>UNIT – IV</b>					<b>9</b>
<b>Advanced Materials:</b> Adhesives and sealants in construction industry-Acrylics, Bridge bearings, Industrial waste materials in concrete Rapid wall panels, Moisture Barriers.					
<b>UNIT – V</b>					<b>9</b>
<b>Planning for Earthwork Construction:</b> Planning, Graphical Presentation of Earthwork, Earthwork Quantities, Mass Diagram, Pricing Earthwork Operations.					
				<b>Total: 45</b>	
<b>REFERENCES:</b>					
1.	Adam M Neville, “Properties of Concrete”, 5 <sup>th</sup> Edition, Longman Sc and Tech Publishers, 2011.				
2.	Kumar Mehta P. and Paulo J.M. Monteiro, “Concrete Microstructure, Properties and Materials”, McGraw Hill, 2006.				
3.	Verghese P.C., “Building Material”, PHI EEE, New Delhi, 2012.				

<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1:	determine the structural, physical and long-term performance of building materials used in construction	Applying (K3)
CO2:	demonstrate the mechanical and non-mechanical behavior of neo- materials	Applying (K3)
CO3:	utilize advanced materials used in construction projects	Applying (K3)
CO4:	categorize crucial areas in manufacturing building materials	Analyzing (K4)
CO5:	plan and allocate suitable materials for earthwork	Applying (K3)

**Mapping of COs with POs**

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		3
CO3	2		3		3
CO4	3		3		3
CO5	2		3		3

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

18CMT14 FINANCE AND ACCOUNTING FOR MANAGEMENT					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
Preamble	To make the students to understand the cash flow technique and accounting concepts				
Prerequisites	Construction Management				
<b>UNIT – I</b>					<b>9</b>
<b>Financial Aspects:</b> Financing of projects - means of finance - Equity and Debt - financial institutions - cost of Capital - special schemes - Risk Analysis, Sources and Measures of risk - Methods of risk analysis - Project and Risk Analysis in Practice					
<b>UNIT – II</b>					<b>9</b>
<b>Time Value of Money:</b> Time Value of Money - Time lines and Notations - Future and Present value of single amount - Future and Present value of an annuity - Simple interest - Compound interest - Project cash Flows - Principles of cash flow estimation.					
<b>UNIT – III</b>					<b>9</b>
<b>Costing:</b> Investment Criteria - Discounting criteria -Net present value (NPV), Benefit cost ratio (BCR), internal rate of return(IRR) - Non-Discounting criteria - Pay Back Period, Urgency - Accounting rate of return(ARR) - Indian Practice of Investment Appraisal - International Practice of Appraisal.					
<b>UNIT – IV</b>					<b>9</b>
<b>Accounting Concepts and Standards:</b> Introduction - Accounting Concepts - Principles - Policies and Standards -Types of accounting concepts - Accounting Standards - Scope and functions of Accounting Standards Board - International Financial Reporting System - Distinction between Management Accounting and Financial Accounting.					
<b>UNIT – V</b>					<b>9</b>
<b>Management Accounting and Budgetary Control:</b> Management accounting - Concept, Need, Importance and Scope - Standard costing and Variance analysis (materials, labor): Budgetary control - Meaning, Need, Objectives, Essentials of Budgeting, Different types of budgets.					
<b>Lecture:45, Tutorial:15, Total: 60</b>					
<b>REFERENCES:</b>					
1.	Prasanna Chandra, “Projects -Planning Analysis Selection Implementation and Review”, 21 <sup>st</sup> Edition, Tata McGraw Hill, New Delhi, 2014.				
2.	Joy P.K., “Total Project Management - The Indian Context (Chapters 37)”, 2 <sup>nd</sup> Edition, Macmillan India Ltd., New Delhi, 2002.				
3.	Barcus S.W. and Wilkinson J.V., “Hand Book of Management Consulting Services”, McGraw Hill Education, New York, 1994.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1:	choose the important aspect of financial and risk analysis	Applying (K3)
CO2:	determine the time value of money with varying cash flows	Applying (K3)
CO3:	compare the discounting and non discounting criteria in project appraisal	Analyzing (K4)
CO4:	identify the various accounting concepts with policies and standards	Understanding (K2)
CO5:	illustrate the importance behind management accounting and budgetary control	Applying (K3)

**Mapping of COs with POs**

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		1		
CO2	2		2		
CO3	1		1		
CO4	1		2		2
CO5	2		2	2	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy

18CMT15 CONSTRUCTION EQUIPMENT AND MACHINERIES					
		L	T	P	Credit
		3	0	0	3
Preamble	To impart knowledge in the selection of appropriate equipment based on the requirements of project at optimum cost and time.				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Equipment Management:</b> Identification - Planning - Equipment Management in Projects - Maintenance and Replacement - Optimizing Construction Equipment System Productivity - Cost Analysis of Equipment - Fundamental Concepts of Equipment economics - Financing methods - Rental and lease contract considerations					
<b>UNIT – II</b>					<b>9</b>
<b>Earthwork Equipment:</b> Tractors - Motor Graders - Scrapers - Front end Loaders - Earth Movers - Equipment for Dredging and Trenching - Tunneling methods and equipments - Compaction Equipment - Diaphragm wall equipment - Pile Driving Equipment - Drilling and Blasting - Safety measures.					
<b>UNIT – III</b>					<b>9</b>
<b>Equipments for Screening and Transporting:</b> Forklifts and related equipment - Portable Material Bins - Tower crane - Conveyors - Aggregate Crushers - Feeders - Screening Equipment - General Crane - Gantry girder - Mono rails.					
<b>UNIT – IV</b>					<b>9</b>
<b>Concreting Equipment:</b> Batching and Mixing Equipment - Hauling equipment - RMC - Modern Formwork Techniques - MIVAN Construction - Shuttering - Types of pumps used for Construction - Boom placer - Equipment for Grouting and Dewatering - 3D Concrete Printing.					
<b>UNIT – V</b>					<b>9</b>
<b>Surveying Equipment:</b> Modern electronic surveying equipments - Digital levels - Digital theodolite - Advance Total station - Lasers and sensors in Surveying - Remote sensing - Geographical Information System.					
				<b>Total: 45</b>	
<b>REFERENCES:</b>					
1.	Deodhar S.V., “Construction Equipment and Job Planning”, 1 <sup>st</sup> Edition, Khanna Publishers, New Delhi, 1988.				
2.	Peurifoy R.L., “Construction Planning, Equipment and Methods”, 7 <sup>th</sup> Edition, McGraw Hill, Singapore, 2013.				
3.	Sharma S.C., “Construction Equipment and Management”, 5 <sup>th</sup> Edition, Khanna Publishers, New Delhi, 2007.				
4.	Leonid Nadolinets, “Surveying Instruments and Technology”, 1 <sup>st</sup> Edition, CRC Press, 2017.				

<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>			
On completion of the course, the students will be able to					
CO1:	execute cost analysis for the equipment	Applying (K3)			
CO2:	decide the suitable equipments for earth work	Applying (K3)			
CO3:	schedule equipments for screening and transporting in construction	Applying (K3)			
CO4:	carry on concrete works with suitable equipments	Applying (K3)			
CO5:	employ an instrument to perform surveying	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		3
CO3	2		3		3
CO4	2		3		3
CO5	2		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy					

**18GET01 INTRODUCTION TO RESEARCH**  
(Common to Engineering and Technology Branches)

L	T	P	Credit
3	0	0	3

Preamble	To familiarize the fundamental concepts/techniques adopted in research, problem formulation and patenting. To disseminate the process involved in collection, consolidation of published literature and rewriting them in a presentable form using latest tools.
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Prerequisites	Nil
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<b>UNIT – I</b>	<b>9</b>
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**Concept of Research:** Meaning and Significance of Research: Skills, Habits and Attitudes for Research - Time Management - Status of Research in India. Why, How and What a Research is? - Types and Process of Research - Outcome of Research - Sources of Research Problem - Characteristics of a Good Research Problem - Errors in Selecting a Research Problem - Importance of Keywords - Literature Collection – Analysis - Citation Study - Gap Analysis - Problem Formulation Techniques.

<b>UNIT – II</b>	<b>9</b>
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**Research Methods and Journals:** Interdisciplinary Research - Need for Experimental Investigations - Data Collection Methods - Appropriate Choice of Algorithms / Methodologies / Methods - Measurement and Result Analysis - Investigation of Solutions for Research Problem - Interpretation - Research Limitations. Journals in Science/Engineering - Indexing and Impact factor of Journals - Citations - h Index - i10 Index - Journal Policies - How to Read a Published Paper - Ethical issues Related to Publishing - Plagiarism and Self-Plagiarism.

<b>UNIT – III</b>	<b>9</b>
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**Paper Writing and Research Tools:** Types of Research Papers - Original Article/Review Paper/Short Communication/Case Study - When and Where to Publish? - Journal Selection Methods. Layout of a Research Paper - Guidelines for Submitting the Research Paper - Review Process - Addressing Reviewer Comments. Use of tools / Techniques for Research - Hands on Training related to Reference Management Software - EndNote, Software for Paper Formatting like LaTeX/MS Office. Introduction to Origin, SPSS, ANOVA etc., Software for detection of Plagiarism.

<b>UNIT – IV</b>	<b>9</b>
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**Effective Technical Thesis Writing/Presentation:** How to Write a Report - Language and Style - Format of Project Report - Use of Quotations - Method of Transcription Special Elements: Title Page - Abstract - Table of Contents - Headings and Sub-Headings - Footnotes - Tables and Figures - Appendix - Bibliography etc. - Different Reference Formats. Presentation using PPTs.

<b>UNIT – V</b>	<b>9</b>
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**Nature of Intellectual Property:** Patents - Designs - Trade and Copyright. Process of Patenting and Development: Technological research - innovation - patenting - development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents.

**Total: 45**

**REFERENCES:**

1.	DePoy, Elizabeth, and Laura N. Gitlin, “Introduction to Research-E-Book: Understanding and Applying Multiple Strategies”, Elsevier Health Sciences, 2015.
2.	Walliman, Nicholas, “Research Methods: The basics”, Routledge, 2017.
3.	Bettig Ronald V., “Copyrighting culture: The political economy of intellectual property”, Routledge, 2018.

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>	
CO1:	list various stages in research/patenting and categorize the quality of journals	Analyzing (K4)	
CO2:	formulate a research problem from published literature/journal papers	Evaluating (K5)	
CO3:	write, present a journal paper/ project report using latest tools in proper format	Creating (K6)	
CO4:	select suitable journal and submit a research paper	Applying (K3)	
<b>Mapping of COs with POs</b>			
COs/POs	PO1	PO2	PO3
CO1	3	2	1
CO2	3	2	3
CO3	3	3	1
CO4	3	2	1
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy			

18CML11 MANAGEMENT TOOLS FOR CONSTRUCTION ENGINEERS I						
			L	T	P	Credit
			0	0	2	1
Preamble	To derive quantities, schedule and allocate resources for construction projects using the management tools.					
Prerequisites	Nil					
<b>List of Exercises:</b>						
1. Quantity takeoff and Preparation of bid for construction project						
2. Usage of MS Project & PRIMAVERA with CPM & PERT						
3. Estimation of a single storey building.						
4. Scheduling of construction project using MS project (Scheduling includes report and tracking)						
5. Scheduling and allocation of resources.						
6. Scheduling of construction project using Primavera (Scheduling includes report and tracking)						
7. Resource leveling, resource list and Resource loading						
8. Deterministic and Probabilistic Inventory Models - Software applications						
9. Decision Making – Baye’s Theory						
						<b>Total: 30</b>
<b>REFERENCES / MANUALS / SOFTWARES:</b>						
1.	Carl S Chattfield and Timothy D Johnson, “Microsoft Project 2016 Step by Step”, 1 <sup>st</sup> Edition, Pearson Publication, 2016.					
<b>COURSE OUTCOMES:</b>						
On completion of the course, the students will be able to						<b>BT Mapped (Highest Level)</b>
CO1:	execute the computer application in optimization and sequencing problems					Applying (K3), Manipulation (S2)
CO2:	schedule using management tools					Applying (K3), Manipulation (S2)
CO3:	allocate resources and quantify the volume of activities involved in a project					Applying (K3), Manipulation (S2)
<b>Mapping of COs with POs</b>						
COs/POs	PO1	PO2	PO3	PO4	PO5	
CO1	2	2	3	3		
CO2	2	2	3	3		
CO3	2	2	3	3		
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy						

18CMT21 ADVANCED TECHNIQUES FOR CONSTRUCTION						
			L	T	P	Credit
			3	0	0	3
Preamble	To equip the students with knowledge about the Advanced Construction Techniques adopted in the industry					
Prerequisites	Nil					
<b>UNIT – I</b>	<b>9</b>					
<b>Construction Techniques:</b> Reinforced and pre-stressed concrete construction: Introduction - Mechanized methods of earthwork - Estimation of quantities of earthwork in grading - Grading of sites - Blasting methods - Fabrication of reinforcement and transportation of erected reinforcement - Introduction to pre-stressed concrete - Types of pre-stressing – Advantages - Methods of pre-stressing and Equipment for pre-stressing operation.						
<b>UNIT – II</b>	<b>9</b>					
<b>Construction of Special Structures:</b> Introduction to Prefabricated structures - Planning for pre-casting - Selection of equipment for fabrication - Transport and erection of prefabricated components - Quality measures - Design considerations of precast elements - Safety measure during erection.						
<b>UNIT – III</b>	<b>9</b>					
<b>Construction of Earthquake Resistant Buildings:</b> Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks						
<b>UNIT – IV</b>	<b>9</b>					
<b>Modular Construction and High rise buildings:</b> Introduction to modular construction - Modular coordination - Modular standardization - Modular system building – Limitation - Advantages and disadvantages of modular construction.						
<b>UNIT – V</b>	<b>9</b>					
<b>Rehabilitation and Strengthening Techniques:</b> Offshore and port technology - Coast preservation technique - Facilities crossing a strait or a sea area - Foundation technology - Soil improvement techniques - Shield tunneling technology - Earth-retaining excavation techniques.						
					<b>Total: 45</b>	
<b>REFERENCES:</b>						
1.	Robert Wade Brown, “Practical Foundation Engineering Handbook”, 2 <sup>nd</sup> Edition, McGraw Hill Publications, 2001.					
2.	William P. Spence, “Construction Materials, Methods and Techniques”, 3 <sup>rd</sup> Edition, Delmar Publications, 2010.					
3.	Roy Chudley, “Advanced Construction Technology”, 5 <sup>th</sup> Edition, Pearson Publications, 2015.					

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	adapt various sub structure and super structure techniques involved in construction	Applying (K3)			
CO2:	draw the construction sequence of special structures and their design methods	Applying (K3)			
CO3:	develop the seismic building design methods	Applying (K3)			
CO4:	employ the need of rehabilitation and strengthening techniques	Applying (K3)			
CO5:	assimilate the need for dismantling techniques and modular construction	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		3
CO3	2		3		3
CO4	2		3		3
CO5	2		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CMT22 CONSTRUCTION PLANNING, SCHEDULING AND CONTROL					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>
Preamble	To learn management tools and techniques for planning, scheduling, organizing, controlling and monitoring of construction projects.				
Prerequisites	Construction Management				
<b>UNIT – I</b>					<b>9</b>
<b>Construction Planning:</b> Introduction to construction projects - Project categories - Project participants - Project Life Cycle - Planning - Role of planning department in construction - Objectives - Principles - Stages of planning - Project clearance procedures - Documentation for major works.					
<b>UNIT – II</b>					<b>9</b>
<b>Project Scheduling:</b> Construction scheduling - Work Breakdown Structure - Project Cost and Time Estimation - Bar Chart - Milestone Chart - CPM - PERT - RPM - LOB - Software's in construction scheduling - Primavera - MSP.					
<b>UNIT – III</b>					<b>9</b>
<b>Scheduling with Resource Constraints:</b> Scheduling with resource constraints and precedence - Use of advanced scheduling techniques - Scheduling with uncertain durations - Calculations for Monte Carlo schedule simulation - Crashing and time/cost tradeoffs - Improving the scheduling process.					
<b>UNIT – IV</b>					<b>9</b>
<b>Project Controlling:</b> Monitoring and control of construction projects – Quality control – Importance - Objectives - Methods - Cost control - Objectives - Control systems - Direct and indirect cost control - Project budgetary control - Project risk analysis and mitigation.					
<b>UNIT – V</b>					<b>9</b>
<b>Organizing and Use of Project Information:</b> Types of project information- accuracy – use of information – computerized information – uses – database – database models- relational model- centralized model- applications.					
<b>Lecture:45, Tutorial:15, Total: 60</b>					
<b>REFERENCES:</b>					
1.	Dr. Seetharaman S., “Construction Engineering and Management”, 2 <sup>nd</sup> Edition, Umesh Publications, 2000.				
2.	Chitkara K.K., “Construction Project Management Planning Scheduling and Controlling”, 18 <sup>th</sup> Reprint, Tata McGraw Hill, 2009.				
3.	Sengupta and Guha, “Construction Management and Planning”, 1 <sup>st</sup> Edition, Tata McGraw Hill Publication, 2015.				

<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>			
On completion of the course, the students will be able to					
CO1:	summarize the importance of planning	Understanding (K2)			
CO2:	determine the project time and cost	Applying (K3)			
CO3:	analyze time –cost trade offs	Analyzing(K4)			
CO4:	implement project control techniques	Applying (K3)			
CO5:	make use of database models	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	1		3		
CO2	2	2	2		
CO3	1		3		
CO4	1		3	2	3
CO5	2	2	3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CMT23 CONTRACT LAWS AND REGULATIONS					
		L	T	P	Credit
		3	1	0	4
Preamble	Create awareness on contracts for construction industry, impart knowledge on tender preparation, tendering process, arbitration procedure and laws, Legal requirements and Labour Regulations.				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Construction Contracts:</b> Indian Contract Act - Elements of contracts - Types of contracts - Features - Suitability - Design of contract documents - International contract document (FIDIC, etc) - Standard contract document - Contractual claims - Law of Torts.					
<b>UNIT – II</b>					<b>9</b>
<b>Tenders:</b> Project cost estimation - Rate analysis - Overhead charges - Bidding models and bidding strategies - Owner's and contractor's estimate - Prequalification - Bidding - Accepting - Evaluation of tender - World Bank procedures and guidelines - Tamilnadu Transparency in Tenders Act.					
<b>UNIT – III</b>					<b>9</b>
<b>Arbitration:</b> Arbitration Act - UNCITRAL model law - Forms of arbitration - Arbitration agreement - Appointment of arbitrators - Conditions of arbitration - Powers and duties of arbitrator - Enforcement of award - Costs - Duties and responsibilities of parties					
<b>UNIT – IV</b>					<b>9</b>
<b>Legal Requirements:</b> Insurance and bonding - Laws Governing Sale, Purchase and use of urban and rural land – Land revenue codes – Tax Laws – Income Tax, GST, Excise and Custom Duties and their influence on construction costs.					
<b>UNIT – V</b>					<b>9</b>
<b>Labour Regulations:</b> Social security – Welfare legislation – Laws relating to wages, bonus and industrial disputes, labour administration – Insurance and safety regulations – Workmen’s Compensation Act – Indian Factory Act – Tamilnadu Factory Act – Child Labor Act - Other Labor Laws.					
<b>Lecture:45, Tutorial:15, Total: 60</b>					
<b>REFERENCES:</b>					
1.	Gajaria G.T., “Laws Relating to Building and Engineering Contracts in India”, 4 <sup>th</sup> Edition, M.M.Tripathi Pvt. Ltd., Bombay, 2000.				
2.	Joseph T. Bockrath, “Contracts and the Legal Environment for Engineers and Architects”, 7 <sup>th</sup> Edition, McGraw-Hill, New York, 2010.				
3.	Jimmie Hinze, “Construction Contracts”, 2 <sup>nd</sup> Edition, McGraw-Hill, New York, 2001.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1:	draft a contract document with all necessary elements	Applying (K3)
CO2:	prepare a tender and contract as per legal requirement	Applying (K3)
CO3:	suggest suitable type of arbitration and resolving disputes between parties	Applying (K3)
CO4:	examine the laws and taxes influencing construction costs	Applying (K3)
CO5:	solve disputes by implementing labour regulations in construction projects	Applying (K3)

**Mapping of COs with POs**

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		
CO2	2	3	3		
CO3	2		3		
CO4	2		3		
CO5	2		3		

1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy

18CML21 MANAGEMENT TOOLS FOR CONSTRUCTION ENGINEERS II						
			L	T	P	Credit
			0	0	2	1
Preamble	To estimate and model the construction projects using advanced management tools and techniques					
Prerequisites	Management Tools For Construction Engineers I					
<b>List of Exercises:</b>						
1. Usage of Management tools for construction Projects						
2. Comparison of MS Project & PRIMAVERA with various WBS						
3. Estimation of a multi storey building.						
4. Modelling of project using Revit Architecture						
5. Modelling using BIM						
6. Determination of RI value using SPSS						
7. SPSS for single and multiple objective function						
8. Introduction to other advanced management software						
						<b>Total: 30</b>
<b>REFERENCES / MANUALS / SOFTWARES:</b>						
1.	Daniel L. Williams, Elaine Britt Krazer, “Oracle Primavera P6 Version 8: Project and Portfolio Management”, 1 <sup>st</sup> Edition, Packt Publishing Ltd., 2012.					
<b>COURSE OUTCOMES:</b>					<b>BT Mapped (Highest Level)</b>	
On completion of the course, the students will be able to						
CO1:	model the building using BIM & Revit Architecture					Applying (K3), Manipulation (S2)
CO2:	determine the ranking values using SPSS and report the same					Applying (K3), Manipulation (S2)
CO3:	examine the quantity for multi storey building and document it					Analyzing (K4), Manipulation (S2)
<b>Mapping of COs with POs</b>						
COs/POs	PO1	PO2	PO3	PO4	PO5	
CO1	2	2	3	3		
CO2	2	2	3	3		
CO3	3	3	3	3		
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy						

<b>18CME01 MATERIAL MANAGEMENT</b>							
				<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
				<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To identify, define and comprehend the effective purchase, utilization and storage of materials.						
Prerequisites	Nil						
<b>UNIT – I</b>	<b>9</b>						
<b>Introduction:</b> Importance of material management - Role of Material Management in construction industry - scope, objectives and functions - Integrated approach to materials management - Role of material manager.							
<b>UNIT – II</b>	<b>9</b>						
<b>Classification and Codification of Materials of Construction:</b> ABC, FSN, VED, SOS analysis - Procedure and its use - Standardization in materials and their management - Procurement - identification of sources of procurement- vendor analysis - Material requirement planning - purchase procedure - legal aspects.							
<b>UNIT – III</b>	<b>9</b>						
<b>Inventory Management:</b> Store Purchase Manual - Inventory Control techniques. EOQ - Advantages and limitation of use of EOQ, Reorder Point - Safety stock and stock out cost - Concept of (JIT) - Just in time management- Indices used for assessment of effectiveness of inventory management.							
<b>UNIT – IV</b>	<b>9</b>						
<b>Stores Management and Quality Control:</b> Receipt and inspection - Care and safety in handling - losses and wastage on storage - Bulk purchasing - scheduling of resources - Conventional methods of maintaining quality in Construction - Statistical method of quality control - Quality management and its economics							
<b>UNIT – V</b>	<b>9</b>						
<b>Project Evaluation and Procurement:</b> Materials Management Systems - Procurement of Materials - Cost control - Discounted Cash Flow - Real Options Theory - Project delivery methods - Integrated project delivery - Competitive bidding and Contract negotiation.							
<b>Total:</b>							<b>45</b>
<b>REFERENCES:</b>							
1.	“A Guide to the Project Management Body of Knowledge (PMBOK Guide)”, 4 <sup>th</sup> Edition, An American National Standard, ANSI/PMI 990001-2008.						
2.	Chitale A.K. and Gupta R.C., “Material Management – Text and Cases”, 3 <sup>rd</sup> Edition, Prentice Hall of India Pvt. Ltd., 2014.						
3.	Joseph Philips, “Project Management and Professional (Certification Study Guides)”, 4 <sup>th</sup> Edition, McGraw Hill Publication, 2013.						

<b>COURSE OUTCOMES:</b>						<b>BT Mapped (Highest Level)</b>
On completion of the course the students will be able to						
CO1:	demonstrate the need and role of material management				Applying (K3)	
CO2:	realize materials, sources of procurement and conduct vendor analysis				Applying (K3)	
CO3:	adapt effective management for inventory				Applying (K3)	
CO4:	execute store management and exercise quality control on material				Applying (K3)	
CO5:	determine the evaluation of material management system and cost control				Applying (K3)	
<b>Mapping of COs with POs</b>						
COs/POs	PO1	PO2	PO3	PO4	PO5	
CO1	2		3			
CO2	2		3	2		
CO3	2		3		3	
CO4	2		3			
CO5	2		3			
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy						

18CME02 CONSTRUCTION PROJECT MANAGEMENT					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To enrich the concepts related to Project management and Resources Utilization				
Prerequisites	Material Management				
<b>UNIT I</b>					<b>9</b>
<b>Introduction to Project:</b> Concept of a Project – Characteristic features – Project Life cycle – Phases – Project Management – Tools and techniques for project management – Role of project managers.					
<b>UNIT II</b>					<b>9</b>
<b>Role of Project Management:</b> Development of project plan and objectives – Leadership and Motivation - Interpersonal Behaviour in Project Organizations – Organization and project team –communication in project management.					
<b>UNIT III</b>					<b>9</b>
<b>Working Systems:</b> Design and Construction Process - Design and Construction as an Integrated System – Work breakdown system (WBS) – Project execution plan –Sub systems of project management- Monitoring of projects -Monitoring of contracts.					
<b>UNIT IV</b>					<b>9</b>
<b>Project Direction:</b> Project direction – Direction during production stage – Value engineering review – Stages –Directives – Project coordination – Procedure – Interface management – Project control –Scope for progress control – Overall project progress control – Stages – Methods.					
<b>UNIT V</b>					<b>9</b>
<b>Resource Management:</b> Basic concept – Labor requirements – Labor productivity – Site productivity – Equipment Management – Material management- Procurement organization – Procurement planning – Functions of material management –Analysis of Inventory control					
<b>Total: 45</b>					
<b>REFERENCES:</b>					
1.	Prasanna Chandra, “Project Planning, Analysis, Selection, Implementation and Review”, 21 <sup>st</sup> Edition, Tata McGraw Hill, NewDelhi, 2014.				
2.	Chitkara K.K., “Construction Project Management: Planning Scheduling and Control”, 18 <sup>th</sup> Edition, Tata McGraw-Hill, New Delhi, 2009.				
3.	Choudhury S., “Project Management”, 31 <sup>st</sup> Edition, Tata McGraw-Hill, New Delhi, 2008.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	identify tools and techniques for project management	Understanding (K2)			
CO2:	apply value engineering practices for construction projects	Applying (K3)			
CO3:	manipulate design and construction of working system in a project	Applying (K3)			
CO4:	estimate costs associated with construction projects	Analyzing (K4)			
CO5:	choose appropriate resources for different types of projects	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		
CO2	2		3		
CO3	3		3	2	2
CO4	2		2	2	2
CO5	2		3	2	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT - Bloom's Taxonomy					

18CME03 MANAGEMENT INFORMATION SYSTEMS					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To cognize the role of Information Systems and development of system model for providing support systems to the industry				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Introduction to Information System:</b> Introduction to Information System: System Concepts - Trends - Types of Information System - Operations Support Systems - Transaction processing systems - Management information systems - Management Support Systems - Strategic Information system and other classifications - Success and Failure with IT.					
<b>UNIT – II</b>					<b>9</b>
<b>Strategic uses of Information Technology:</b> Business level Strategy - Firm level Strategy - Role of IT in Re-engineering – Functional Business Systems – Marketing – Manufacturing – Human Resource – Accounting – Financial Management Systems.					
<b>UNIT – III</b>					<b>9</b>
<b>Enterprise System:</b> Business Process Integration with IT - Challenges of Enterprise Systems - International Information Systems - Outsourcing and off-shoring - Supply Chain Management - Customer Relationship Management Enterprise Resource Planning - E-commerce Business Models - Electronic Payment Systems - Electronic Data Interchange (EDI).					
<b>UNIT – IV</b>					<b>9</b>
<b>Support Systems:</b> Decision Support Systems: Group decision support system – What if Analysis – Sensitivity Analysis – Goal seeking Analysis – Optimization Analysis - Knowledge management system - Artificial Intelligence Technologies in Business - Expert Systems					
<b>UNIT – V</b>					<b>9</b>
<b>Developing Business System and Security:</b> System Development Life Cycle – Approaches: Water Flow – Prototype – Spiral – RAD – Incremental – System Analysis – System Design Tools: Data Flow Diagram – System Implementation – Software Assurance Testing – Data Quality Audits – Ethical Analysis.					
<b>Total: 45</b>					
<b>REFERENCES:</b>					
1.	Haag Cummings and Mccubbrey, “Management Information Systems for the Information Age”, 9 <sup>th</sup> Edition, Tata McGraw-Hill, 2013.				
2.	Joe Peppard and Johnward, “The Strategic Management of Information Systems”, 4 <sup>th</sup> Edition, Wiley Publication, 2016.				
3.	Kenneth C. Laudon, “Management Information Systems”, 6 <sup>th</sup> Edition, Prentice Hall International Edition, 2000.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to					<b>BT Mapped (Highest Level)</b>
CO1:	apply the role of information systems in an organization				Applying (K3)
CO2:	develop strategic management plan and implement it				Applying (K3)
CO3:	demonstrate enterprise systems and the role of internet in MIS				Applying (K3)
CO4:	execute various support systems for implementing information systems				Applying (K3)
CO5:	plan a framework for software model and relate ethical and social issues of IS				Applying (K3)
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		
CO2	2		3		
CO3	2		3		
CO4	2		3		2
CO5	2		3	3	
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

<b>18CME04 INFRASTRUCTURE MANAGEMENT</b>						
			<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
			<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To equip knowledge and skill sets in the rapidly evolving Infrastructure domain and to resolve the risk factors in successful implementation					
Prerequisites	Nil					
<b>UNIT – I</b>	<b>9</b>					
<b>Basic Concepts of Infrastructure:</b> Infrastructure - Definition and types - An overview of the Power sector - Water supply and Sanitation sector - Road, rail, air and port transportation sectors telecommunications sector - urban infrastructure - rural infrastructure in India. An introduction to special economic zones - Organizations and players in the field of infrastructure - Credit rating of infrastructure projects, credit allocation framework for infrastructure projects.						
<b>UNIT – II</b>	<b>9</b>					
<b>Private involvement in infrastructure:</b> Infrastructure privatization- benefits of infrastructure privatization- problems with infrastructure privatization- challenges in privatization of water supply- challenges in privatization of power - privatization of infrastructure in India- Privatization of road transportation infrastructure in India.						
<b>UNIT – III</b>	<b>9</b>					
<b>Challenges to successful infrastructure planning and implementation:</b> Mapping and facing the landscape of risks in infrastructure projects - Economic and Demand risks - Political risks - Socio- Environmental risks - Cultural risks in international infrastructure projects - Legal and contractual issues in infrastructure - Challenges in construction and maintenance of infrastructure.						
<b>UNIT – IV</b>	<b>9</b>					
<b>Infrastructure Financing and Risk Management:</b> An overview of infrastructure project finance - procurement process, concession - design and award, financial risk analysis, management and mitigation - risk management framework for infrastructure projects - shaping the planning phase of infrastructure projects to mitigate risks - Designing sustainable contracts -Introduction to fair process and negotiation - Negotiation with multiple stakeholders on infrastructure projects.						
<b>UNIT – V</b>	<b>9</b>					
<b>Strategies for successful infrastructure project implementation:</b> Sustainable development of infrastructure - Information technology and systems for successful infrastructure management - Innovative design and maintenance of infrastructure facilities - infrastructure modeling and life cycle analysis techniques - Capacity building and improving the Governments role in infrastructure implementation. An integrated framework for successful infrastructure planning and management.						
					<b>Total: 45</b>	
<b>REFERENCES:</b>						
1.	David I. Cleland and Roland Gareis, “Global Project Management Handbook: Planning, Organization and Controlling International Projects”, 2 <sup>nd</sup> Edition, McGraw Hill Series, 2006.					
2.	Jeffrey L. Beard, Edward C. Wundran, Michael C. Loulakis, “Design, Build: Planning through development”, 1 <sup>st</sup> Edition, McGraw Hill Series, 2001.					
3.	Richard Lambeck, John Eschemuller, “Urban Construction Project Management”, 1 <sup>st</sup> Edition, McGraw Hill Series, 2009.					

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to					<b>BT Mapped (Highest Level)</b>
CO1:	employ the basic concepts related to infrastructure management in projects				Applying (K3)
CO2:	discover the benefits and problems with infrastructure privatization				Applying (K3)
CO3:	identify the challenges of infrastructure implementation				Applying (K3)
CO4:	assess the financial risk and suggest the suitable mitigation measures				Applying (K3)
CO5:	choose the strategies for successful implementation of infrastructure projects				Applying (K3)
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		
CO2	2		3		
CO3	2		3		
CO4	2		3		
CO5	2		3		
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CME05 CONSTRUCTION PROJECT CONTROL AND ORGANIZATION					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To recall the facts and concepts of project, quality and safety management with Database models and softwares				
Prerequisites	Construction Management				
<b>UNIT – I</b>					<b>9</b>
<b>Introduction to Project:</b> Concept of a Project – Characteristic features – Project Life cycle – Phases – Project Management – Tools and techniques for project management – Role of project managers- Organization structure.					
<b>UNIT – II</b>					<b>9</b>
<b>Project Initiation:</b> Capital investments - Capital budgeting – feasibility study – preliminary analysis – market, technical, financial, economic and ecological – Market and Demand analysis - Detailed technical analysis					
<b>UNIT – III</b>					<b>9</b>
<b>Project Budget:</b> Cost Control Problem -The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows – Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.					
<b>UNIT – IV</b>					<b>9</b>
<b>Quality and Safety Management:</b> Quality and Safety Concerns in Construction -Organizing for Quality and Safety – Work and Material Specifications – Safety measures- safety management in construction projects					
<b>UNIT – V</b>					<b>9</b>
<b>Project Information:</b> PMIS Report -Integrated Approach for the Management-Distribution of Project Information - Database Models-Information and Transfer Flow					
				<b>Total: 45</b>	
<b>REFERENCES:</b>					
1.	Chitkara K.K., “Construction Project Management: Planning, Scheduling and Control”, 18 <sup>th</sup> Edition, Tata McGraw-Hill, New Delhi, 2008.				
2.	Calin M. Popescu, Chotchai Charoenngam, “Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications”, 1 <sup>st</sup> Edition, Wiley, New York, 1995.				
3.	Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders”, 2 <sup>nd</sup> Edition, Prentice Hall, Pittsburgh, 2000.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	identify tools and techniques for project management	Understanding (K2)			
CO2:	draft the technical, financial, market and ecological reports	Applying (K3)			
CO3:	forecast the cost accounts and scheduled budgets	Applying (K3)			
CO4:	manage quality and safety in construction	Applying (K3)			
CO5:	produce PMIS report and monitor transfer flow	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		2		
CO2	1	3	2		
CO3	1		2	2	
CO4	1		3		2
CO5	1	3	3	2	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CME06 BUILDING INFORMATION MANAGEMENT						
			L	T	P	Credit
			3	0	0	3
Preamble	To evaluate the importance of structural systems in Construction of building, Infrastructure and other special structures					
Prerequisites	Building Science					
<b>UNIT – I</b>						<b>9</b>
<b>Structural System:</b> Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and specification.						
<b>UNIT – II</b>						<b>9</b>
<b>Environmental Aspects and Services:</b> Qualities of enclosure necessary to maintain a specified level of interior environmental quality – Weather resistance – Thermal infiltration – Acoustic Control – Transmission reduction – Air quality – Illumination.						
<b>UNIT – III</b>						<b>9</b>
<b>System Integration:</b> Relevant systems integration with structural systems, Plumbing – Electricity – Vertical circulation and their interaction. Technological and methodological demands on construction management in infrastructure development projects.						
<b>UNIT – IV</b>						<b>9</b>
<b>Construction and Infrastructure:</b> Construction component of various infrastructure sectors - highway - Ports and aviation - Oil and gas - Power – Telecom - Railways - Irrigation. Current scenario - future needs.						
<b>UNIT – V</b>						<b>9</b>
<b>Building Information Modeling:</b> Introduction to BIM fundamentals - Modeling of Building Elements: modeling exterior and interior walls, creating floors and roofs, Adding doors, windows, footings, columns, and beams. Introduction to Revit Architecture.						
						<b>Total: 45</b>
<b>REFERENCES:</b>						
1.	Muthu Shoba Mohan G., “Principles of Architecture”, 1 <sup>st</sup> Edition, Oxford University Press, New Delhi, 2006.					
2.	Kochnar, Sammer and Phatak, Deepak B., “Infrastructure and Governance”, Academic Foundation, Darya Gang, New Delhi, 2006.					
3.	Nawari and Kuenstle, “Building Information Modeling (BIM): A Framework for Structural Design”, CRC Press, Taylor and Francis Group, 2015.					

<b>COURSE OUTCOMES:</b> On completion of the course the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	classify the structural systems with economical way of choosing materials	Applying (K3)			
CO2:	validate the aspects of environmental quality and its specifications	Analyzing (K4)			
CO3:	select appropriate technology to implement infrastructure development projects	Understanding (K2)			
CO4:	choose construction components for various infrastructure projects	Applying (K3)			
CO5:	determine the importance of modeling software	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		1		
CO2	2		2		
CO3	2		2		3
CO4	1		2		2
CO5	1		2	3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CME07 SUSTAINABLE ENGINEERING SYSTEMS FOR BUILDINGS					
		L	T	P	Credit
		3	0	0	3
Preamble	To impart the knowledge on Sustainable development procedures and strategies for a sustainable future.				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Introduction to Sustainable Development:</b> An Introduction to Sustainability Concepts and Life Cycle Analysis - Definitions and principles of Sustainable Development - Risk and Life Cycle Framework for Sustainability - Sustainability Revolution - Future directions.					
<b>UNIT – II</b>					<b>9</b>
<b>Environmental Sustainability:</b> Operational guidelines - Hurdles to sustainability - Performance Indicators of sustainability and Assessment mechanism -Optimizing sustainability in Land, Water and Construction methods –Energy powering Sustainable Development – Financing for environment and Sustainable Development					
<b>UNIT – III</b>					<b>9</b>
<b>Measurements:</b> Integrated approach for resource protection and management - Managing the Process - Building Audit- Energy-Efficiency Measures for Existing Buildings - Gap Analysis.					
<b>UNIT – IV</b>					<b>9</b>
<b>Greening Site Management:</b> Green building concepts – LEED - Net-Zero Energy (Zero-Carbon) Buildings - Living Building Challenge - Reducing Commuting by Building Occupants - Reducing Urban Heat Island Effect with Green and Reflective Roofs - Green Roofs – Maintenance of Green Sites - Indoor Environmental Quality Credits - Water Efficiency.					
<b>UNIT – V</b>					<b>9</b>
<b>Global Commitment:</b> Climate change - Chemistry of atmosphere - Chemistry of greenhouse gases -Effects on plants and animals. Global warming, Sea level rise, Ozone problem - greenhouse effect -Role of fossil fuels in climate change - Future use of renewable energy - Innovations in sustainability - Role of Governments, Industries And Individuals, International Agreements and Protocols.					
				<b>Total: 45</b>	
<b>REFERENCES:</b>					
1.	Ganeshia Somayaji “Environmental Concerns and Sustainable Development: Some perspectives from India”, 1 <sup>st</sup> Edition, TERI Press, New Delhi, 2009.				
2.	Rogers Peter P., “An Introduction to Sustainable Development”, 1 <sup>st</sup> Edition, Glen Educational Foundation Inc., USA, 2012.				
3.	Jerry Yudelson, “Greening Existing Buildings”, 1 <sup>st</sup> Edition, McGraw-Hills Green Source Series, 2010.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	utilize the concept of socio-economic policies for sustainable development	Applying (K3)			
CO2:	employ the strategies for implementing eco development programmes	Applying (K3)			
CO3:	apply the different approaches for resource conservation and management	Applying (K3)			
CO4:	execute action plans for implementation of sustainable development	Applying (K3)			
CO5:	solve the impact of technological innovations on environment	Applying (K3)			
<b>Mapping of COs with POs</b>					
<b>COs\POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
CO1	2		3		3
CO2	2		3		3
CO3	2		3		3
CO4	2		3		3
CO5	2		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CME08 REAL ESTATE DEVELOPMENT AND DESIGN					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To develop and design the infrastructure facilities for Society				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Introduction:</b> Real estate projects - Types of real estate projects - Significance - Project management important in commercial real estate - Network - Budget management - Time management - Risk management and communications issues.					
<b>UNIT – II</b>					<b>9</b>
<b>Planning and Stages:</b> Real Estate Strategy, Planning and Analysis - Requirements- Experience and skills - Stages - Land Banking - Land Packaging - Land Development - Building Development - Building Operation - Renovation Stage and Redevelopment Stage.					
<b>UNIT – III</b>					<b>9</b>
<b>Development and Acquisition:</b> Development -Acquisition Tasks- Financing- Market Studies and Marketing Strategies- Environmental Requirements- Approvals and Permits- Improvements- Transportation and Accessibility Consideration- Disposition-Construction Management for Developers and Owners-Project Management Challenges in Real Estate Acquisition Projects					
<b>UNIT – IV</b>					<b>9</b>
<b>Project Management Framework and Anatomy:</b> Preliminary Planning - Planning and Development-Construction Management-Anatomy -Cost-Schedule and Contractor Management-Quality Control-Risk Management-Completion-software-Tracking- integration.					
<b>UNIT – V</b>					<b>9</b>
<b>Evaluation Alternative Investments:</b> Assessing of Real Estate projects - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – Value Added Tax (VAT) – Inflation-case studies.					
				<b>Total: 45</b>	
<b>REFERENCES:</b>					
1.	Bruggeman Fishr, “Real Estate, Finance and Investment”, 15 <sup>th</sup> Edition, McGraw Hill, 2015.				
2.	Patel B.M., “Project management - Strategic Financial Planning, Evaluation and Control”, 2 <sup>nd</sup> Edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2000.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to					<b>BT Mapped (Highest Level)</b>
CO1:	estimate project time including risk and budget				Applying (K3)
CO2:	adapt strategy for planning and analysis				Applying (K3)
CO3:	make use of marketing strategies and requirements				Applying (K3)
CO4:	implement the frame cost-schedule network				Applying (K3)
CO5:	assess real estate projects with additional taxes				Evaluating (K5)
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		2
CO2	2		3		2
CO3	2		3		2
CO4	2		3		2
CO5	3		3		2
1 - Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CME09 GIS IN CONSTRUCTION ENGINEERING AND MANAGEMENT					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To assimilate the concepts of GIS and its applications in construction industry				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Introduction to GIS:</b> Introduction - component of GIS - input data - data acquisition - geo referencing - spatial data structures - modeling surfaces – networks - Spatial data analysis: data integration - spatial interpolation - surface analysis - network analysis - digital terrain visualization - Global Positioning System(GPS) and Ground Penetrating Radar (GPR).					
<b>UNIT – II</b>					<b>9</b>
<b>GIS Data:</b> Field data - Statistical data, maps, aerial Photographs, satellite data, points , lines, and areas features, vector and raster data, data entry through keyboard, digitizer and scanners, preprocessing of data rectification and registration, interpolation techniques - Advantages of GIS - Commercially available GIS hardware and Software.					
<b>UNIT – III</b>					<b>9</b>
<b>Global Positioning System:</b> Introduction - GPS Segments: Spaces Segment, Control Segment, User Segment Features of GPS Satellites - Principle of Operation surveying with GPS - Methods of observations, Absolute Positioning, Relative Positioning, differential GPS Receivers - Navigational Receivers, Surveying Receivers, Geodetic Receivers - Computation of Co-ordinates: Transformation from Global to Local Datum , Geodetic Coordinates to map co-ordinates, GPS Heights and mean sea level Height - Applications of GPS.					
<b>UNIT – IV</b>					<b>9</b>
<b>Applications in Civil Infrastructure Management:</b> GIS based planning and data base management in civil infrastructure - GIS in Transportation infrastructure management-Intelligent Transport System - Case Study, Urban Transport Planning, Highway Alignment, Traffic Congestion analysis and Accident Studies - Case Study, Road Network Planning - Application of GIS in Environmental and Water resource Management - GIS-GPS based Green infrastructure Management					
<b>UNIT – V</b>					<b>9</b>
<b>Applications of GIS in Construction Management:</b> Emerging trends in building automation and control systems for facility management - Construction material procurement - Site layout and Inventory Management - Reducing construction waste and improving construction efficiency - Case Studies.					
<b>Total: 45</b>					
<b>REFERENCES:</b>					
1.	Chor Pang Lo, “Concepts and Techniques of Geographic Information Systems”, 2 <sup>nd</sup> Edition, Pearson Publications, 2016.				
2.	Michael N. Demars, “Fundamentals of GIS”, 4 <sup>th</sup> Edition, Wiley Publications, 2012.				
3.	Ruqayah Hadi, “GIS in Construction Management”, 1 <sup>st</sup> Edition, LAP LAMBERT Academic Publishing, 2016.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	derive the base concepts of geographical information system	Applying (K3)			
CO2:	carry out GIS data classification	Applying (K3)			
CO3:	model the integration of GIS and GPS	Applying (K3)			
CO4:	perform the application of GIS in the field of infrastructure management	Applying (K3)			
CO5:	practice suitable applications of GIS in the field of construction management	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		
CO2	2		3	3	3
CO3	2		3	3	3
CO4	2		3	3	3
CO5	2		3	3	3
1 - Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CME10 CONSTRUCTION PERSONNEL MANAGEMENT					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To emphasis role of personnel function in construction firms, to give basis of personnel management, man power planning, Labour laws and industrial relations.				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Manpower Management:</b> Manpower Planning – Importance – Requirement –Process – Organizing – Staffing- Directing- Controlling –Factors Influencing Supply and Demand of Human Resource- Role of HR Manager – Personnel Principles – Recruitment – Sources – Selection Process –Placement and Induction – Retention of Employees					
<b>UNIT – II</b>					<b>9</b>
<b>Leadership, Interpersonal and Communication:</b> Leadership Power- Leadership Styles- Leadership in Administration – Interpersonal Relations – Introduction – Analysis of Different Ego States- Analysis of Transaction- Analysis of Strokes – Analysis of Life Position – Communication – Flow- Barriers- Way to Overcome Barriers- Group Dynamics – Team Building					
<b>UNIT – III</b>					<b>9</b>
<b>Stress, Conflict, Performance, Time and Motivation:</b> Stress – Causes – Managing Stress – Conflicts – Causes – Management Managing Conflicts-Performance Appraisal – Horizontal –Vertical - 360 <sup>0</sup> – Methods of Improving Performance Appraisal- Time Management – Styles- Techniques – Motivation – Types – Analysis					
<b>UNIT – IV</b>					<b>9</b>
<b>Training and Development:</b> Training and Development – Objectives – Need- Training Process – Methods- Tools and Aids – Evaluation of Training Program					
<b>UNIT – V</b>					<b>9</b>
<b>Legal Aspects:</b> Overview of Labour Laws in India-Industrial Disputes Act – Grievance Handling – Enquiry Procedure- Compensation – Incentives – Pension –GPF –EPF – Group Insurance					
				<b>Total: 45</b>	
<b>REFERENCES:</b>					
1.	Dr. Chandramohan A., “Human Resource Management”, 1 <sup>st</sup> Edition, APH Publishing Corporation, 2008.				
2	Dwivedi R.S., “Human Relations and Organisational Behaviour”, 5 <sup>th</sup> Edition, Macmillian India Ltd., 2010.				
3	Mei Yung Leung, “Stress Management in the Construction Industry”, 1 <sup>st</sup> Edition, John Wiley & Sons, 2014.				

<b>COURSE OUTCOMES:</b> On completion of the course the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	summarize the importance of manpower planning	Understanding (K2)			
CO2:	develop the interpersonal skills	Applying (K3)			
CO3:	adapt effective management	Applying (K3)			
CO4:	outline training methods	Understanding (K2)			
CO5:	make use of legal concepts in construction industry	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		2		2
CO2	2		3		2
CO3	1		3		2
CO4	2		3		2
CO5	1		1		1
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

<b>18SEE16 METRO TRANSPORTATION SYSTEM AND ENGINEERING</b>				
(Common to Structural Engineering & Construction Engineering and Management branches)				
	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To impart knowledge on the basic elements of metro transportation system			
Prerequisites	Nil			
<b>UNIT – I</b>				<b>9</b>
<b>General :</b> Overview of Metro transportation system; Need of Mass transport system; Types of mass transport systems; Peak Hour Peak Direction Traffic(PHPDT) demand studies and selection of suitable mass transport system; Comparison of Bus Rapid Transit (BRT) Vs PHPDT; Train operation plan; prediction of Number of Rake, Car, and Head way; Mathematical model for the selection of best fit routing.				
<b>UNIT – II</b>				<b>9</b>
<b>Alignment:</b> Site survey; Factors influencing the alignment; Land acquisition within right of way; Horizontal and Vertical Curves; Super elevation; Points and Crossing; Types of crossings; Loop line; Shunting neck; Limiting train speed Vs alignment curvature; Rail and Road Vehicle access (RRV).				
<b>UNIT – III</b>				<b>9</b>
<b>Tunnel, Ramp, At Grade and Elevated corridor:</b> Types of Tunnel and various construction methods; Cut and cover, Mined tunnel, Bored tunnel, NATM, Box/Pipe pushing; type of Cross passages and its requirements as per NFPA standard; Damage assessment studies and Instrumentation & Monitoring methods; Risk and mitigation measures of underground construction, Ramp and At Grade corridor; Types of elevated corridor, Construction methods of Viaduct, Portal and Girder system; Bearings and movement joints; Difference between Mono and Metro Rail system.				
<b>UNIT – IV</b>				<b>9</b>
<b>Stations:</b> Type of stations; selection of type and its locations; Components of elevated and under-ground (UG) stations, Platform level, Concourse level, Roof level, Paid & Unpaid areas, Public & Equipment operation room areas; Necessity of OTE, UPE, Draught relief and Vent shafts in UG stations, Tunnel ventilation Fan, Power supply and SCADA system. Size of station based on emergency evacuation methods as per NFPA standard; Fire and Ventilation system; Construction methods of Under-ground and Elevated stations; Cut and cover and Retaining wall system, Diaphragm wall and Pile systems.				
<b>UNIT – V</b>				<b>9</b>
<b>Depot:</b> Types of depot; Components of Depot; Stabling Yard; Infrastructure Shed, type of bogie wash, turn table; Auto coach wash plant; Depot Control Center (DCC) and its operations, Integrated Control Center (ICC); Test track; Power supply stations, ASS and TSS; Water and Sewage Treatment plant.				
				<b>Total: 45</b>
<b>REFERENCES:</b>				
1.	Avishai Ceder, “Urban Transit Systems and Technology”, 2 <sup>nd</sup> Edition, John Wiley & Sons, New York, 2017.			
2.	Vukan R. Vuchic, “Public Transit Planning and Operation”, 3 <sup>rd</sup> Edition, CRC Press, 2016.			
3.	William D. Middleton, “Metropolitan Railways: Rapid Transit in America”, 1 <sup>st</sup> Edition, Indiana University Press, 2003.			

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to					<b>BT Mapped (Highest Level)</b>
CO1:	summarize the various elements of metro transportation system				Understanding (K2)
CO2:	adapt the various alignments in metro transportation system				Applying (K3)
CO3:	implement the concept of ramp and elevated corridor in metro transportation system				Applying (K3)
CO4:	plan the various stations in metro transportation system				Applying (K3)
CO5:	organize the various depot in metro transportation system				Applying (K3)
<b>Mapping of COs with POs</b>					
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
CO1	3		3		2
CO2	3		3		2
CO3	3		3		2
CO4	3		3		2
CO5	3		3		2
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CME11 SHORING, SCAFFOLDING AND FORMWORK					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To plan and detail the components of formwork with various accessories and classify the shores				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Elements for Formwork:</b> Overall and Detailed Planning - Units - Schedule for column formwork - Formwork elements - Development of basic system - Economical formwork construction.					
<b>UNIT – II</b>					<b>9</b>
<b>Form Work and Scaffolding Accessories:</b> Crane arrangement - Formwork beams - Formwork ties - Wales - Scaffold frames - Form accessories - Vertical transport table form work - Advantages - Functions of various components - Planning of Slip form operations.					
<b>UNIT – III</b>					<b>9</b>
<b>Shoring for Buildings:</b> Type of shores - Size and spacing - Safety practices - Horizontal shores - Deflection, bending and lateral stability - Shear, Bearing - Examples in wall forms - Slab forms - Beam form - Ties, Anchors and Hangers - Column forms.					
<b>UNIT – IV</b>					<b>9</b>
<b>Materials for Shoring Shuttering and Form:</b> Lumber - Types - Finish - Sheathing boards - Plywood - Reconstituted wood - Steel -Aluminium - Form lining materials - Hardware and fasteners - Pressures on Formwork -Temperature - Rates of Placing - Consistency of concrete – Vibration- Advanced Materials used for formworks					
<b>UNIT – V</b>					<b>9</b>
<b>Safety Practices for Forms and its Types:</b> Form for shell structures - Curb and Invert forms - Arch and Wall - Slipforms - Principles - Types of scaffolds - General safety requirements - Precautions against particular hazards - Scaffolding systems.					
				<b>Total: 45</b>	
<b>REFERENCES:</b>					
1.	Peurifoy Robert L., and Oberlender Garold D., “Formwork for Concrete Structures”, 3 <sup>rd</sup> Edition, McGraw-Hill, New York, 1996.				
2.	Hurd M.K., “Formwork for Concrete”, 6 <sup>th</sup> Edition Special Publication No. 4. American Concrete Institute, Detroit, 1995.				
3.	Austin C.K., “Formwork for Concrete”, 4 <sup>th</sup> Edition, Cleaver - Hume Press Ltd., London, 1996.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to					<b>BT Mapped (Highest Level)</b>
CO1:	design economical formwork				Applying (K3)
CO2:	organize various formwork components				Applying (K3)
CO3:	plan different types of shores, beams and slab forms based on their applications				Applying (K3)
CO4:	estimate the different types of finishing materials and advanced materials used for formworks				Applying (K3)
CO5:	apply the safety practices meant for formwork construction				Applying (K3)
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		1
CO2	2		2		1
CO3	2		3		3
CO4	2	1	2		3
CO5	2		3		1
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom's Taxonomy					

<b>18CME12 SYSTEM INTEGRATION IN CONSTRUCTION</b>						
			<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
			<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To study the various models of management information systems and their application to project management.					
Prerequisites	Building Sciences					
<b>UNIT – I</b>	<b>9</b>					
<b>Structural Integration:</b> Structural System - Current areas of research - Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and Specification - Profession of building in construction – Standards and Importance.						
<b>UNIT – II</b>	<b>9</b>					
<b>Environmental Factors:</b> Qualities of enclosure necessary to maintain a specified level of interior environmental quality – Weather resistance – Thermal infiltration – Acoustic Control – Transmission reduction – Air quality – illumination – Relevant systems integration with structural systems.						
<b>UNIT – III</b>	<b>9</b>					
<b>Building Services and Safety:</b> Building Services and Safety - Ability of systems to protect fire - Preventive systems - Fire escape system design - Planning for pollution free construction environmental - Hazard free construction execution. Plumbing - Electricity - Vertical circulation and their interaction.						
<b>UNIT – IV</b>	<b>9</b>					
<b>Tools and Requirements:</b> Approaches Tools and Techniques in system integration - Current problems and requirements in construction industry - System Integration Tips and Benefits in Buildings.						
<b>UNIT – V</b>	<b>9</b>					
<b>Designing and Software:</b> Future research opportunities - Software such as BAS-CMMS-Security software, and building performance visualization software - Designing Integration into New Construction - Early Owner Involvement is a Key to Success in construction.						
					<b>Total: 45</b>	
<b>REFERENCES:</b>						
1	David V.Chadderton, “Building Services Engineering”, 6 <sup>th</sup> Edition, Routledge, 2013.					
2.	Peter R. Smith and Warren G. Julian, “Building Services”, Applied Science Publishers Ltd., London, 1993.					

<b>COURSE OUTCOMES:</b>						<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to						
CO1:	adapt the system integration, services and maintenance					Applying (K3)
CO2:	design the structure with least possible maintenance					Applying (K3)
CO3:	plan the structure with essential building services					Applying (K3)
CO4:	determine the hazardous area in construction and implement safety measures					Applying (K3)
CO5:	utilize appropriate tools and techniques required for system integration					Applying (K3)
<b>Mapping of COs with POs</b>						
COs/POs	PO1	PO2	PO3	PO4	PO5	
CO1	2		3		3	
CO2	2		3		3	
CO3	2		3		2	
CO4	2		3		2	
CO5	2		3		3	
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy						

18CME13 QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION						
			L	T	P	Credit
			3	0	0	3
Preamble	To classify the organization, do quality planning and implement the techniques needed for QA/QC programme					
Prerequisites	Construction Management					
<b>UNIT – I</b>						<b>9</b>
<b>Construction Organization:</b> Types of organization - Inspection - Quality Management Systems and method - Responsibilities and authorities in quality assurance and quality control - Quality circle.						
<b>UNIT – II</b>						<b>9</b>
<b>Quality Planning:</b> Quality Policy - Objectives and methods in Construction Industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance - Taguchi's concept of quality - Document - Contract and construction programming - Inspection procedures - Processes and products - Total QA / QC programme and cost implication.						
<b>UNIT – III</b>						<b>9</b>
<b>Quality Assurance:</b> Objectives - Regularity agent, owner, design, contract and construction oriented objectives, methods - Techniques and needs of QA/QC - Different aspects of quality.						
<b>UNIT – IV</b>						<b>9</b>
<b>Factors of Construction Quality:</b> Appraisals - Critical, Major Failure Aspects and Failure Mode Analysis - Stability methods and tools, optimum design - Reliability testing, reliability coefficient and reliability prediction.						
<b>UNIT – V</b>						<b>9</b>
<b>Quality Control:</b> Total Quality Control- Quality Control by statistical methods – Sampling by attributes and by variables - Selection of new materials - Influence of drawings, detailing, specification, standardization - Bid preparation - Construction activity, environmental safety, social and environmental factors - Natural causes and speed of construction - Life cycle costing -Value engineering and value analysis.						
						<b>Total: 45</b>
<b>REFERENCES:</b>						
1.	O'Brian James J., “Construction Inspection Handbook - Quality Assurance and Quality Control”, 2 <sup>nd</sup> Edition, Van Nostrand, New York, 1989.					
2.	Charles S. Tapiero, “The Management of Quality and its Control”, 3 <sup>rd</sup> Edition, Springer Science Edition, 2016.					
3.	Amitava Mitra, “Fundamentals of Quality Control and Improvement”, 1 <sup>st</sup> Edition, Wiley Edition, 2016.					

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	adapt different types of organization and quality management methods	Applying (K3)			
CO2:	implement the techniques for consumers satisfaction and quality inspection	Applying (K3)			
CO3:	interpret the methods and techniques of QA/QC	Applying (K3)			
CO4:	describe major failure aspects and implement FMEA for construction projects	Applying (K3)			
CO5:	apply quality principles in construction along with value engineering practices	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		3
CO3	3		3		3
CO4	2		3		3
CO5	2		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CME14 RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To study the resources required for construction and to impart the effective management strategies towards the successful completion of the project.				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Resource Planning:</b> Resource planning - Stages of planning - Procurement - Identification - Planning for material - Labour - Time schedule and cost control - types of resources.					
<b>UNIT – II</b>					<b>9</b>
<b>Resource Management:</b> Systems approach in resource management-Characteristics of resources- Resources utilization- Measurement of actual resources required-Tools for measurement of resources - Classes of labour- Labour productivity - Cost of labour- Labour schedule.					
<b>UNIT – III</b>					<b>9</b>
<b>Time and Cost Management:</b> Time and quality - Management and planning - Managing time on project-forecasting the future-Critical path measuring the changes and their effects- Cash flow and cost control, objectives of cost control.					
<b>UNIT – IV</b>					<b>9</b>
<b>Materials and Equipments:</b> Time of purchase- Quantity of material- Sources- Transportation- Delivery and distribution. <b>Equipment:</b> Planning and selecting by optimistic choice with respect to cost and time- Source and handling - Depreciation of construction equipment.					
<b>UNIT – V</b>					<b>9</b>
<b>Resource Allocation and Levelling:</b> Time-cost trade off - Computer application in resource leveling - Resource list - Resource allocation - Resource smoothing- Resource loading – Calculation of EAC and ETC – Value management.					
<b>Total: 45</b>					
<b>REFERENCES:</b>					
1.	Canter M.R., “Resource Management for Construction”, 1 <sup>st</sup> Edition, Macmillan International Higher, London, 1993.				
2.	Kumar Neeraj Jha, “Construction Project Management”, 2 <sup>nd</sup> Edition, Pearson India Education Services, New Delhi, 2018.				
3.	Sears Glenn A., “Construction Project Management”, 6 <sup>th</sup> Edition, John Wiley & Sons Inc., New Jersey, 2015.				

<b>COURSE OUTCOMES:</b>				<b>BT Mapped (Highest Level)</b>	
On completion of the course, the students will be able to					
CO1:	organize and allocate the resources needed for a construction project			Applying (K3)	
CO2:	determine the factors that have an effective control over time and cost			Applying (K3)	
CO3:	calculate the resource based on the need			Applying (K3)	
CO4:	recommend a suitable equipment for a construction activity			Applying (K3)	
CO5:	implement value management concepts in construction projects			Applying (K3)	
<b>Mapping of COs with POs</b>					
COs\POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		3
CO3	2		3		3
CO4	2		3		3
CO5	2		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

18CME15 IPR AND PATENTING						
			L	T	P	Credit
			3	0	0	3
Preamble	To make the student to aware about new concepts and importance of patenting in research and development					
Prerequisites	Nil					
<b>UNIT I</b>						<b>9</b>
<b>Introduction to Intellectual Property Rights (IPR):</b> Concept and Meaning of Intellectual Property Rights- Nature and Characteristics of IPR-Origin and Development - Theories - Philosophical aspects.						
<b>UNIT II</b>						<b>9</b>
<b>International Institutions and Basic International Conventions:</b> Paris Convention for the Protection - The Berne Convention - TRIPS Agreement-International Institutions Concerned with Intellectual Property.						
<b>UNIT III</b>						<b>9</b>
<b>Contemporary Issues in IPR:</b> Interface between IPR with Human Rights - Competition Law- Sustainable development -The Impact of Internet on IPR - IPR Issues in Biotechnology- E-Commerce and IPR issues						
<b>UNIT IV</b>						<b>9</b>
<b>Basics of Patents:</b> Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent						
<b>UNIT V</b>						<b>9</b>
<b>Procedure for Filing a Patent (National and International):</b> Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication etc, Time frame and cost, Patent Licensing, Patent Infringement						
						<b>Total: 45</b>
<b>REFERENCES:</b>						
1.	Radha Krishnan R. and Balasubramanian S., “Intellectual Property Rights”, 1 <sup>st</sup> Edition, Excel Books, 2012.					
2.	Sheetal Chopra, “A Book on Indian Patenting System and Patent Agent Examination”, Kindle Edition, Notion Press Publication, 2018.					
3.	Susan K. Shell, “Private Power, Public Law: The Globalization of Intellectual Property Rights”, 6 <sup>th</sup> Edition, Cambridge University Press, 2003.					

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	illustrate the concepts behind IPR	Applying (K3)			
CO2:	explain various international conventions	Understanding (K2)			
CO3:	collect the interface between IPR and human rights	Applying (K3)			
CO4:	categorize patentable and non-patentable inventions	Analyze (K4)			
CO5:	identify the filing procedures for national and international level	Understanding (K2)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		2		2
CO2	2		2		1
CO3	2		2		1
CO4	2		2		2
CO5	1		1		2
1 – Slight, 2 – Moderate, 3 – Substantial, BT - Bloom's Taxonomy					

18CME16 THRUST AREAS IN CONSTRUCTION						
			L	T	P	Credit
			3	0	0	3
Preamble	To reframe the project reporting relationships of construction project parties and able to apply lean construction techniques to construction projects					
Prerequisites	Nil					
<b>UNIT – I</b>						<b>9</b>
<b>Project Pre-Planning and Partnering:</b> Project Pre-Planning - Definition - Scope - Setting Benchmarks - Documentation - Evaluation of Alternatives - Decision Making - Concept of PDRI (Project Definition Rating Index) - Project Partnering - Definition - Advantages - Role in Preventing Construction Disputes.						
<b>UNIT – II</b>						<b>9</b>
<b>SWOT Analysis:</b> Practical Application of SWOT – SWOT Matrix – utility and advantage – SWOT analysis - case study.						
<b>UNIT – III</b>						<b>9</b>
<b>Supply Chain and Critical Chain Management:</b> Concept of Supplier and Customer - Management Strategy for Implementing SCM - Benefits - Case Study - CCM - Measuring - Monitoring - Control - Advantages.						
<b>UNIT – IV</b>						<b>9</b>
<b>Fast Track Construction:</b> Diagrammatic Representation - Advantages - Suitability - Various Techniques - Case Study.						
<b>UNIT – V</b>						<b>9</b>
<b>Lean Construction Techniques:</b> Definitions - Lean - Value - Pull -Flow -Waste- Lean Construction - Introduction - Concepts - Objective - Development - Practical Applications - Case Study.						
						<b>Total: 45</b>
<b>REFERENCES:</b>						
1.	Lincon H. Forbes and Syed M. Ahmed, “Modern Construction: Lean Project Delivery and Integrated Practices”, 1 <sup>st</sup> Edition, CRC Press, 2010.					
2.	Bhavesh Patel, “Project Management - Financial evaluation with strategic planning, networking and control”, 2 <sup>nd</sup> Edition, Vikas Publishing House Pvt. Ltd., 2011.					
3.	William Carlos, Ruben and Kerry, “Construction Supply Chain Management”, 1 <sup>st</sup> Edition, CRC Press, 2008.					

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	generalize the importance of pre-planning and partnering	Understanding (K2)			
CO2:	carry out SWOT analysis for projects	Applying (K3)			
CO3:	implement supply chain and critical chain management for real construction projects	Applying (K3)			
CO4:	carry out the techniques involved in fast track construction	Applying (K3)			
CO5:	apply lean techniques	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1			2		1
CO2	2		2		2
CO3	3		3		3
CO4	1		3		3
CO5	3		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

<b>18CME17 PROJECT SAFETY MANAGEMENT</b>						
			<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
			<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To impart the importance of safety and safety practices in construction					
Prerequisites	Construction Management					
<b>UNIT – I</b>						<b>9</b>
<b>Construction Safety Management:</b> Safety in construction operations - Safety in use of construction equipment - General trades and their occupational hazards - Fire safety in buildings - Causes of fire hazards - fire control devices - Technologies and equipments.						
<b>UNIT – II</b>						<b>9</b>
<b>Designing for Safety:</b> Safety culture - Safe workers - Safety and first line supervisors - Safety and middle managers - Top management practices, Company activities in safety - Safety personnel – Sub contractual obligation – Project coordination and safety procedures – Workers compensation.						
<b>UNIT – III</b>						<b>9</b>
<b>Safety Policies and Contractual Obligations:</b> Study of safety policies - Study of various IS codes - Operations of construction and OSHA guidelines - Safety in construction contracts – Substance abuse – Safety record keeping.						
<b>UNIT – IV</b>						<b>9</b>
<b>Safety Programmes:</b> Problem areas in construction safety – Elements of an effective safety programme – Job-site safety assessment – Safety meetings – Safety incentives.						
<b>UNIT – V</b>						<b>9</b>
<b>Safety During Construction:</b> Safety concern in construction - Role of owners in safety and health management - Proactive position as an owner -Allocation of responsibility for safety - Fostering total safety culture -Promote job site safety - Additional concerns of owners.						
						<b>Total: 45</b>
<b>REFERENCES:</b>						
1.	Jimmy W. Hinze, “Construction Safety”, 1 <sup>st</sup> Edition, Prentice Hall Inc., 1997.					
2.	Richard J. Coble, Jimmie Hinze and Theo C. Haupt, “Construction Safety and Health Management”, 1 <sup>st</sup> Edition, Prentice Hall Inc., 2001.					
3.	Amarjit Singh, “Implementation of Safety and Health on Construction Site”, 1 <sup>st</sup> Edition, A.A. Balkema Publishers, Netherlands, 1999.					

<b>COURSE OUTCOMES:</b> On completion of the course the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	organize various construction activities prone to accidents	Applying (K3)			
CO2:	implement various constructions safety concepts	Applying (K3)			
CO3:	assess the causes of construction site accidents	Applying (K3)			
CO4:	plan effective safety programme	Applying (K3)			
CO5:	demonstrate various safety practices among personnel involved in projects	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs\POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		3
CO3	2		3		3
CO4	2		3		3
CO5	2		3		3
1 – Slight, 2 – Moderate, 3 – Substantial, BT – Bloom’s Taxonomy					

<b>18CME18 MAINTENANCE AND REHABILITATION OF STRUCTURES</b>						
(Common to Construction Engineering and Management & Structural Engineering branches)						
			L	T	P	Credit
			3	0	0	3
Preamble	To identify the causes of deterioration and consequent modern rehabilitation strategy at optimum cost					
Prerequisites	Construction Materials and Concrete Technology					
<b>UNIT – I</b>	<b>9</b>					
<b>General Aspects:</b> Performance of construction materials and components in actual structure for strength, permeability, thermal properties and cracking effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, Effects of cover thickness.						
<b>UNIT – II</b>	<b>9</b>					
<b>Maintenance and Diagnosis of Failure:</b> Maintenance, Repair and rehabilitation, Facets of Maintenance, Importance of Maintenance, Various aspects of inspection - Assessment procedure for evaluating a damaged structure. Diagnosis of construction failures.						
<b>UNIT – III</b>	<b>9</b>					
<b>Materials and Techniques for Repair:</b> Special concretes and mortar, concrete chemicals, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fiber reinforced concrete. Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Guniting and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning.						
<b>UNIT – IV</b>	<b>9</b>					
<b>Modern Techniques of Retrofitting:</b> Structural first aid after a disaster, guniting, jacketing, use of chemicals in repair, application of polymers, ferrocement and fiber concretes as rehabilitation materials, rust eliminators and polymer coating for rebars, foamed concrete, mortar repair for cracks, shoring and underpinning, strengthening by prestressing.						
<b>UNIT – V</b>	<b>9</b>					
<b>Post repair Maintenance of Structures:</b> Protection and Maintenance schedule against environmental distress to all those structures - Special cares in rehabilitation of heritage structures - high rise buildings - bridges and other special structures.						
					<b>Total: 45</b>	
<b>REFERENCES:</b>						
1.	Dayaratnam P. and Rao R., “Maintenance and Durability of Concrete Structures”, 1 <sup>st</sup> Edition, University Press, India, 1997.					
2.	Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, 1 <sup>st</sup> Edition, Longman Scientific and Technical, UK, 1991.					
3.	Dodge Woodson R., “Concrete Structures – protection, repair and rehabilitation”, 1 <sup>st</sup> Edition, Elsevier Butterworth – Heinmann, UK, 2009.					

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	examine the performance of construction materials influenced by various factors	Applying (K3)			
CO2:	choose repair and maintenance strategies for structures	Applying (K3)			
CO3:	apply suitable post repair techniques for special structures	Applying (K3)			
CO4:	adopt appropriate pre-stressing technique for special structures	Applying (K3)			
CO5:	select the maintenance strategies for special structures	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		3
CO3	2		3		3
CO4	2		3		3
CO5	2		3		3
1 – Slight, 2 – Moderate, 3 – Substantial , BT - Bloom's Taxonomy					

<b>18CME19 GREEN BUILDING MANAGEMENT</b>					
(Common to Construction Engineering Management & Structural Engineering branches)					
		<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
Preamble	To categorize conventional and eco friendly building concept and building certification systems as per Indian and International Standards				
Prerequisites	Nil				
<b>UNIT – I</b>					<b>9</b>
<b>Introduction to IGBC and Green Building Concept:</b> Green building concept- Introduction to IGBC- Green Building rating tools - Green project management and certification - Documentation and certification - Methods and management practices					
<b>UNIT – II</b>					<b>9</b>
<b>Introduction to Green Rating Systems:</b> History of green rating systems - LEED, GRIHA, BREEAM, IGBC - Need and use of green rating systems - Structure of the rating systems - Market response to various rating systems - Selection of the appropriate rating system.					
<b>UNIT – III</b>					<b>9</b>
<b>Alternative Construction Materials and Construction Methods:</b> Building and material reuse - Salvaged materials - Material content - Manufactured materials - Recycled content – Eco block - Volatile organic compounds (VOC's) Natural non-petroleum based materials - Alternative construction methods - Alternative systems - Waste management and recycling - Design for deconstruction					
<b>UNIT – IV</b>					<b>9</b>
<b>Performance Testing:</b> Cost and performance comparisons and benchmarking - Building modeling and energy analysis - Cost benefit analysis - Testing and verification - Energy, shell and systems installation testing - Blower door - Duct tightness - Thermal imagery - Air quality - Moisture testing - Commissioning, metering, monitoring -Weatherization - Air sealing – HVAC - Moisture control - Energy retrofits and green remodels.					
<b>UNIT – V</b>					<b>9</b>
<b>Future of Building Rating Systems:</b> Role of green building consultant - Determining the various green points - Green accreditation examinations - Energy modeling and energy auditing in green building ratings - Consultancy scope and services for green rating systems - Codes and certification programs - Green rating registration - Documentation and management - Inspection and evaluation - Deep energy retrofits - Green remodel ratings - International green construction codes and ratings - Case study on existing green building.					
<b>Total: 45</b>					
<b>REFERENCES:</b>					
1.	Ross Spiegel G., “Green Building Materials A Guide to Product Selection and Specification”, 3 <sup>rd</sup> Edition, John Wiley & Sons, 2010.				
2.	Jagadish K.S., “Alternative Building Materials and Technologies”, New Age International Pvt. Ltd. Publishers, 2008.				
3.	Sam Kubba, “Handbook of Green Building Design and Construction”, 2 <sup>nd</sup> Edition, Butterworth-Heinemann Publications, 2016.				

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>			
CO1:	model the concepts of green building	Applying (K3)			
CO2:	execute the existing green building rating systems	Applying (K3)			
CO3:	discover alternate construction materials and methods	Analyzing (K4)			
CO4:	examine the green buildings	Analyzing (K4)			
CO5:	design the codes for certification of green construction.	Applying (K3)			
<b>Mapping of COs with POs</b>					
COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	2		3		3
CO2	2		3		3
CO3	2		3		3
CO4	2		3		3
CO5	2		3		3
1- Slight , 2 - Moderate , 3 – Substantial, BT – Bloom’s Taxonomy					