

ACADEMIC CURRICULA
POST GRADUATE DEGREE
PROGRAMMES

Master of Technology

(Choice Based Flexible Credit System)

Regulations 2021

Volume – 26
Syllabi for Civil Engineering and Nanotechnology
Programmes

Professional Core and Elective Courses



SRM

INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

**Kattankulathur, Chengalpattu District 603203, Tamil Nadu,
India**

ACADEMIC CURRICULA

Civil Engineering Common Professional Elective Course

Regulations 2021

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

**Kattankulathur, Chengalpattu District 603203, Tamil Nadu,
India**

Course Code	21MAE501T	Course Name	ADVANCED MATHEMATICAL TECHNIQUES		Course Category	E	PROFESSIONAL ELECTIVE			L	T	P	C
										3	0	0	3
Pre-requisite Courses	Nil		Co-requisite Courses	Nil		Progressive Courses	Nil						
Course Offering Department		Mathematics			Data Book / Codes/Standards		Statistical table						
Course Learning Rationale (CLR)	The purpose of learning this course is to:												
CLR-1:	learn the concept of one dimensional wave equations and diffusion equation												
CLR-2:	understand the concepts of Euler's equations												
CLR-3:	learn concepts of Fredholm and Volterra integral equations												
CLR-4:	study the sampling techniques to real world applications												
CLR-5:	learn the concept of design of experiment and control charts												
Course Outcomes (CO):	At the end of this course, learners will be able to:										Programme Outcomes (PO)		
										1	2	3	
CO-1:	solve one dimensional wave equations and diffusion equation by using Laplace and Fourier transform techniques										3	3	-
CO-2:	familiar with solving Euler's equations										3	3	-
CO-3:	solve Fredholm and Volterra integral equations										3	3	-
CO-4:	transfer the knowledge to model the sampling techniques										3	3	-
CO-5:	construct design of experiments and control charts										3	3	-
Module 1: Transform Techniques9 Hour													
Laplace transform - Fourier transform - One-dimensional wave equation using Laplace transform methods - Displacements in long string - Longitudinal vibration of an elastic bar - One-dimensional diffusion equation using Fourier transform methods – One-dimensional diffusion equation using Fourier sine transform methods – One-dimensional diffusion equation using Fourier cosine transform methods.													
Module 2: Variational and Isoperimetric Problems9 Hour													
Euler's Equations - Functional involving x, y, y' - Functional on higher order derivatives - Functional dependent on functions of independent variables - Geodesics – Ritz method.													
Module 3: Integral Equations9 Hour													
Fredholm integral equations - Volterra integral equations - Integro- differential equation - Green's function - Fredholm equations with separable kernel - Iterative methods.													
Module 4: Testing of Hypothesis9 Hour													
Sampling distribution, Null hypothesis, Alternate hypothesis - One-tailed test, two-tailed test - Level of significance, Critical region - Large samples test - Student - t test - single Proportion - Two Sample proportions - Large sample test, Single Mean - Difference of Means - Paired 't' test - Applications of Difference of Means - small samples - F-test problems - Differences between two population variances - Differences between two Normal population variances - Applications of paired - t-test. - Chi-Square goodness of fit - Chi-square test - Independent Attributes.													
Module 5: Design of Experiments and Statistical Quality Control9 Hour													
Design of Experiments – Completely Randomized Design – Randomized Block Design – Latin Square Design - Control theory - Control charts for X and R - Control charts for X and S.													

Learning Resources	1. Gupta, S.C., & Kapoor, V.K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, Edition 2018	4. B.V. Ramana, "Higher Engineering Mathematics", McGraw Hill Publication, 2017.
	2. Dr.B.S.Grewal., "Higher Engineering Mathematics", Khanna Publishers, 44 th Edition, 2019	5. Vijay K. Rohatgi., A.K. Md. Ehsanes Saleh, An Introduction to Probability and Statistics, 2 nd Edition, Wiley, 2008.
	3. M. B. K. Moorthy, "Advanced Mathematical Methods", Yesdee Publication, 2 nd Edition, 2019.	6. R.A.Johnson and C.B Gupta, " Miller & Freund's Probability and Statistics for Engineers", Pearson Eduction, Asia, 7th Edition, 2007.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	15%	-	15%	-	15%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	15%	-	15%	-	15%	-
Level 6	Create	15%	-	15%	-	15%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Madhan Shanmugasundaram, Infosys Technologies, madshan@gmail.com	1. Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in 2. Prof. K.C. Sivakumar, IIT Madras, kcskumar@iitm.ac.in	1. Dr. V. Subburayan, SRMIST 2. Dr. G. Arul Joseph, SRMIST

ACADEMIC CURRICULA

Construction Engineering and Management Professional Core Courses

Regulations 2021

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

**Kattankulathur, Chengalpattu District 603203, Tamil Nadu,
India**

Course Code	21CEC531T	Course Name	MODERNISTIC APPROACHES IN CONSTRUCTION MANAGEMENT	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>understand the necessity and application of building information modelling</i>
CLR-2:	<i>understand the different types of lean tools and the implementation in construction project</i>
CLR-3:	<i>identify the need for sustainability in construction and practices</i>
CLR-4:	<i>exploring the applications of automation in construction practices</i>
CLR-5:	<i>understanding the requirement of internet of things and its implementation in construction projects.</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	<i>understand the applications and types of modular housing</i>	3	2	3
CO-2:	<i>develop and implement the prefabrication techniques in construction</i>	3	3	2
CO-3:	<i>apply the knowledge to identify the suitable materials and products for cost efficiency</i>	1	1	3
CO-4:	<i>accrue comprehensive knowledge of automation in construction practices</i>	2	2	2
CO-5:	<i>expose to the modern technique and futuristic trends in modular housing</i>	3	2	3

Module-1 – Trends in Construction Management	9 Hour
<i>Construction management practices - History of construction management methods - Project management - Fast track construction - Building Information Modelling (BIM) - BIM components - Applications of BIM - BIM application in planning stage - BIM application in execution stage - Challenges in implementation of BIM.</i>	
Module-2 – Lean Project Management	9 Hour
<i>Lean tools for construction industry - Lean in construction management - Benefits in lean in construction management - Work flow of LPS - Lean construction methods - Lean – Minimization of risks - Practical implementation of lean methods - Last Planner system (LPS) in construction industry - Work flow of LPS - Lean design and delivery - Lean and sustainability principles - Lean implementation challenges.</i>	
Module-3 – Sustainability in Construction	9 Hour
<i>Sustainable construction- Sustainable construction necessity- Sustainability of construction industry requirement- Sustainable development framework- Rating Systems for construction projects-Green supply chain management- Smart homes and energy.</i>	
Module-4 – Modernistic Automation Approaches	9 Hour
<i>Data analytics to improve building performance - Need of sensor technologies and robotic applications - Integration of sensor and model data - Automation applications - Additive manufacturing - 3D concrete printing - Unmanned Aerial System (UAS) applications in the built environment - Augmented reality - Robotic automation application to AEC - Smart buildings - Smart city planning.</i>	
Module-5 – Modern Tools in Construction Management	9 Hour
<i>Manufacturing and construction industries - Building prefabrication - Modular building - Digital construction - Direct digital manufacturing - Virtual digital and construction - Internet of Things - Automation in site logistics - Automation in data management - Cloud based Systems - Block chain in the built environment - Distributed ledger technology - Application of AI in construction industry.</i>	

Learning Resources	1. <i>BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers</i> , Publisher: John Wiley & Sons; 2nd edition (1 July 2011)	3. <i>Sustainable Construction: Green Building Design and Delivery</i> , Charles J. Kibert, 4th edition, 2016, John Wiley & Sons
	2. <i>Lean Construction: Practical Insights for innovating Construction Management</i> By Alexander Lange, 2016	4. <i>Automation and Robotics in Construction XI</i> , Alan Chamberlain, Newnes, 2012, 5. https://www.coursera.org/learn/bim-fundamentals , 6. https://www.coursera.org/specializations/construction-management

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	25%	-	20%	-
Level 3	Apply	20%	-	25%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	5%	-	10%	-
Level 6	Create	10%	-	5%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. K. M. Nanthan, L&T, R KMNNN@Intecc.com	1. Dr. S.Kandasamy, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, drskandasamy@veltech.edu.in	1. Dr. L.Krishnaraj, SRMIST
2. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	2. Dr.P.Ramados, Puducherry Technological University, Puducherry, dosspr@ptuniv.edu.in	2. Dr. M.Balasubramanian, SRMIST

Course Code	21CEC532J	Course Name	CONSTRUCTION PLANNING, SCHEDULING AND CONTROL	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the concepts of construction management principles
CLR-2:	explore the advantages of construction project management
CLR-3:	analyze the basic concepts of planning, scheduling and control
CLR-4:	explore the concepts of construction project management
CLR-5:	explore the concepts of computer applications in project management

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the knowledge of construction management principles	2	2	3
CO-2:	apply the knowledge of identification of activities	3	2	3
CO-3:	schedule the networking of activities using the critical path method and PERT	2	2	3
CO-4:	accrue the knowledge of calculating duration and resources	2	3	3
CO-5:	apply the knowledge of updating and monitoring the projects	2	3	3

Module-1 – Basic Concepts in Construction Planning **15 Hour**
 Construction project management - Construction participants and management consultants - Project maturity level - Construction project characteristics and classification - Feasibility Study and project scope formulation - Importance and benefits of integrated planning- Construction planning phase and processes - Construction project management: Matrix organisation - Contracts procurement schedule - Project procurement options - PCMC approach - Project planning types and techniques - Project failure: causes and Integrated planning- Role and function of chief planner and construction manager - project time, resource and cost management process - Works construction methods statement and Sequential vs fast track approach. **Laboratory:** Creating a project milestone and task of project - Creating a calendar for the project - Project activity Baseline plan - Project breakdown structure - Provide input on project and task - Input on working times

Module-2 – Construction Duration Estimation and Breakdowns **15 Hour**
 Defining project activities - Work breakdown levels and Works construction methods statement - Activity identification approaches - Duration estimation basics and methods - Duration estimation procedure - Activity resource estimation - Activity cost classification and database - Scheduling Fundamentals - Scheduling techniques- Assigning responsibilities and Structuring cost breakdown - Activity costs and BOQ work-item relationship- Scheduling classification - Hierarch of scheduling techniques and Preparing invoice schedule - Schedule of milestone events, plant and equipment - Schedule of project material requirements - Schedule of specialized agencies- – Estimating Resource Requirements for Work Activities – Coding Systems. **Laboratory:** Scheduling the activity - Providing input on resources -Resource tracking -Providing input for tracking -Resource levelling -Resource profile before and after levelling

Module-3– Network Analysis **15 Hour**
 Network analysis - Network analysis – Types - CPM Network analysis - Network elements, Modeling and events - Event timings, Associated and connected terms - Network logic- Developing network logic diagram -Float and its types, criticality and critical activity - PERT network modeling and computing critical path - Uncertainty in project duration estimation - Probability of meeting a given time schedule - Fundamentals of PNA - PNA vs CPM modeling -Network crashing and time cost tradeoff-Calculations for monte carlo schedule simulation- Resource scheduling - Inputs and outputs for resource scheduling - Resource leveling - Resource smoothening . **Laboratory:** Tracking Gantt chart for project -Project reporting- Introduction about software -Introduction about enterprises, OBS and WBS-Adding new project - Adding new enterprises and organizational break down structure.

Module-4 – Tracking of Project **15 Hour**

Updating project data and its methods - Schedule – Monthly progress report - Measuring progress at site - Typical reports to Aid progress review - Project integrated control framework - Labor, equipment and materials productivity control -Cost control and project time-cost tradeoff techniques - Time progress monitoring methodology and reduction techniques- Financial accounting systems and cost accounts- Critical chain project management - Guidelines for reviewing time progress and project control codes - Role and functions to improve resource productivity - Project management information system and its - Information management policy - PMIS functions, architectural and infrastructural components - PMIS configuration and responsibilities - Project document management and project data management - Role of project management office and factors influencing PMIS success. **Laboratory:** New project setup with project and activity ID with name -creating the calendar for the project- importance -Providing input working time with assigning predecessor and successor- Prepare scheduling- Providing input for scheduling - Work break down structure.

Module-5 – Project Controlling

15 Hour

Project management software - MS project - Milestone processing - Construction planning system - AMS real time process - Project kick start - Primavera and functions of project management - Scheduling function - Resource management function - Tracking or monitoring function - Reporting function - Additional functions - LSM and Artificial Intelligence in construction industry - Advantages of management tools - Computerized organization and use of information – Organizing information in databases – Relational model of databases – Other conceptual models of databases. **Laboratory:** Resource levelling -Providing inputs for levelling- Tracking the project -Providing input for tracking - Illustrations of tools used for project- Resource budgeting - reporting the project

Learning Resources	1. Calin M. Popescu, Chotchai Charoenngam, "Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications", Wiley, New York, 1995.	3. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamental Concepts for Owners, Engineers", Architects and Builders, Prentice Hall, Pittsburgh, 2000.
	2. Chitkara, K.K. "Construction Project Management: Planning, Scheduling and Control", McGraw-Hill Publishing Company, New Delhi, 1998.	4. Halpin, D. W., "Financial and Cost Concepts for Construction Management", John Wiley & Sons, New York, 1985. 5. Willis, E. M., "Scheduling Construction Projects", John Wiley & Sons, 1986

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-I Average of unit test (45%)		Life Long Learning CLA-II Practice (15%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	-	20%	20%	-
Level 2	Understand	20%	-	-	20%	20%	-
Level 3	Apply	20%	-	-	20%	20%	-
Level 4	Analyze	20%	-	-	20%	20%	-
Level 5	Evaluate	10%	-	-	10%	10%	-
Level 6	Create	10%	-	-	10%	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. K. M. Nanthan, L&T, RKMNNN@Intecc.com	1. Dr. A .R. Krishnaraja, Kongu Engineering college, krajacivil@kongu.ac.in	1. Dr. M. Balasubramanian, SRMIST
2. Mr. Jayasankar k, Ultra tech cement Limited, jayasankar2411@gmail.com	2. Dr. K.Yogeswari, B.S. Abdur Rahman Crescent Institute of Science and technology, yogeswari@crescent.education	2. Dr. L. Krishnaraj, SRMIST

Course Code	21CEC533J	Course Name	CONSTRUCTION MATERIALS AND PRACTICES	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes / Standards	IS10262:2019, IS456:2000		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the concepts of building materials
CLR-2:	explore the advantages and properties of architectural materials
CLR-3:	analyze the basic concepts of smart materials.
CLR-4:	identify the various properties and its types of chemical and mineral admixtures
CLR-5:	explore the of concepts and special concretes.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the knowledge of building materials and practice	2	2	2
CO-2:	apply the knowledge of productivity, properties of architectural materials	3	2	3
CO-3:	accrue the knowledge of smart materials.	2	3	3
CO-4:	formulate and implement the chemical and mineral admixture in construction techniques.	2	3	3
CO-5:	apply the knowledge of concepts and special concretes in research applications	2	3	3

Module-1 - Building Materials	15 Hour
Building materials: Cement- Types - Properties and testing – Aggregate – Types - Properties and testing, Reinforcement –Types - Manufacturing process - Properties – Types of coatings & coatings to reinforcement. Metals: Metals and special alloys of steel - Water jet cut stainless steel, mill slab steel, tension rods assemblies and cast iron - Heat treatment – Tendons - GI sheets, tubes and lightweight roofing materials - Aluminium and its products- Laboratory work: Properties of cement, fine and coarse aggregate.	
Module-2 - Architectural Materials	15 Hour
Architectural materials: Wood and wood product – Glass - Floor finishes – Paints – Tiles - Thermal insulation and acoustic absorption materials - decorative panels and laminates - architectural glass and ceramics - ferrocement. Polymers- Structural plastics and composites- Polymer membranes- Coatings-Adhesives, Non-Weathering materials-Flooring and facade materials- Glazed brick - Photo catalytic cement – Acid etched copper and composite fibres Laboratory work: Fresh concrete properties	
Module-3 – Smart Materials	15 Hour
Smart Materials: Neoprene, Bridge pads, Thermocole, Smart and intelligent materials – Special features –Case studies showing the applications of smart and Intelligent Materials. Petroleum products, Fibre reinforced polymers, Bituminous materials Laboratory work: Hardened concrete	

Module-4 Chemical and Mineral Admixtures **15 Hour**

Chemical and mineral admixtures: Types and properties of chemical admixtures - Water proofing compounds– Sealants, Engineering grouts, Various types of finishes & treatments, Fly ash – Silica fume – GGBFS - Metakaolin – Rice husk ash - Properties and its application in concrete under special environment.

Laboratory work: Testing of concrete with admixture

Module-5 – Special Concrete **15 Hour**

Concrete mix design - Special concrete: Self-compacting concrete – Lightweight concrete – Self dynamic concrete – Self Healing Concrete – Nanotube concrete – High density concrete – High performance concrete – Ready mix concrete – Geopolymer concrete.

Laboratory work: Testing of special concrete

Learning Resources	1. Kumar Mehta P. and Paulo J. M. Monteiro, (2014), Concrete: Microstructure, Properties and Materials, 4th Edition, McGraw-Hill, New Delhi.	5. George C. Sih, Alberto Carpinteri and Surace, G (Eds.) (2010), Advanced Technology for Design and Fabrication of Composite Materials and Structures: Applications to the Automotive, Marine, Aerospace and Construction Industry, in: Engineering Applications of Fracture Mechanics Series, Springer, Netherlands
	2. Shetty. M. S., (2017), Concrete Technology, S. Chand and Company Ltd, New Delhi.	
	3. Neville. A. M., (2012), Properties of Concrete, Pearson, New Delhi.	
	4. ACI 211.1-91 Reapproved 2009, Standard Practice for selecting Proportions for Normal, Heavyweight, and Mass Concrete, USA	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (45%)		Life Long Learning CLA-2- Practice (15%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	-	20%	20%	-
Level 2	Understand	20%	-	-	20%	20%	-
Level 3	Apply	20%	-	-	20%	20%	-
Level 4	Analyze	20%	-	-	20%	20%	-
Level 5	Evaluate	10%	-	-	10%	10%	-
Level 6	Create	10%	-	-	10%	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. R.Ramachandran, The Ramco Cements Limited, Chennai, ram@ramcocements.co.in	1. Dr. J. Saravanan, Annamalai University, ausjs5070@gmail.com	1. Dr. N.Pannirselvam, SRM IST
2. Mr. K. M. Nanthan, L&T, RKMNNN@Intecc.com	2. Dr. A.K. Kaliluthin., B.S. Abdur Rahman Crescent Institute of Science and Technology, yogeswari@crescent.education	2. Dr. S.Manikandaprabhu alias Saravanan, SRMIST

Course Code	21CEC534T	Course Name	ADVANCED CONSTRUCTION METHODS	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							4	0	0	4

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	provide students with a comprehensive understanding of the construction of special foundation used for construction.
CLR-2:	equip students with the knowledge, identify, assess, and safety hazards through the concepts of formwork.
CLR-3:	develop students understanding of the importance of precast technology.
CLR-4:	enhance students understanding of the importance of speed in construction using steel structures.
CLR-5:	enable students to apply theoretical knowledge and practical skills to real-world construction concept of large span structure.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	identify and analyze common special construction and understand the special foundation.	2	2	2
CO-2:	develop and implement comprehensive safety management in using formwork	2	3	2
CO-3:	assess and control the new technology of precast technology.	3	3	2
CO-4:	technology to enhance safety in construction, including the use of steel.	2	3	2
CO-5:	identify and analyze common space in construction and understand the importance of large span structure in the industry.	2	3	3

Module-1 - Construction of Special Foundations	12 Hour
Construction of special foundations: Dewatering system: Pumping well points, Bored wells, Electro – Osmosis, Injection with cement, Clays and chemical, Freezing process, Vibro – Flotation, Construction of pile foundation - Introduction, Types of piles, Pile cap and pile shoe, Pile driving, Pulling of piles, Loads on Piles, Causes of failures of piles, Reverse and direct mud circulation method, Pile driving formulas, Bentonite and polymer for soil stabilisation in piles, Construction of raft foundation, Diaphragm wall construction, Pore pressure release in raft, Well foundation, Tremie concreting, Jack down method, Temperature measurement and Control in mass concreting.	
Module-2 - Special Formwork	12 Hour
Special formwork: Introduction to IS, Proprietary formwork, Modular formwork, Permanent formwork, Tunnel formwork, Aluminum formwork, Jump formwork, Slip formwork Industrial roof and flooring: Vacuum dewatered concrete, IPS water proofing, Types of roofs, Profile roofing, Industrial flooring, Mezzanine floor, Composite flooring, Profile roofing, Shear connectors, Wind bracing, Cleat and purlins	
Module-3 - Precast Concrete Technology	12 Hour
Precast concrete technology: Classification of precast concrete elements, Advantages and disadvantages, Types of precast concrete non-building elements (Manufacturing process, Casting yard set up and facilities, Uses, Installation and IS standards), Types of precast concrete building elements and its fabrication (Casting yard set up – Facilities and equipment's), Application and installation including all points to be considered such as marking, Lifting, Placing etc., Joints in precast buildings	
Module-4 - Construction of Steel Structures	12 Hour
Construction of steel structures: Introduction to various steel sections available as per IS standards, Built-up section, Collection of structural and fabrication drawing, Understanding of detailing and fabrication drawing, Fabrication and marking of various steel building elements, Lifting and placing of steel building elements, Fabrication of steel columns, Truss, Girders, Gantry girders, Riveted and welded connections	
Module-5 – Large Span Structures	12 Hour
Introduction to large span structures construction, Trenchless techniques, Bow string bridges, Suspension bridges, Cable stayed bridges, Domes, Aerial transportations, Introduction of Special structure construction: Lattice tower, Rigging of transmission line structures, Articulate structure.	

Learning Resources	1. Roy Chudley, Roger Geeno, "Advanced Construction Technology" Latest Edition.	4. McMullan, R. (2017). Environmental Science in Building (8th ed.). Palgrave Macmillan.
	2. Sankar, S.K. And Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008	5. Robertwade Brown, "Practical Foundation Engineering Hand Book", McGraw Hill Publications, 2005.
	3. Emmitt, S. (2013). Advanced Construction Technology (5th ed.). Routledge.	6. Patrick Powers .J, "Construction Dewatering: New Methods And Applications" John Wiley & Sons, 2002.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	15%	-	15%	-	15%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	25%	-	25%	-	25%	-
Level 4	Analyze	25%	-	25%	-	25%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	5%	-	5%	-	5%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1.Mr. GAB Suresh, The Ramco Cements Limited, Chennai, gab@ramcocements.co.in	1. Dr.R.Senthil, Anna University, Chennai, senthil@annauniv.edu	1. Dr N.Pannirselvam, SRMIST
2. Er. T. Gurusamy, GHAA Associates guru.epmc@gmail.com	2. Dr.R.Baskar, Annamalai University, Chidambaram, rajaram_baskar@rediffmail.com	2. Dr. S.Manikandaprabhu alias Saravanan, SRMIST

Course Code	21CEC535T	Course Name	CONSTRUCTION ECONOMICS AND FINANCIAL MANAGEMENT	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	provide a foundation in economic principles relevant to the construction industry.
CLR-2:	equip students with financial analysis tools for project evaluation and investment decisions.
CLR-3:	introduce advanced financial techniques for comprehensive project appraisal and risk management.
CLR-4:	develop understanding of financial accounting, reporting, and the Indian taxation framework.
CLR-5:	familiarize students with financial markets, instruments, and regulatory bodies in India.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	apply basic economic principles to analyze the construction industry's landscape.	2	2	3
CO-2:	evaluate construction projects using various financial analysis and investment appraisal methods.	2	3	3
CO-3:	utilize advanced financial techniques to assess project feasibility and manage financial risks.	2	3	3
CO-4:	prepare and interpret financial statements and understand tax implications in the construction sector.	1	3	3
CO-5:	demonstrate knowledge of financial markets, instruments, and the role of financial institutions in India.	2	2	3

Module-1- Fundamentals of Economics	12 Hour
Introduction to economics; Macroeconomics - Basic terminologies; Indian economic status; GDP and its calculations; Microeconomics - Demand and Supply curve; Relationship between GDP, Inflation, Interest rate, and Employment; Importance and economics of construction sector; Different forms of construction business organization.	
Module-2 - Financial Analysis and Project Evaluation	12 Hour
Project selection criteria; Feasibility study; Cost of capital, Rate of return and Minimum attractive rate of return; Simple interest vs compound interest; cash flow diagram; Time value of money - Present value and future value of single amount, Present value and future value of Annuity, Annuities due, Loan amortization schedule; out of pocket commitment; payback period; Average annual rate of return; Net Present Value (NPV) -Alternatives with equal lives and unequal lives - Common multiple method, Study period method, Alternatives with infinite lives.	
Module-3 - Advanced Financial Analysis Techniques	12Hour
Discounted payback period; Internal rate of return; Future worth comparison; Equivalent annual charge; Benefit cost ratio; Incremental rate of return; Sensitivity analysis; Sensitivity analysis with single alternative, more than one alternative; Breakeven point; Marginal costing; Cost volume profit analysis; Margin of safety; Running account bills, Final account bills.	

Module-4 - Financial Accounting and Taxation **12 Hour**

Financial accounting; Accounting process; Accounting concepts; Relevant accounting statements - Profit and loss statement, Balance sheet, Cash flow statement; Financial statement analysis; Case study of financial statement analysis; Ratio analysis. Indian taxation system; Introduction to tax planning; Overview of income tax and practice; Tax planning; Tax incentives and tax exemptions; Depreciation, effect of depreciation on tax calculation.

Module-5 - Financial Markets and Instruments **12 Hour**

Indian Monetary system and financial system - structure and role, Financial markets; Financial instruments – Equities, Bonds, Treasury Securities, Derivatives, Mutual Funds, Exchange-Traded Funds (ETFs); Basics of share market; Financial services – insurance, assets management companies, Credit rating agencies; Private equities - Leveraged Buyouts (LBOs) and venture capital, Financial regulatory bodies role and functions - Securities exchange board of India (SEBI), Insurance regulatory and development authority (IRDA), Reserve bank of India (RBI)

Learning Resources	1. Prasanna Chandra, Project Selection, Planning, Analysis, Implementation and Review, Tata McGraw Hill, Publishing Company, 1995. 2. Halpin, D.W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985. 3. Warneer Z Hirsch, Urban Economics, Macmillan, New York, 1993.	4. Madura, J and Veit, E.T., Introduction to Financial Management, West Publishing Co., St. Paul, 1988 5. Management and Organisation, Prentice – Hall of India, 1995
---------------------------	--	--

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. T. Gurusamy, GHAA Associates guru.epmc@gmail.com	1. Dr. Nikhil Bugalia, IIT Madras, nbugalia@civil.iitm.ac.in	1. Dr. K.S. Anandh, SRMIST
2. Er. Midhun Kumar V, Uniconsys Pvt Ltd	2. Dr. S. Kamal, BITS Trichy, kamalselva21@gmail.com	2. Dr. M. B. Sridhar, SRMIST

ACADEMIC CURRICULA

Construction Engineering and Management Professional Elective Courses

Regulations 2021



SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

**Kattankulathur, Chengalpattu District 603203, Tamil Nadu,
India**

Course Code	21CEE531T	Course Name	QUANTITATIVE ANALYSIS IN CONSTRUCTION	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	estimate quantity of construction materials.
CLR-2:	know the different types of values and software applications in estimation.
CLR-3:	understand the basic concepts of quantitative techniques application.
CLR-4:	understand the basic optimization problem solving approaches.
CLR-5:	know the applications of scheduling and simulation models.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the estimation of materials.	2	2	3
CO-2:	estimate the different types of values for construction project.	3	2	3
CO-3:	solve the basic operation research problems.	2	2	3
CO-4:	apply the application knowledge of optimization approaches.	2	3	3
CO-5:	accrue comprehensive knowledge of scheduling and simulation models.	2	3	3

Module-1: Introduction to Quantitative Analysis	9 Hour
Basic skills for construction drawing - Procedure for drawing - Specification using standard codes - Laboratory assignments - Develop visualization skills - Organization of working - Drawings and specifications - Types of drawing in construction - Architectural drawing - Structural drawing - Electrical drawing - Plumbing drawing - Finishing drawing - Developing submission of drawings - Drawing to scale with location plan - Site plan - Block plan - Case study - Introduction to estimation - Methods of estimates - Advantages - Objectives - Specification - Importance of specification	
Module-2: Quantity Measurement	9 Hour
General specifications - Detailed specifications - Quantity take off - Men quantity - Material quantity - Machinery quantity - Duration calculation - Rules of measurement - Methods of measurement - A complete estimate of a project - A complete estimate of a project - A Case study - A Case study - Load bearing structures - framed structures - Calculation of quantities - Quantities of brick work - Quantities of RCC - Quantities of PCC - Plastering, whitewashing - colour washing and painting - varnishing for shops - Calculation rooms - residential building with flat	
Module-3: Method of Estimation and Valuation	9 Hour
Pitched roof - Practice experiment - MS- EXCEL practice - Cost X- practice - Quantity take off by using MS- EXCEL - Estimation of quantities stage wise - Carryout the rate analysis - costing for different stages of work - Preparation of Bid - delivery of the bid - proposal of an engineering construction project - Introduction to Valuation - Gross income and net income - Outgoing - Scrap value - Salvage Value - Obsolescence and annuity - Capitalized value - Years purchase - Sinking fund - Depreciation - Valuation of building - Determination of depreciation - Method of valuation	
Module-4: Optimization Approaches	9 Hour
Life of various items of work - Example of valuation - Mortgage lease - Fixation of rent - Examples of rent fixation - Plinth area required for residential buildings - Introduction to Operations research - Linear programming - Terms - Graphical method - Problems - Simplex Methods - Concepts - Dynamic programming – concepts - Shortest path method - concept - problems - Integer Programming - Branch and bound techniques - problems - Transportation Problems - Least cost method - North west corner cell method	
Module-5: Simulation Models	9 Hour
Vogel's approximation method - Problems - U-V method - Problems - Application to Production Scheduling - Basics - Terms/concepts - Single machine scheduling - Flow Shop Scheduling - Problems - Job shop Scheduling - Simulation Models - Basic - Terms - Basic Problems - Problems - Game Theory applications – Concept - Terms - Algorithms - Basic models - Problems	

Learning Resources	1. <i>Estimating and Costing in Civil Engineering</i> , B. N. Dutta, S. Dutta, UBS Publishers Distributors (P), Limited, 1991	3. <i>Quantitative Techniques in Management</i> , 3e, N. D. Vohra, Tata McGraw-Hill Education, 2006
	2. <i>Operations Management for Construction</i> , Chris March, Routledge, 2009	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	1. Dr. S. Kamal, University college of Engineering, Ramnad, kamalselva21@gmail.com	1. Dr. L. Krishnaraj, SRMIST
2. Mr. K. M. Nanthan, L&T, RKMNNN@Intecc.com	2. Dr. K.Yogeswari, B.S. Abdur Rahman Crescent Institute of Science and technology, yogeswari@crescent.education	2. Dr. M. Balasubramanian, SRMIST

Course Code	21CEE532T	Course Name	CONSTRUCTION PERSONNEL MANAGEMENT	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the unique challenges and opportunities of human resource management in the construction industry.
CLR-2:	develop effective leadership skills for managing construction projects and teams.
CLR-3:	explore advanced strategies for talent management, employee engagement, and workforce analytics.
CLR-4:	apply project management principles to plan, execute, and control construction projects.
CLR-5:	conduct research in construction HRM to inform decision-making and improve practices.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	analyze the roles, responsibilities, and legal aspects of construction personnel management.	2	2	3
CO-2:	demonstrate leadership skills, including communication, problem-solving, and team building.	2	2	3
CO-3:	design and implement HR strategies for talent management, workforce development, and retention.	1	2	3
CO-4:	manage construction projects effectively using various tools, techniques, and methodologies.	1	2	3
CO-5:	critically evaluate research in construction HRM and apply findings to improve practice.	3	3	3

Module-1 - Introduction to Construction Personnel Management	9 Hour
Overview of construction industry - Roles and responsibilities in construction projects - Organizational structures in construction - Human resource planning in construction - Job analysis and design - Recruitment and selection - Employee onboarding and training - Performance management - Compensation and benefits - Labor relations in construction - Health and safety management - Legal and ethical issues in construction HRM	
Module-2 - Leadership in Construction	9 Hour
Leadership theories and styles - Leadership skills for construction managers - Decision making and problem solving - Communication and conflict resolution - Team building and motivation - Managing diversity in construction - Emotional intelligence in leadership - Change management - Crisis management - Ethical leadership - Sustainability leadership in construction - Case studies in construction leadership	
Module-3 - Advanced Topics in Construction HRM	9 Hour
Talent management in construction - Employee engagement and retention - Succession planning - Workforce analytics in construction - Technology in HRM (HRIS, AI, social media) - Strategic HRM in construction - International HRM in construction - Contractor and subcontractor management - Managing remote and virtual teams - Work-Life balance in construction - Employee wellness programs - future trends in construction HRM	
Module-4 - Project Management in Construction	9 Hour
Project life cycle and organization - Project planning and scheduling - Project cost and quality management - Risk management in construction projects - Procurement and contract management - Stakeholder management - Project control and monitoring - Project closure and evaluation - Agile project management in construction - Project management tools and techniques - Project management office (PMO) In construction - Case studies in construction project management	
Module-5 - Research Methods in Construction HRM	9 Hour
Research design and methodology - Quantitative research methods - Qualitative research methods - Mixed methods research - Data collection techniques - Data analysis and interpretation - Research ethics in construction HRM - Writing a research proposal - Conducting a literature review - Writing a research report - Dissemination of research findings - Case studies in construction HRM research	

Learning Resources	1. Loosemore, M., Dainty, A., & Lingard, H. (2003). <i>Human Resource Management in Construction Projects: Strategic and Operational Approaches</i> (1st ed.). London: Routledge.	4. Smith, J. G. (2009). <i>Construction Management: Subcontractor Scopes of Work</i> (1st ed.). CRC Press. 5. Cartlidge, D. (2015). <i>Construction Project Manager's Pocket Book</i> (1st ed.). Routledge.
	2. Sears, S. K., Sears, G. A., Clough, R. H., Rounds, J. L., & Segner, R. O. (2008). <i>Construction Project Management: A Practical Guide to Field Construction Management</i> (5th ed.). Wiley.	
	3. Goetsch, D. L. (2021). <i>Leadership in the Construction Industry: Developing Authentic Leaders in a Dynamic World</i> (1st ed.). Routledge.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. G Muneeswaran, L&T, gmeswar@Intecc.com	1. Dr. Ramesh Kannan. M, Anna University (CEG), rameshkannan@annauniv.edu	1. Dr. K.S. Anandh, SRMIST
2. Er. P. Jahanathan, UCON PT Structural System, Pvt. Ltd., jegan@utraconindia.com	2. Dr. S. Kamal, BITS Trichy, kamalselva21@gmail.com	2. Dr. J. Rajprasad, SRMIST

Course Code	21CEE533T	Course Name	ORGANIZATION DYNAMICS AND HUMAN RESOURCE MANAGEMENT	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>understand organizational dynamics and its impact in construction.</i>
CLR-2:	<i>explore advanced topics in organizational dynamics for effectiveness.</i>
CLR-3:	<i>develop leadership skills for success in the construction industry.</i>
CLR-4:	<i>apply HRM principles for effective workforce management.</i>
CLR-5:	<i>master accident reporting and analysis for improved safety.</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	<i>analyze organizational dynamics in construction projects.</i>	2	2	3
CO-2:	<i>apply advanced organizational concepts to enhance effectiveness.</i>	1	2	3
CO-3:	<i>demonstrate leadership skills in construction project scenarios.</i>	1	2	3
CO-4:	<i>formulate effective HRM strategies for construction projects.</i>	1	2	3
CO-5:	<i>prepare comprehensive accident reports and propose solutions.</i>	2	3	3

Module-1 - Introduction to Organization Dynamics in the Construction Industry	9 Hour
Understanding organization dynamics - Role of organization dynamics in the construction industry - Key factors influencing organization dynamics - Impact of organization structure on dynamics - Leadership and its impact on organization dynamics - Communication and organization dynamics - Conflict management in construction organizations - Decision making and problem solving in construction organizations - Change management in construction organizations - Role of technology in organization dynamics - Case study: organization dynamics in a construction project	
Module-2 - Advanced Topics in Organization Dynamics	9 Hour
Organizational learning and knowledge management - Innovation and creativity in organizations - Organizational effectiveness and excellence - Corporate governance and ethics - Corporate social responsibility and sustainability - Diversity and inclusion in organizations - Emotional intelligence in organizations - Organizational agility and resilience - Digital transformation in organizations - Organizational network analysis - Future of work and organizations - Case study: leading organizational change	
Module-3 - Leadership in the Construction Industry	9 Hour
Introduction to leadership - Importance of leadership in the construction industry - Leadership styles in construction - Role of leaders in promoting a safety culture - Communication and training - Managing safety risks and hazards - Legal and regulatory aspects of safety leadership - Technology and safety leadership - Case study: leadership in a construction project	
Module-4 - Human Resource Management in the Construction Industry	9 Hour
Introduction to human resource management (HRM) - Importance of HRM in the construction industry - HRM processes and practices in construction - Recruitment and selection in the construction industry - Training and development in the construction industry - Performance management in the construction industry - Compensation and benefits in the construction industry - Employee relations in the construction industry - Legal and ethical issues in HRM for the construction industry - Role of technology in HRM - Case study: HRM practices in a construction company	

Module-5 - Reporting and Analysis of Accidents in the Construction Industry**9 Hour**

Importance of accident reporting - Process of accident reporting in the construction industry - Analysis of accident reports - Accident investigation techniques - Role of HRM in accident reporting and analysis - Impact of organization dynamics on accident reporting - Use of technology in accident reporting and analysis - Legal and regulatory aspects of accident reporting - Preventive measures and safety recommendations - Communication of accident analysis findings - Case study: Accident reporting and analysis in a construction project

Learning Resources	1. "Strategic Management and Organisational Dynamics: The Challenge of Complexity to Ways of Thinking about Organisations" by Ralph D. Stacey, Financial Times Prentice Hall, 2007	4. "Human Resource Management in Construction Projects" by Andrew Dainty, Routledge, 2013
	2. "Organizational Dynamics and Intervention: Tools for Changing the Workplace" by Robert W. Allen, Routledge, 2015	5. https://onlinecourses.nptel.ac.in/noc20_mg51/course
	3. "Human Resource Management" by Prof. Gary Dessler, Pearson Education, 2012	6. https://onlinecourses.nptel.ac.in/noc24_mg04/course

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. G Muneeswaran, L&T, gmeswar@Intecc.com	1. Dr. Rajasekaran C, NITK, bcrajasekaran@nitk.edu.in	1. Dr. K.S. Anandh, SRMIST
2. Er. P. Jahanathan, UCON PT Structural System, Pvt. Ltd., jegan@utraconindia.com	2. Dr. S. Kamal, BITS Trichy, kamalselva21@gmail.com	2. Dr. A. Arokiaprakash, SRMIST

Course Code	21CEE534T	Course Name	BUILDING REHABILITATION AND FORENSIC ENGINEERING	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>understand the various building defect</i>
CLR-2:	<i>analyze the building damages and failures</i>
CLR-3:	<i>identify the various building repair materials</i>
CLR-4:	<i>analyze the basic concepts of methods and techniques on demolishing and dismantling structures</i>
CLR-5:	<i>explore the advanced level of various techniques used for building structural strengthening</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	<i>understand the causes of failure of structures</i>	3	2	3
CO-2:	<i>diagnose distress of structures and familiar with the case studies</i>	3	3	2
CO-3:	<i>apply the knowledge of assessing building stability and maintenance</i>	1	1	3
CO-4:	<i>accrue comprehensive knowledge of strengthening of various structural members</i>	2	2	2
CO-5:	<i>expose to the modern technique and futuristic of structural health monitoring</i>	3	2	3

Module-1 – Failure of Structure	9 Hour
<i>Failure of structures: Review of the construction theory - Causes of distress in structural members - Design and construction error - Material deficiencies - Holistic model of deterioration of RCC - Permeability of concrete - Corrosion of steel - Aggressive deteriorating chemical agents - Over loading</i>	
Module-2 – Evaluation of Structure	9 Hour
<i>Stages of conditional survey - Non-destructive evaluation test – Concrete strength assessment – Chemical tests – Corrosion potential assessment – Fire damage assessment – Structural integrity assessment – Evaluation of building configuration – Case study on multi-storied building</i>	
Module-3 – Repair Materials and Methods	9 Hour
<i>Essential parameters for repair materials – Premixed cement concrete/ mortar – Polymer modified concrete/ mortar - Epoxy and Polyester resins - Gypsum mortar - Surface coatings - Ferrocement and fibre concretes – Mechanical anchors - Guniting and jacketing - Strengthening by pre-stressing - Provisions of BIS 1893 and 4326</i>	
Module-4 – Protection and Structural Health Monitoring	9 Hour
<i>Importance of protection - Categories of maintenance - Building maintenance - Preventive and horticulture maintenance - Corrosion mitigation techniques – Day to day, annual and special repairs - Definition and motivation for SHM - Basic components of SHM - Working mechanism - Proactive maintenance of structures using SHM</i>	
Module-5 – Futuristic Structural Health Monitoring	9 Hour
<i>Structural Vision Data - Structural Damage Localization - Structural Image Classification – AI in vision based SHM - Digital Twins – Wireless sensos – Edge computing – AR/VR – IoT in SHM</i>	

Learning Resources	1. Robert. T Ratay, <i>Forensic Structural Engineering Handbook</i> , Mc Graw Hill, 2009.	4. Dov Kaminetzky, <i>Design and Construction Failures</i> , Galgotia Publication, New Delhi, 2009.
	2. <i>Handbook on repair and rehabilitation of RCC buildings</i> , CPWD, New Delhi, 2002.	5. Stephen E. Petty, <i>Forensic Engineering: Damage Assessments for Residential and Commercial</i> , 2 nd edition, CRC press, Florida, 2013
	3. Khalid M. Mosalam, Yuqing Gao, <i>Artificial Intelligence in Vision-Based Structural Health Monitoring</i> , Springer Nature, Switzerland, 2024.	6. CPWD maintenance manual, CPWD, New Delhi, 2000

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	30%	-	25%	-	30%	-
Level 3	Apply	30%	-	25%	-	30%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	5%	-	-	-
Level 6	Create	-	-	5%	-	-	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. K. M. Nanthan, L&T, R KMNNN@Intecc.com	1. Dr. H Jane Helena, Anna University, Chennai, jane@annauniv.edu	1. Dr. N.Pannirselvam, SRMIST
2. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	2. Dr.S.Eswari, Puducherry Technological University, Puducherry, eswariepc@ptuniv.edu.in	2. Dr. S.Manikandaprabhu alias Saravanan, SRMIST

Course Code	21CEE535T	Course Name	CONSTRUCTION MATERIAL MANAGEMENT	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the various material classification
CLR-2:	explore the various material purchase techniques
CLR-3:	analyze the various procurement technique
CLR-4:	identify the store management technique
CLR-5:	explore the concepts of waste management

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the knowledge of construction materials and practice	2	2	3
CO-2:	apply the knowledge of calculating and purchasing materials	3	2	3
CO-3:	accrue the knowledge of designing the correct procurement technique	2	2	3
CO-4:	accrue knowledge of various store management	2	3	3
CO-5:	apply the knowledge of concepts of waste management	2	3	3

Module-1 - Material Classification	9 Hour
Material classification- Organizing for materials management – Basis for forming organizations – Conventional and modern approaches to organizing materials management- Material requirement planning- enterprise resource planning- Scope, Importance – Functions of material management- Materials identification – Classifying of materials – Codification of materials – Standardization – Simplification and variety reduction of materials –Integrated material management system- Demand forecasting – Types and techniques.	
Module-2 - Material Purchasing	9 Hour
Material purchasing–Purchasing function- Planning purchasing materials –Purchase function- Norms of vendor rating – CEI methodology – Material selection and development – Purchasing procedures and methods – Legal aspects – Insurance of materials – ABC analysis in material management- Just in time principles of material management- Lead time in material management- Integrated approaches in material management – Vendor rating system- Ethical concepts in purchase – CIL Purchase manual 2020 and its amendments- Legal aspects of purchasing: Indian contract act, Sale of goods act, Indian companies act, GST act, Arbitration & conciliation act- Awareness of SAP-ERP in CIL.	
Module-3 - Procurement Management	9 Hour
Supply management – Sources of supply – Outsourcing material management- Procurement organization - Procurement planning - Functions of material management – Types of inventory- Inventory control- Economic order quantity, Forecasting techniques, Determination of safety stocks, Spare parts inventory- Procurement on gem - Supply chain management- Quality control and cost control in material management – Sustainability in material management. role and management of flow of material in supply chain management- Procurement cycle- Materials handling and transportation, Comparative transportation cost	
Module-4 - Store Management	9 Hour
Storing of materials-management of stores – Location – Different types of stores – Methods of storing – Safety and security of materials – Stores equipment – Materials handling equipment – Factors affecting materials handling- Logistics- War housing- Risk analysis- Insurance and responsibilities of the different stakeholders -Claims.	
Module-5 - Waste Management	9 Hour

Scrap and obsolete management of surplus obsolete and scrap materials waste identification- Waste minimization techniques- Waste management- Reduce- Recovery- Recycle- Reasons for accumulation of surplus obsolete and scrap materials – Methods of disposal – Regulations and procedures.

Learning Resources	1. Datta .A.K, "Materials Management: Procedures, Text and Cases", PHI Learning Pvt. Ltd., 2004.	3. Richard J. Tersine, "Principles Of Inventory And Materials, Management", Prentice Hall, 2004
	2. Arnold, "Introduction To Materials Management", Pearson Education India, 2009	4. Richard J. Tersine, "Modern Materials Management", John Hardin Campbell - 2007 5. Gopalakrishnan .P, "Handbook of Materials Management", PHI Learning Pvt. Ltd. 2004

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. K. M. Nanthan, L&T, RKMNNN@Intecc.com	1. Dr. J. Saravanan, Annamalai University, ausjs5070@gmail.com	1. Dr. M. Balasubramaniam, SRMIST
2. Mr. Jayasankar k, Ultra Tech cement Limited, jayasankar2411@gmail.com	2. Dr. K.Yogeswari, B.S. Abdur Rahman Crescent Institute of Science and technology, yogeswari@crescent.education	2. Dr. N. Ganapathy Ramasamy, SRMIST

Course Code	21CEE536T	Course Name	ADVANCED PROJECT MANAGEMENT CONCEPTS	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand advanced project planning techniques to enhance project initiation and planning phases.
CLR-2:	gain skills in executing and controlling projects to ensure project objectives are met efficiently.
CLR-3:	learn to effectively close projects, ensuring thorough evaluation and benefits realization.
CLR-4:	master advanced project management tools and techniques for comprehensive project oversight.
CLR-5:	develop leadership and ethical decision-making skills for effective project management and governance.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	create detailed project plans using advanced planning methodologies and tools.	1	2	3
CO-2:	implement and control project execution using advanced monitoring techniques.	1	2	3
CO-3:	conduct thorough project closure and evaluation to assess project success and lessons learned.	2	3	3
CO-4:	utilize advanced tools and techniques for effective project management and benefit realization.	1	2	3
CO-5:	demonstrate ethical leadership and decision-making in managing diverse project teams.	2	2	3

Module-1 - Advanced Project Planning	9 Hour
Overview of construction industry - Importance of safety in construction - Common hazards in construction - Role of management in construction safety - Safety culture and climate - Safety legislation and standards - Introduction to osha and its role - Safety performance metrics - Accident causation theories - Risk perception and management - Safety training and education - Case studies on construction safety.	
Module-2 - Project Execution and Control	9 Hour
Directing and managing project work - Quality assurance and control - Information distribution and performance reporting - Risk monitoring and control - Issue management and resolution - Scope verification and control - Schedule control - Cost control - Procurement control - Stakeholder engagement - Team development and management - Agile project execution	
Module-3 - Project Closure and Evaluation	9 Hour
Administrative closure procedures - Project review and lessons learned - Project performance and benefit realization - Post-project audits - Project termination strategies - Contract closure - Product verification and validation - Transition planning - Organizational change management - Knowledge management - Agile project retrospectives - Sustainability in project management	
Module-4 - Advanced Project Management Tools and Techniques	9 Hour
Earned value management - Critical chain project management - Program evaluation and review technique - Monte carlo simulation - Decision tree analysis - Advanced risk assessment techniques - Advanced quality tools (Six sigma, Lean) - Advanced communication tools (Social media, Collaboration tools) - Advanced procurement techniques (E-auctions, vendor managed inventory) - Project portfolio management - Benefits realization management - Agile project management tools	

Module-5 - Leadership and Ethics in Project Management**9 Hour**

Leadership styles and theories - Emotional intelligence in leadership - Conflict management - Negotiation and influencing - Team motivation and reward systems - Cultural and diversity considerations - Ethical decision making - Corporate social responsibility - Governance and compliance - Professional conduct and codes of ethics - Sustainability and ethics in project management - Agile leadership and ethics

Learning Resources	1. Project Management Institute. (2021). A guide to the project management body of knowledge (PMBOK guide) (7th ed.). Project Management Institute.	4. Highsmith, J. (2009). Agile project management: Creating innovative products (2nd ed.). Addison-Wesley Professional.
	2. Kerzner, H. (2022). Project management: A systems approach to planning, scheduling, and controlling (13th ed.). Wiley.	5. Kerzner, H. (2022). Project management case studies (6th ed.). Wiley.
	3. Verzuh, E. (2021). The fast forward MBA in project management (6th ed.). Wiley.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. T. Gurusamy, GHAA Associates guru.epmc@gmail.com	1. Dr. Nikhil Bugalia, IIT Madras, nbugalia@civil.iitm.ac.in	1. Dr. K.S. Anandh, SRMIST
2. Er. P. Jahanathan, UCON PT Structural System, Pvt. Ltd., jegan@utraconindia.com	2. Dr. S. Shanmugapria, Coimbatore Institute of Technology, kamalselva21@gmail.com	2. Dr. V. R. Prasath Kumar, SRMIST

Course Code	21CEE537T	Course Name	TEMPORARY STRUCTURES IN CONSTRUCTION	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the management concepts of formwork in construction project
CLR-2:	identify the various methods and its applications of formwork system
CLR-3:	identify the various design considerations on form work
CLR-4:	analyze the basic concepts of different methods in formwork arrangements
CLR-5:	explore the advanced level and different systems of formwork arrangements

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	accrue the knowledge on having the basics in formwork practice	2	2	3
CO-2:	accrue knowledge of various formwork materials and accessories	3	2	3
CO-3:	apply the knowledge of calculating and design of formwork system in projects	2	2	3
CO-4:	apply the knowledge while designing the formwork in different methods	2	3	3
CO-5:	accrue comprehensive knowledge of advanced level in formwork system	2	3	3

Module-1- Planning, Site Equipment and Plant for Form Work	9 Hour
Introduction - Forms for foundations, columns, beams walls etc., General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning for maximum reuse- Planning examples. Overall Planning - Detailed planning - Standard units - Corner units – Pass units - Calculation of labour constants - Site layout plan -Crane arrangements -Recheck plan details – Planning for safety- Transporting plant -Wales and ties – Vertical transportable formwork. Formwork Hour - Labour Requirement – Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork – Formwork Accessories.	
Module-2 - Formwork Materials and Accessories	9 Hour
Lumber - Types - Finish - Sheathing ratio -Working stresses -Repetitive member stress - Plywood -Types and grades -Textured surfaces and strength – Reconstituted wood -Steel -Aluminium -Form lining materials - Hardware and fasteners - Nails in Plywood –Bolts, lag screws and connectors - Bolt loads. Allowable withdrawal load and lateral load. - Tubular steel shores - Patented shores Horizontal shores -Ellis shores - Dayton sure grip and Baker Roof shores – Safeway Symons Shores-Dead shore -Raking and Flying shores. Bracing for lateral loads - Prefabricated panel system.	
Module-3 - Design Considerations and Design of Formwork and Shores	9 Hour
Design considerations - Live loads and Wind pressure - Concrete pressure on formwork- Concrete density -Height of discharge -Temperature -Rate of Placing - Consistency of concrete - Vibration -Hydrostatic pressure and pressure distribution - Examples -Adjustment for non-standard conditions- Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability -Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Allowable load vs length behaviour of wood shores - Form lining Design Tables for Wall formwork - Slab Formwork - Column Formwork – Slab props - Stacking Towers - Free standing and restrained - Rosett Shoring - Shoring Tower – Heavy Duty props.	

Module-4 - Formwork for Different Systems**9 Hour**

Location of job mill -Storage - Formwork for Wall footings -Column footings- Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiplex - Slab on grade and paving work -Highway and Airport paving - External vibration - Prefabricated panel systems - Giant forms -Curved wall forms -Tolerance for walls - Erections Practices -Column heads-Beam or girder forms - Suspended forms- Cycling with lifting fork - Moving with table trolley and table prop- Suggested Tolerances -Concrete Joint construction-Flying system forms. Causes of failures -Case studies- ACI - Design deficiencies - Finish of exposed concrete -Design deficiencies -Safety factors -Stripping sequence - Reshore installation -Advantages of reshoring.

Module-5 - Design and Safety Considerations for Different Structures**9 Hour**

Hemispherical, Parabolic, Translational shell forms -Design considerations -Loads - Typical barrel vaults Folded plate roof details - Forms for Thin Shell roof slabs design considerations - Building forms - Strength requirements - Tunnel forming components - Curb and gutter forms - Invert forms -Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous advancing slope method - Tolerances - Slip forms- Principles -Types -Advantages -Functions of various components-Planning -Safety in slip forms -Special structures built with slip form technique case study -Codal provisions -Types of scaffolds -Putlog and Independent scaffold -Single pole scaffolds -Fixing ties- Spacing of ties - bracing -knots safety net -General safety requirements- Gantry and system scaffolds - Shuttering for Precast members and continuous casting forms.

Learning Resources	1. Austin, C.K., "Formwork for Concrete", Cleaver-Hume Press Ltd., London, 1996.	3. Michael P. Hurst, "Construction Press", London and New York, 2003.
	2. Hurd, M.K., "Formwork for Concrete", Special Publication No.4, American Concrete Institute, Detroit, 1996	4. Robert L. Peurifoy and Garold D. Oberlender, "Formwork For Concrete Structures", McGraw - Hill, 1996

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	1. Dr. S. Kamal, University college of Engineering, Ramnad, kamalselva21@gmail.com	1. Dr. S. Prakashchandar, SRMIST
2. Mr. K. M. Nanthan, L&T, RKMNNN@Intecc.com	2. Dr. K.Yogeswari, B.S. Abdur Rahman Crescent Institute of Science and technology, yogeswari@crescent.education	2. Dr. N. Ganapathy Ramasamy, SRMIST

Course Code	21CEE538T	Course Name	STATISTICAL APPLICATION IN CONSTRUCTION PRACTICES	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the concepts of statistic in civil engineering
CLR-2:	explore the advantages of inferential statistics
CLR-3:	analyze the basic concepts of regression analysis and model building
CLR-4:	explore the concepts of multivariate statistical methods
CLR-5:	explore the concepts of statistical quality control and reliability engineering

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the knowledge of statistic in construction management	2	2	3
CO-2:	apply the knowledge of identification of statistics	3	2	3
CO-3:	schedule the regression analysis and model building	2	2	3
CO-4:	accrue the knowledge of multivariate statistical methods	2	3	3
CO-5:	apply the knowledge of statistical quality control and reliability engineering	2	3	3

Module-1 – Introduction to Statistics in Civil Engineering	9 Hour
Role and importance of statistics in construction practices, Types of data: Qualitative and Quantitative, Data collection methods: Surveys, experiments, observational studies, Descriptive statistics: Measures of central tendency and dispersion, Data visualization: Histograms, box plots, scatter plots, Probability theory: Basic probability concepts and rules, Conditional probability and Bayes' theorem, Random variables: Discrete and continuous, Common probability distributions: Binomial, Poisson, Normal, and Exponential distributions.	
Module-2 – Inferential Statistics	9 Hour
Sampling methods and distributions: Importance of sampling in civil engineering studies, Types of sampling: Random, stratified, cluster, systematic, Sampling distributions and the central limit theorem, Estimation and hypothesis testing: Point and interval estimation, Confidence intervals for means, proportions, and variances, Formulation of hypotheses: Null and alternative, Hypothesis testing: Z-tests, t-tests, chi-square tests, and ANOVA, Practical applications in construction: Material strength, load testing, quality control.	
Module-3– Regression Analysis and Model Building	9 Hour
Simple and multiple regression: Introduction to regression analysis, Estimation of regression parameters using least squares, Hypothesis testing in regression, Model diagnostics and validation. Advanced regression techniques: Polynomial regression and interaction terms, Logistic regression for binary outcomes, Nonlinear regression models, Applications in civil engineering: Cost estimation, project scheduling, and risk assessment.	
Module-4 – Multivariate Statistical Methods	9 Hour
Multivariate data analysis: Introduction to multivariate statistics, Principal component analysis, Factor analysis and its applications. Multivariate Regression and Discriminant Analysis: Multiple regression analysis, Canonical correlation analysis, Discriminant analysis for classification problems, Applications in construction project management and site analysis.	
Module-5 – Statistical Quality Control and Reliability Engineering	9 Hour
Quality Control Tools and Techniques: Control charts for variables and attributes, Process capability analysis, Six Sigma methodology and its applications in construction. Reliability and Life Data Analysis: Basic concepts of reliability engineering, Reliability function, hazard rate, and failure rate, Estimation of reliability and maintainability, Reliability-based design and maintenance planning, Applications in construction equipment, structural elements, and material performance.	

Learning Resources	1. Montgomery, D. C., & Runger, G. C. (2010). <i>Applied Statistics and Probability for Engineers</i> (5th ed.). Wiley. 2. Devore, J. L. (2011). <i>Probability and Statistics for Engineering and the Sciences</i> (8th ed.). Cengage Learning. 3. Ang, A. H.-S., & Tang, W. H. (2007). <i>Probability Concepts in Engineering: Emphasis on Applications to Civil and Environmental Engineering</i> (2nd ed.). Wiley.	4. Freund, J. E., & Perles, B. M. (2007). <i>Statistics: A First Course</i> (8th ed.). Pearson. 5. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). <i>Multivariate Data Analysis</i> (8th ed.). Cengage Learning. 6. Rao, S. S. (2004). <i>Reliability-Based Design</i> . McGraw-Hill.
---------------------------	--	---

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. K. M. Nanthan, L&T, RKMNNN@Intecc.com	1. Dr. A.R. Krishnaraja, Kongu Engineering college, krajacivil@kongu.ac.in	1. Dr. N.Pannirselvam, SRM IST
2. Mr. Jayasankar k, Ultra Tech cement Limited, jayasankar2411@gmail.com	2. Dr. A.K. Kaliluthin., B.S. Abdur Rahman Crescent Institute of Science and Technology,	2. Dr.S.Anandh, SRMIST

Course Code	21CEE539T	Course Name	DIGITAL TRANSFORMATION IN CONSTRUCTION PRACTICES	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							2	1	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	comprehend the concept and significance of digital transformation within the construction sector.
CLR-2:	gain proficiency in utilizing Building Information Modeling (BIM) for various construction phases.
CLR-3:	explore diverse digital tools and technologies used in construction practices.
CLR-4:	develop expertise in data management and analytics for informed construction decision-making.
CLR-5:	devise and execute effective digital transformation strategies for construction projects and organizations.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	analyze the impact of digital transformation on construction industry processes and outcomes.	2	2	3
CO-2:	apply BIM principles and tools to enhance design, construction, and facility management.	1	2	3
CO-3:	evaluate and select appropriate digital tools and technologies for specific construction tasks.	2	2	3
CO-4:	utilize data collection, analysis, and visualization techniques to optimize construction projects.	2	2	3
CO-5:	develop and implement comprehensive digital transformation strategies for construction organizations.	3	3	3

Module-1 - Introduction to Digital Transformation	9 Hour
Understanding digital transformation - Role of digital transformation in construction - Evolution of digital tools in construction - Impact of digital transformation on construction practices - Case studies of digital transformation in construction - Challenges in implementing digital transformation - Future trends in digital construction - Digital transformation and sustainability - Role of government and policy in digital transformation - Legal and ethical considerations in digital transformation - Digital transformation and project management	
Module-2 – BIM Implementation	9 Hour
Introduction to BIM - BIM in design and construction - BIM for facility management - BIM standards and protocols - BIM tools and software - BIM and collaboration - BIM and sustainability - BIM and cost estimation - BIM and risk management - Case studies of BIM implementation - Future trends in BIM	
Module-3 - Digital Tools and Technologies in Construction	9 Hour
Introduction to digital tools in construction - CAD and CAE tools - Project management software - Drones in construction - Virtual and augmented reality in construction - IoT in construction - AI and machine learning in construction - Digital twin technology - GIS and remote sensing in construction - Case studies of digital tools in construction - Future trends in digital tools	
Module-4 - Data Management and Analytics in Construction	9 Hour
Introduction to data management in construction - Data collection methods in construction - Data storage and security in construction - Big data in construction - Data analytics in construction - Predictive analytics in construction - Data visualization in construction - Role of cloud computing in construction - Case studies of data management in construction - Future trends in data management and analytics - Legal and ethical considerations in data management	

Module-5 - Digital Transformation Strategy and Implementation**9 Hour**

Developing a digital transformation strategy - Role of leadership in digital transformation - Change management in digital transformation - Training and skill development for digital transformation - Measuring the success of digital transformation - Overcoming resistance to digital transformation - Case studies of successful digital transformation - Role of innovation and creativity in digital transformation - Digital transformation and business models - Future of construction industry with digital transformation

Learning Resources	1. Bruno Daniotti, Marco Gianinetti, Stefano Della Torre. "Digital Transformation of the Design, Construction and Management Processes of the Built Environment". Springer Cham. 2020. 2. Jennifer Whyte, Dragana Nikolić. "Virtual Reality and the Built Environment". 2 nd Edition, Routledge, 2018. 3. Chuck Eastman, Paul Teicholz, Rafael Sacks, and Kathleen Liston "BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors". Wiley, 2018	4. Brad Hardin, Dave McCool. "BIM and Construction Management: Proven Tools, Methods, and Workflows". 2 nd Edition. Wiley. 2015. 5. Rogers, D. L. (2016). The Digital Transformation Playbook: Rethink Your Business for the Digital Age. Columbia University Press.
---------------------------	---	--

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Mr. M. Suman Dhas, L&T, Chennai	1. Dr. Senthilkumar. V, IIT Palakkad, senthil@iitpkd.ac.in	1. Dr. K.S. Anandh, SRMIST
2. Dr. A. Kallarpiran, SEED for Safety	2. Dr. Ramesh Kannan. M, Anna University (CEG), rameshkannan@annauniv.edu	2. Dr. V. R. Prasath Kumar, SRMIST

Course Code	21CEE540T	Course Name	QUALITY AND RISK MANAGEMENT IN CONSTRUCTION PROJECTS	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	discuss the importance of quality and performance excellence
CLR-2:	describe the key elements of total quality management and the evolution of approaches for managing quality
CLR-3:	apply basic quality tools to design, control, and improve goods & services and processes
CLR-4:	understand the meaning of risk and uncertainty and their potential impact on a project
CLR-5:	improve project outcomes by applying and using the risk management process

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the core principles of quality management	2	3	2
CO-2:	study the role of quality from a strategic perspective, including competitive advantage and the importance of customers	3	2	3
CO-3:	learn tools and techniques for designing quality goods and services, for controlling quality in operations, and for improving quality and processes	1	3	3
CO-4:	gain broad knowledge of risk concepts, principles and terminology	2	2	3
CO-5:	understand of specific risk analysis methodologies and the ability to apply them in practice	3	3	2

Module-1 - Total Quality Concepts	9 Hour
Terms and definition in quality- Types of quality- Levels of quality- Paradigm of quality - Quality policy, objectives& manual - Dimensions of quality - Quality standards and codes – ISO 9000 - Quality leadership - Quality evolution and quality gurus- Factors influencing construction quality-Critical, Major failure aspects and analysis- Responsibilities and authorities in quality assurance -Architects, Engineers, contractors and consultants.	
Module-2 – Construction Quality Management	9 Hour
Quality assurance control and inspection –Management tools for quality control- acceptance and sampling- Specification and tolerance- Control charts -- Quality costs – Quality circle – Customer satisfaction – customer rating system- Quality related training – Implementing a Quality system - Techniques and Needs Of QA/QC-Different Aspects of Quality-Appraisals,- Statistical quality control- Fundamentals of statistical concepts- statistical process control –Factors influencing construction quality – Roles of authorities in construction quality – Life cycle of a construction project – Check for various construction activities - TQM	
Module-3 – Quality Tools and Techniques	9 Hour
Taguchi's design of experiments - Failure aspects - Reliability - Failure mode effect analysis – Six sigma in construction – Kaizen for continuous improvement – Seven tools for quality control - Quality audits & reports – Elements of quality audits- – Third party certification	
Module-4 - Risk Management	9 Hour
Risk management plan, process and tools - Elements of risk Project uncertainties identification – Risk assessment matrixes – Addressing strategies – Scoring method – Decision tree – Cost escalation method – Monte carlo method in risk management – Risk modelling- Framework and strategies – Risk mitigation methods- uncertainty- tools and techniques for risk assessment- Case study on risk assessment.	
Module-5 – Construction Risk Management (CRM)	9 Hour
Approach to construction project delivery – Construction industry system – CRM process and approaches – CRM decision making- labour issues- Safety hazards- Disputes – Insurance and claims– Improper documentation- Errors – Reduce Construction Risks with Software- Review Results- Management tools and techniques of CRM – Risk perceptions – Construction risk mitigation and its types – BIM based risk management.	

Learning Resources	1. James, J.O Brian, "Construction Inspection Handbook -Quality Assurance and:Quality Control", Van Nostrand, New York, 2009.	5. Sathyanarayanan Rajendran and Mandi Kime, "Construction Project Safety-Management Best-Practices Handbook", 2015.
	2. Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", Tata McGraw Hill 2002.	6. Yuri Raydugin, "Project Risk Management Essential Methods for Project Teams and Decision Makers", Wiley, New Jersey, 2013
	3. John L. Ashford, "The Management of Quality in Construction", E & F.N, Spon. New York, 2009.	7. Alex C. Arthur, Construction Risk Management Decision Making Understanding current practices, John Wiley & Sons Ltd., USA, 2022
	4. Poornima M. Charantimath, "Total Quality Managemnet", Pearson, New Delhi, 2011	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. K. M. Nanthan, L&T, R KMNNN@Intecc.com	1. Dr. M. Vinod Kumar,, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, drmvinodkumar@veltech.edu.in	1. Dr. N.Pannirselvam, SRMIST
2. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	2. Dr.S.Palanivel, Puducherry Technological University, Puducherry, spalanivel@ptuniv.edu.in	2. Dr. S.Manikandaprabhu alias Saravanan, SRMIST

Course Code	21CEE541T	Course Name	INDUSTRIAL HEALTH AND SAFETY MANAGEMENT	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	provide students with a comprehensive understanding of the construction industry, its inherent hazards, and the importance of safety in construction.
CLR-2:	equip students with the knowledge and skills necessary to identify, assess, and control construction health and safety hazards through effective management systems and technologies.
CLR-3:	develop students' understanding of the importance of health and hygiene in construction, including the identification and mitigation of health hazards and the implementation of wellness programs.
CLR-4:	enhance students' understanding of the role of leadership, culture, and behavior in fostering a positive safety environment within the construction industry.
CLR-5:	enable students to apply theoretical knowledge and practical skills to real-world construction safety scenarios through case studies and analysis.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	identify and analyze common hazards in construction and understand the importance of safety in the industry.	2	1	3
CO-2:	develop and implement comprehensive safety management systems, including policies, procedures, and training programs.	3	2	3
CO-3:	assess and control health hazards in construction, promote healthy behaviors, and implement wellness programs.	2	1	3
CO-4:	leverage technology to enhance safety in construction, including the use of drones, wearable technologies, BIM, AI, and IoT.	3	2	3
CO-5:	identify and analyze common hazards in construction and understand the importance of safety in the industry.	2	1	3

Module-1 - Introduction to Construction Safety	9 Hour
Overview of construction industry - Importance of safety in construction - Common hazards in construction - Role of management in construction safety - Safety culture and climate - Safety legislation and standards - Introduction to osha and its role - Safety performance metrics - Accident causation theories - Risk perception and management - Safety training and education - Case studies on construction safety.	
Module-2 - Construction Health and Hygiene	9 Hour
Occupational health in construction - Common health hazards in construction - Industrial hygiene principles - Exposure assessment and control - Noise and vibration control - Heat stress management - Respiratory protection - Ergonomics in construction - Hazardous material management - Health surveillance and monitoring - Wellness programs in construction - Case studies on construction health issues	
Module-3 - : Construction Safety Management Systems	9 Hour
Elements of safety management system - Safety policy and objectives - Safety roles and responsibilities - Safety planning and implementation - Safety inspection and auditing - Accident investigation and reporting - Emergency preparedness and response - Contractor safety management - Safety communication - Safety management system evaluation - Continuous improvement in safety - Case studies on safety management systems	
Module-4 - Construction Safety Technologies	9 Hour
Role of technology in construction safety - Safety data and analytics - Use of drones for safety inspection - Wearable technologies for safety - Virtual and augmented reality in safety training - Building information modeling (BIM) for safety - AI and machine learning in safety management - Mobile applications for safety - Internet of things (IoT) in Safety - Predictive safety analytics - Future trends in safety technologies - Case studies on safety technologies	
Module-5 - Leadership and Culture in Construction Safety	9 Hour
Role of leadership in safety - Leadership styles and safety - Safety culture and its impact - Developing a positive safety culture - Employee engagement in safety - safety behavior and attitudes - Psychological safety - Safety climate assessment - Role of unions in safety - Safety reward and recognition programs - Transformational safety leadership - Case studies on safety leadership and culture	

Learning Resources	1. Richard Coble, Jimmie W. Hinze, Theo C. Haupt, <i>Construction Safety and Health Management</i> , 1st Edition, Prentice Hall, 2000. 2. Alan Griffith, Tim Howarth, <i>Construction Health and Safety Management</i> , 1st Edition, Routledge, 2014. 3. Helen Lingard., <i>Work, Health and Wellbeing in the Construction Industry</i> , Taylor & Francis, 2023	4. Patrick Manu, <i>Construction Safety, Health and Well-being in the COVID-19 era</i> , Taylor & Francis, 2023. 5. Kumar Neeraj Jha, Dilip A Patel, Amarjit Singh. <i>Construction Safety Management</i> , 1st Edition, Pearson, 2022
---------------------------	---	---

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. G Muneeswaran, L&T, gmeswar@Intecc.com	1. Dr. Nikhil Bugalia, IIT Madras, nbugalia@civil.iitm.ac.in	1. Dr. K.S. Anandh, RMIST
2. Dr. A. Kallarpiran, SEED for Safety	2. Dr. S. Kamal, BITS Trichy, kamalselva21@gmail.com	2. Dr. V. R. Prasath Kumar, SRMIST

Course Code	21CEE542T	Course Name	BUILDING SERVICES AND FACILITY MANAGEMENT	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand basic concepts and principles of building services
CLR-2:	study the rudiments of electrical installations in a building
CLR-3:	describe mechanical operation and design principles for HVAC
CLR-4:	state fire safety requirements and regulations
CLR-5:	introduce the concepts of intelligent and smart buildings

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the basics of water distribution, piping and sewerage system in buildings	2	2	3
CO-2:	identify physical aspects of mechanical and electrical necessities in buildings	2	3	2
CO-3:	learn the operation and principles of HVAC systems	3	2	1
CO-4:	bring about an exposure to fire safety arrangement and guidelines	1	3	3
CO-5:	apply techniques related to smart building and systems	3	2	3

Module-1 – Water Supply and Sanitary System	9 Hour
Water Supply - Water purification process - Layout of water distribution network - Component of cold and hot water supply system – Types of tanks - types of pipes - plumbing system for building-internal supply in buildings - Rainwater Harvesting - storm water drainage from buildings - Arrangement of sewerage systems in housing - Pipe systems - septic and sewage treatment plant	
Module-2 – Electrical System and Design	9 Hour
Types of electrical system – Distribution in buildings - Single/three phase supply - Protective devices in electrical installation - Earthing and its types - Electrical installations in buildings - Types of wires - Wiring systems - Main and distribution boards – Transformers and switch gears - Principles of illumination	
Module-3 – Heating, Ventilating and Air Conditioning (HVAC)	9 Hour
Heat emitters - Low temperature and High temperature hot water heating systems - Underfloor and panel heating - Thermal insulating material - Thermal insulation of roofs and exposed walls Ventilation requirements – Natural and Mechanical ventilation – Factors affecting indoor airflow – Air velocity and diffusion - Principles and systems of air conditioning – Thermodynamics - Transfer of heat - Refrigeration cycle components -Types of air conditioning systems for buildings - Different systems of ducting	
Module-4 - Fire Safety Design	9 Hour
Fire hazard of materials and building - Fire detection and alarm system – Water based fire extinguishers – Gas based fire extinguishers – Special and portable fire extinguishing system – Wet and Dry risers - Means of fire escape – Smoke detectors, control and vents – Staircase pressurization – Emergency power supply - General Requirements as per IS: 1642:1989 and NBC 2005	
Module-5 – Smart and Intelligent Buildings	9 Hour
Elevators and Escalators – Building automation hardware - Smart building fixtures and components – Smart insulation – Smart windows – Home assistance – Green buildings - Zero energy Buildings – IoT and AI based building system	

Learning Resources	1. Fred Hall and Roger Greeno, "Building Services Handbook", Elsevier, Oxford, 2007	4. Shengwei Wang, Intelligent buildings and building automation, Spon Press, 2010
	2. Fair G.M., Geyer J.C. and Okun .D, "Water and waste Engineering", Vol. II, John Wiley & sons, Inc., New York. 2008.	5. Marco Casini, "Smart Buildings - Advanced Materials and Nanotechnology to Improve Energy-Efficiency and Environmental Performance", Elsevier, 2018.
	3. William H. Severns and Julian R. Fellows, "Air conditioning and refrigeration", John Wily and sons, London, 2008	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. K. M. Nanthan, L&T, R KMNNN@Intecc.com	1. Dr.R.Baskar, Annamalai University, Chidambaram, rajaram_baskar@rediffmail.com	1. Dr. N.Pannirselvam, SRM IST
2. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	2. Dr.G.Vijayakumar, Puducherry Technological University, Puducherry, gvk@ptuniv.edu.in	2. Dr. S.Manikandaprabhu alias Saravanan, SRMIST

Course Code	21CEE543T	Course Name	CONSTRUCTION EQUIPMENT AND AUTOMATION	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>understand the concepts of sub structure construction.</i>
CLR-2:	<i>identify the various earthwork equipment and its applications in real projects for highway construction.</i>
CLR-3:	<i>identify the various equipment such as forklifts and screening equipment, management, depreciation and cost control.</i>
CLR-4:	<i>investigate the implementation of building automation.</i>
CLR-5:	<i>examine the integration of networking principles to develop energy efficient buildings.</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	<i>understand the knowledge of equipment management in sub structure construction.</i>	2	2	3
CO-2:	<i>apply the knowledge of calculating productivity of earthwork equipment's for the development of highways.</i>	3	2	3
CO-3:	<i>accrue the knowledge of equipment used in as forklifts and screening equipment</i>	2	2	3
CO-4:	<i>accrue comprehensive knowledge of automation in construction practices</i>	2	3	3
CO-5:	<i>evaluate the data networking and developing energy efficient buildings.</i>	2	3	3

Module-1 - Sub Structure Construction	9 Hour
Sub structure construction: Techniques of box jacking – Pipe Jacking -Under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques -Dewatering and stand by Plant equipment for underground open excavation- Superstructure construction: Launching girders, bridge decks, offshore platforms – Material handling - erecting lightweight components on tall structures - Erection of articulated structures - Fabrication and erection of steel trusses and frames	
Module-2 - Highway Construction Practice	9 Hour
Highway construction practice: Embankment construction - Ground improvement techniques, Retaining and Breast walls on hill road. Bituminous Constructions-Concrete road construction: Test - construction equipment's -Method of construction of joints in concrete pavements - IRC specifications, Dams and harbour construction practice: Construction methods and equipment for dams, Harbours, river works and pipelines, Earthwork equipment: Fundamentals of earthwork operations - Earth moving operations-Types of earthwork equipment -Tractors, motor graders, Scrapers, Front end loaders, earth movers – Capacity calculations.	
Module-3 - Forklifts and Screening Equipment	9 Hour
Forklifts and screening equipment: Forklifts and related equipment - Portable material bins - Conveyors - Equipment used in demolition – Chain pulley blocks. crushers – Feeders - Screening equipment - Batching and mixing equipment - Hauling equipment - Pouring and pumping equipment – ready mixed concrete carriers. Equipment management: Factors affecting selection of equipment and methods –Planning - Equipment management in projects - Maintenance management – Replacement - Cost control of equipment – Depreciation analysis, Methods of calculation of depreciation- Safety management.	
Module-4 - Equipment Automation and Networking	9 Hour
Building automation: Introduction to building automation systems – components– Heating, ventilation, and air conditioning (HVAC)– Lighting – Electrical systems water supply and sanitary systems– Fire safety – Security -Communication and office automation system -Water pump monitoring and control - Control of Computerized HVAC Systems - Networking: Data networking– IBMS system and its components – Centralized control equipment's – substation and field controllers – Gamma building control – energy-efficient building and room automation	
Module-5 – Automations in Construction	9 Hour
Use of automation in construction Industry - Applications of robotics - Case study - Automation and robotics in precast concrete industry – Advantages - Automation and robotics in prefabrication of masonry and On-Site masonry construction - Automation and robotics in production of steel components- Manufacturing process- Automation and robotics in production of steel components - Autonomous equipment stiles	

machinery - 3D-Printing concrete- - Drones in construction – Case study.

Learning Resources	1. Kumar NeerajJha, (2015), Construction Project Management, 2nd Edition, Pearson, New Delhi.	3. Majrouhi Sardroud Javad, (2014), "Automation in Construction Management" Scholars' Press.
	2. Varghese P.C., (2012), Foundation Engineering, PHI Learning Private Limited, New Delhi.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. K. M. Nanthan, L&T, R KMNNN@Intecc.com	1. Dr. H Jane Helena, Anna University, Chennai, jane@annauniv.edu	1. Dr. N.Pannirselvam, SRMIST
2. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	2. Dr.P.Revathi, Puducherry, Technological University, Puducherry, revathi@ptuniv.edu.in	2. Dr. S.Manikandaprabhu alias Saravanan, SRMIST

Course Code	21CEE544T	Course Name	LEAN CONSTRUCTION	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the fundamental principles, philosophies, and concepts of lean thinking in the context of the construction industry.
CLR-2:	identify and analyze the various forms of waste prevalent in traditional construction practices and explore strategies for their elimination.
CLR-3:	master the application of production control techniques and value stream mapping for optimizing construction workflows and processes.
CLR-4:	investigate the implementation of Just-in-Time principles and various lean construction methodologies in real-world scenarios.
CLR-5:	examine the integration of lean principles with other construction management domains like safety, quality, risk, and sustainability.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	demonstrate a comprehensive understanding of lean construction principles and their relevance to improving project efficiency.	2	2	3
CO-2:	critically analyze construction processes to identify waste and propose effective lean solutions to enhance value delivery.	3	2	3
CO-3:	apply production control tools, value stream mapping, and Last Planner System (LPS) for effective project planning and execution.	2	2	3
CO-4:	formulate and implement lean construction strategies incorporating JIT principles and advanced lean tools and techniques.	2	3	3
CO-5:	integrate lean thinking with various aspects of construction management to achieve holistic project improvement and sustainability.	2	3	3

Module-1 – Introduction to Lean Construction Management	9 Hour
Introduction to lean construction management - Review of project management - Productivity in construction - Daily progress report - The state of the industry with respect to its management practices - Construction project phases - The problems with current construction management techniques - Lean management - Toyota's management principle - Evolution of lean in construction industry - Production theories in construction - Lean construction value	
Module-2 – Value in Construction and Waste Elimination	9 Hour
Value in construction - Target value design - Lean project delivery system - Forms of waste in construction industry - Waste elimination - Concepts in lean thinking - Principles of lean construction - Variability and its impact - Traditional construction and lean construction - Traditional project delivery - Lean construction and workflow reliability - work structuring	
Module-3 – Production Control and Value Stream Mapping	9 Hour
Production control - Value stream mapping - Work sampling - Last planner system - Flow and pull based production - Last planner system - Look ahead schedule - Constraint analysis - Weekly planning meeting - Daily huddles - Root cause analysis - Continuous improvement	
Module-4 – Just in Time and Lean Construction Implementation	9 Hour
Just in time - lean construction implementation - Enabling lean through information technology - Lean in design - design structure - BIM (Building information modelling) - IPD (Integrated project delivery) - sustainability through lean construction approach - Case studies in lean construction - Future trends in lean construction - Lean construction and industry 4.0	
Module-5 – Advanced Topics in Lean Construction	9 Hour
Advanced lean construction tools and techniques - Lean construction and safety management - Lean construction and quality management - Lean construction and risk management - Lean construction and supply chain management - Lean construction and human resource management - Lean construction and financial management - Lean construction and environmental management - Lean construction and stakeholder management - Lean construction and contract management - Lean construction and change management - Review and discussion	

Learning Resources	1. David Umstot, Dan Fauchier. "Lean Project Delivery: Building Championship Project Teams." CreateSpace Independent Publishing Platform, 2017 2. Allan R. Coletta. 'The Lean 3P Advantage: A Practitioner's Guide to the Production Preparation Process.' CRC Press, 2012. 3. Kaushal Kumar, Subhav Singh. "Insight to Lean Management for Construction Industry." LAP Lambert Academic Publishing, 2024	4. Garbutt Charlie. "Lean Construction: A Small Contractor's Journey". Advantage Media Group, 2017 5. Joe Donarumo, Keyan Zandy. "The Lean Builder". Lulu publishing services, 2019
---------------------------	---	--

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. Marimuthu, ILCE, technical.secretary1@ilce.in	1. Dr. Senthilkumar. V, IIT Palakkad, senthil@iitpkd.ac.in	1. Dr. K.S. Anandh, SRMIST
2. Dr. A. Kallarpiran, SEED for Safety	2. Dr. Ramesh Kannan. M, Anna University (CEG), rameshkannan@annauniv.edu	2. Dr. A. Arokiaprakash, SRMIST

Course Code	21CEE545T	Course Name	INFRASTRUCTURE AND REAL ESTATE MANAGEMENT	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	provide a comprehensive understanding of global infrastructure development models and stakeholders involved.
CLR-2:	equip students with knowledge of risk management strategies in infrastructure projects.
CLR-3:	develop understanding of real estate sector analysis, laws, regulations, and development processes.
CLR-4:	explore land management, regulatory frameworks, and taxation in the real estate domain.
CLR-5:	introduce the concepts of housing, urban planning, and the impact of policies and regulations.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	analyze global infrastructure development models and identify key stakeholders involved.	2	2	3
CO-2:	apply risk management principles to assess and mitigate risks in infrastructure projects.	2	2	3
CO-3:	evaluate real estate development projects, considering legal, regulatory, and financial aspects.	2	2	3
CO-4:	demonstrate knowledge of land management regulations, acquisition procedures, and taxation.	2	2	3
CO-5:	assess the impact of housing policies, urban planning regulations, and informal housing issues.	2	2	3

Module-1 – Infrastructure Development and Management	9 Hour
Global Infrastructure scenario - Infrastructure development models - Stakeholders in infrastructure planning - Infrastructure economics - Project financing models - Public-Private partnerships (PPPs) - Case studies of PPPs - Infrastructure risks - Risk mitigation strategies - Infrastructure policy and regulation - Infrastructure sectors: Comparative analysis - Future trends in infrastructure development	
Module 2 – Risk Management in Infrastructure Projects	9 Hour
Understanding market risks - Economic and demand risks - Supply and financial risks - Technical and construction risks - Land acquisition risks - Operating risks - Institutional and political risks - Social and environmental risks - Regulatory and legal risks - Case studies of risk management - Risk mitigation strategies - Future of risk management in infrastructure	
Module-3 – Real Estate Sector and Development	9 Hour
Introduction to real estate - Real estate sector analysis - Housing and real estate development - Development control regulations - Zoning and special economic zones - Real estate laws and regulations - Land documents and procedures - Land acquisition and development rights - Real estate pricing and valuation - Real estate approval authorities and procedures - Case studies in real estate development - Future trends in real estate	
Module-4 – Land Management and Regulation	9 Hour
Land divisions and subdivisions - Land acquisition procedures - Transfer of development rights - Sale deed and power of attorney - Site particulars and encumbrance certificate - Guideline value and market price - Administrative and political issues in land management - Land development approval procedures - Statutory taxation in real estate - Real estate regulatory authority (RERA) 2016 - Real estate investment trusts - Case studies in land management	
Module-5 – Housing Planning	9 Hour
Introduction to housing - Housing classification - Housing finance and approval process - Housing policies and schemes - Pradhan Mantri Awas Yojana (PMAY) 2015 - Building bylaws and permissions - floor space index (FSI) and floor area ratio (FAR) - Urban sprawl and regional planning - Planning control tools - informal housing and slums - Urban villages and unauthorized construction - Case studies in urban planning	

Learning Resources	1. W.Ronald Hudson, Ralph Haas, Waheed Uddin, "Infrastructure Management: Integrating, Design, Construction, Maintenance, Rehabilitation and renovation", McGraw Hill Publisher, 2013	4. Makarand Hastak, Infrastructure Planning Handbook, ASCE Press, 2006 5. Singh B. Urban Infrastructure and Real Estate Management, Surendra Publications, 2011 6. Aggarwal. O, Land acquisition, The University book agency, Allahabad, 1995
	2. Pollalis, Spiro N (2016) Planning Sustainable Cities: An Infrastructure-Based Approach, Routledge.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Er. T. Gurusamy, GHAA Associates guru.epmc@gmail.com	1. Dr. Rajasekaran C, NITK, bcrajasekaran@nitk.edu.in	1. Dr. K.S. Anandh, SRMIST
2. Er. P. Jahanathan, UCON PT Structural System, Pvt. Ltd., jegan@utraconindia.com	2. Dr. S. Kamal, BITS Trichy, kamalselva21@gmail.com	2. Dr. M. B. Sridhar, SRMIST

Course Code	21CEE546T	Course Name	SUSTAINABILITY IN BUILT ENVIRONMENT	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the concepts of sustainability and sustainable development
CLR-2:	explore the materials used in sustainable construction
CLR-3:	explore the sustainable design of settlements, buildings, materials and technology.
CLR-4:	evaluate the various systems for green buildings.
CLR-5:	explore the method of estimating the amount of energy required for building.

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understanding of the concept of sustainability and sustainable development in the context of issues like climate change, ecological footprint, etc.	2	2	3
CO-2:	apply the role of material and construction practices in sustainability.	3	2	3
CO-3:	applying the knowledge about sustainable design of settlements, buildings, materials and technology.	2	2	3
CO-4:	familiarity with evaluation systems for green buildings.	2	3	3
CO-5:	explain the method of estimating the amount of energy required for building.	2	3	3

Module-1 – Introduction to Sustainability	9 Hour
Introduction and definition of Sustainability – Carbon cycle – role of construction material: concrete and steel, etc. – CO ₂ contribution from cement and other construction materials- Ecosystems, food chain and natural cycles on earth. Need for sustainable design in the context of anthropogenic activities. Climate change, ecological footprint, carbon footprint, loss of bio-diversity, urban heat islands, energy crisis. Overview of sustainable development. Life cycle analysis. Cradle to cradle concept.	
Module-2- Materials used in Sustainable Construction	9 Hour
Construction materials and indoor air quality – No/Low cement concrete – bamboo, timber, salvage materials,- Bendable Concrete, 3D printed concrete- Recycled and manufactured aggregate – Role of QC and durability – Sustainability in choice of materials and construction techniques/ methods - Use of local materials. Recyclable products. Eco building materials and construction. Bio mimicry, Zero energy buildings, Photo voltaic electricity generation. Thermal energy storage. Nano technology and smart materials.	
Module-3: Sustainability in Settlement and Building Design	9 Hour
Principles of sustainable settlements. Morphology of historic/vernacular settlements in different climatic zones through case studies. Sustainable community – social, cultural and economic factors. Urban ecology, urban heat island effects, smog etc. Case studies of eco city or communities. Sustainable site selection and development. Simple passive design considerations involving site conditions, building orientation, plan form and building envelope for sun and wind. Passive heating of buildings- direct, indirect and isolated gain. Passive cooling of buildings – shading of buildings, insulation, induced ventilation (air vents, wind tower, etc.), radiative cooling, evaporative cooling, earth coupling, desiccant cooling.	

Module-4: Building Rating Systems**9 Hour**

Concept of Green Architecture/ Buildings. Rating systems – LEED, TERI, GRIHA and BREEAM. Control of energy use in building – ECBC code, codes in neighboring tropical countries – OTTV concepts and calculations – Features of LEED and TERI – Griha ratings – Role of insulation and thermal properties of construction materials – influence of moisture content and modeling – Performance ratings of green buildings – Zero energy building

Module- 5: Energy Calculations and Environmental Effects**9 Hour**

Embodied energy in buildings- Components of embodied energy – calculation of embodied energy for construction materials – energy concept and primary energy – embodied energy via-a-vis operational energy in conditioned building – life cycle energy use- Non-renewable sources of energy and environmental aspects – energy norm, coal, oil, natural gas – nuclear energy – global temperature, green house effects, global warming – acid rain: causes, effects and control methods – regional impacts of temperature change.

Learning Resources	1. Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.	6. Dominique Gauzin – Muller 'Sustainable Architecture and Urbanism: Concepts, Technologies and Examples', Birkhauser, 2002.
	2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell, UK, 2016.	7. Catherine Slessor, 'Eco-Tech: Sustainable Architecture and High Technology', Thames and Hudson, 1997.
	3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.	8. Ken Yeang, 'Eco-design : A Manual for Ecological Design', Wiley Academy, 2006.
	4. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.	9. Arvind Krishnan et al, 'Climate Responsive Architecture A Design Handbook for Energy Efficient Buildings', Tata McGraw Hill Publishing Company Limited, New Delhi, 2001.
	5. New Building Materials and Construction World magazine	10. Majumdar M, 'Energy-efficient Building in India', TERI Press, 2009.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	1. Dr. S. Kamal, University college of Engineering, Ramnad, kamalselva21@gmail.com	1. Dr. S. Gopinath, RMIST
2. Mr. K. M. Nanthan, L&T, rkmmnn@Intecc.com	2. Dr. K. Yogeswari, B.S. Abdur Rahman Crescent Institute of Science and technology, yogeswari@crescent.education	2. Dr.M. Balasubramaniam, SRMIST

Course Code	21CEE547T	Course Name	ENERGY EFFICIENCY BUILDINGS	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the engineering management concepts of energy efficiency
CLR-2:	identify the various energy efficiency concepts
CLR-3:	identify the various day lighting and electrical lighting techniques for energy efficiency
CLR-4:	identify the various energy efficiency certification for green building
CLR-5:	analyze the basic concepts of methods and techniques in real time building or project

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand the knowledge of engineering management concepts of energy efficiency	2	2	3
CO-2:	apply the knowledge of energy efficiency concepts	3	2	3
CO-3:	accrue the knowledge of various day lighting and electrical lighting techniques for energy efficiency	2	2	3
CO-4:	accrue the knowledge of various energy efficiency certification for green building	2	3	3
CO-5:	evaluate the various concepts of energy efficiency in real time building or project	2	3	3

Module-1 – Introduction	9 Hour
Energy required for building construction -climate adapted and rejecting buildings- Heat transfer mechanism - Thermal storage - Construction of psychrometric chart - Measuring latent and sensible heat - Problem in psychrometric chart - HVAC study from psychrometric chart- Greenhouse effect- Thermal comfort - Metabolism - Factors affecting thermal comfort - Micro climate - Urban heat island - Factors affecting micro climate and site development- Sun protection and shading coefficient - Energy conservation strategies - Sun path diagram - Construction of sun path diagram - Orientation of building - Software used for orientation of building with sun path - Calculating solar load on vertical surfaces of different orientation- Types of shading devices – Design responses to energy conservation strategies.	
Module-2- Passive Solar Heating and Cooling	9 Hour
General principles of passive Solar Heating - Key design elements - Direct gain-Case studies - Thermal storage wall - Trombe wall system - Case study on trombe wall - Water wall system - Case study on water walls - Sun space with examples - Convective air loop with case study - Passive cooling general principles - Ventilation principles - Ventilation case study - Predicting ventilation in buildings - Worksheet for calculating windows area of Naturally ventilated House - Ventilation requirements, instruments used - Minimum standards for ventilation - Calculation of reduction in heat gain - Ventilation Design to find out probable average indoor wind speed – Air filtration and odor removal- Mandatory Requirements for ventilation as per ECBC building Code - Controls in Ventilation as per ECBC building Code - Prescriptive requirements for special structures - Low-energy comfort systems as per ECBC building Code - Air-side economizer acceptance procedures as per ECBC building code.	
Module-3: Daylighting and Electrical Lighting	9 Hour
Electric lighting, Light distribution - Electric lighting -Control for day lighted buildings - Illumination requirement - Daylighting – Sources and concepts - Building Design Strategies - Case Studies - Components of daylight factor - Light shelves - Recommended daylight factors - Daylighting analysis, Supplementary artificial lighting design - Problems in Illumination requirements - Materials, components and details - Insulation, Types of insulation - Various insulation materials - Heat insulation as per SP41 - Optical materials - Radiant barriers - SP16 and its guidelines for daylighting - Glazing materials building design Strategies - Glazing materials building design strategies – Case studies - Prescriptive requirements for lighting - Calculating interior lighting power – Space function method - Calculating interior lighting power – Space function method - Power adjustment factors- Electrical and renewable energy systems mandatory requirements for lighting as per ECBC building code	
Module-4: Energy Standards and Ratings	9 Hour

Sound and noise - measuring sound waves - Loudness - Intensity of sound - Audible range, Instruments used - sound pressure and intensity, Acoustical criteria and Quality - Noise criteria - Green building features - green construction materials - Green Globe, LEED certification, Guidelines - GRIHA, IGBC certifications and standards - Various energy standards - Envelope Performance Factor - Standard building EPF calculation as per ECBC - Evolution of GRIHA - GRIHA manuals - GRIHA checklist - Various schemes in GRIHA - Case study in India, Abroad (GRIHA Rated) - Whole building performance method as per ECBC building Code - Energy performance Index, EPI ratio as per ECBC building Code.

Module- 5: Design for Climatic Zones

9 Hour

Energy efficient buildings for various zones - Indian classification of Climates - Cold and cloudy climate details - Case studies on cold and cloudy - Cold and sunny - climate details - Case studies on cold and sunny - Hot and dry - climate details - Case studies on hot and dry - Moderate - climate details - Case studies on moderate - Warm and humid - climate details - Case studies on warm and humid - Energy Audit - Energy certification - Software used - Energy auditing template preparation - Energy Simulation Program - Calculating energy consumption of proposed design and standard design - Model making: Design of building, Design of building based on energy, Design of building window analysis, Design of building and Daylight analysis, submit the energy model -

Learning Resources	1. Brown, G.Z. and DeKay, M., "Sun, Wind and Light - Architectural Design Strategies", John Wiley and Sons Inc, 2001	5. Moore, F., "Environmental Control System", McGraw Hill Inc. 2002. 6. Tyagi, A.K. (Ed). "Handbook on Energy Audits and Management Tata Energy Research Institute", 2000.
	2. Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2007. 3. Handbook on Functional Requirements of Buildings Part 1 to 4 SP : 41 (S and T) 1995 4. Majumdar, M (Ed), "Energy - Efficient Buildings" in India, Tata Energy Research Institute, Ministry of Non Conventional Energy Sources, 2002.	6. Osman Attmann, (2010), "Green Architecture Advanced Technologies and Materials". McGraw Hill. 7. Md. Zakiur Rahman, Most. Sharmin Islam, Md. Shahedur Rashid, (2012) "Practice of Green Building Technologies and Water Conservation Process" LAP Lambert Academic Publishing. 8. Sam Kubba, (2012), "Handbook of Green Building Design and Construction: LEED, BREEAM, and Green Globes" Elsevier Science.

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	1. Dr. S. Kamal, , University college of Engineering, Ramnad, kamalselva21@gmail.com	1. Dr. N. Ganapathy Ramasamy, SRMIST
2. Mr. K. M. Nanthan, L&T, RKMNNN@Intecc.com	2. Dr. K. Yogeswari, B.S. Abdur Rahman Crescent Institute of Science and Technology, yogeswari@crescent.education	2. Dr. L. Krishnaraj, SRMIST

Course Code	21CEE548T	Course Name	MODULAR AND LOW-COST CONSTRUCTION	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>gain knowledge of the modular construction method</i>
CLR-2:	<i>understand the importance and methodology of prefabrication</i>
CLR-3:	<i>identify the various low cost materials and products</i>
CLR-4:	<i>analyze the basic concepts of methods and techniques low cost construction practices</i>
CLR-5:	<i>explore the advanced level of various techniques used for modular housing</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	<i>understand the applications and types of modular housing</i>	3	2	3
CO-2:	<i>develop and implement the prefabrication techniques in construction</i>	3	3	2
CO-3:	<i>apply the knowledge to identify the suitable materials and products for cost efficiency</i>	1	1	3
CO-4:	<i>accrue comprehensive knowledge on low cost techniques and equipment</i>	2	2	2
CO-5:	<i>expose to the modern technique and futuristic trends in modular housing</i>	3	2	3

Module-1 – Modular Construction	9 Hour
<i>Applications of modular construction – Benefits -Materials – Steel, Timber, Concrete, Precast concrete - Buildings – Corridor type buildings- Two, three and multistorey buildings - Open-Plan modular buildings - Dimensions for planning of modular buildings - Space planning in housing – rural housing</i>	
Module-2 – Prefabrication	9 Hour
<i>History of Prefabrication, -Industrial prefabrication Site prefabrication and mobile production plants - Type standardization system - Structural systems – Frame system, Panel system, Room model system – Structural and non-structural facades – Case studies</i>	
Module-3 – Low Cost Building Material and Products	9 Hour
<i>Materials - Natural and manmade materials, Walls - Stabilized and sun dried - Soil blocks and bricks - Hollow concrete blocks - Stone masonry blocks, Ferro-cement partitions. Roofs - Precast R.C. plank & joists roof - Precast channel roof - Precast L-Panel roof - Precast funicular shells, Ferro cement shells, Filler slab - Sisal fiber roof - Improved country tiles - Thatch roof</i>	
Module-4 – Low Cost Construction Techniques and Equipment	9 Hour
<i>Rat trap bond construction, precast R.C. and fibrocement technique, Mud technology - Brick molding machine- stabilized soil block making machine - plants for the manufacturing of concrete blocks - low cost roads - low cost retaining walls - geosynthetic</i>	
Module-5 – Development in Modular Housing	9 Hour
<i>Cost comparison-From industrial mass production to customized prefabrication- computer-assisted design and production processes- construction robots-digital construction systems - hybrid modular construction systems-nano house, Case studies</i>	

Learning Resources	1. Mark Lawson, Ray Ogden & Chris Goodier, <i>Design in Modular Construction</i> , CRC press, Florida 2014	4. AK Lal, <i>Hand book of Low cost housing</i> , New age international publisher, New Delhi, 1996
	2. Staib, Dörrhöfer & Rosenthal, <i>Components and systems - modular construction design structure : new technologies</i> , Institute fur international Architecture, Munich, 2008	5. GC Mathur, <i>Low cost housing in developing countries</i> , IBH publisher, New Delhi, 1993
	3. Vidya& Radha, <i>Alternative low-cost building materials</i> , DSATM, Bangalore, India	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. K. M. Nanthan, L&T, R KMNNN@intecc.com	1. Dr. S.Kandasamy, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, drskandasamy@veltech.edu.in	1. Dr. N.Pannirselvam, SRMIST
2. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	2. Dr.P.Ramados, Puducherry Technological University, Puducherry, dosspr@ptuniv.edu.in	2. Dr. S.Manikandaprabhu alias Saravanan, SRMIST

Course Code	21CEE549J	Course Name	BUILDING INFORMATION MODELLING IN CONSTRUCTION	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							2	0	2	3

Pre-requisite Courses	Nil	Co- requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes / Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the concept of BIM
CLR-2:	identify the focus area for the use of the BIM tools in construction
CLR-3:	analyze the basic concepts of modelling of building
CLR-4:	create the building model with mep and scheduling
CLR-5:	integrating the data of the building in various dimensions

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	understand BIM basics and the Benefits	1	2	3
CO-2:	design and build in a virtual environment prior to starting construction	3	1	2
CO-3:	incorporate the mechanical, electrical, and plumbing systems into the 3D building model.	1	3	3
CO-4:	develop a four dimensional model by integrating BIM and the project schedule	2	2	3
CO-5:	discuss collaboration and digital data flow and information management in the construction industry	3	1	3

Module-1 - BIM Introduction	12 Hour
Introduction to BIM - Fundamental of BIM Approach - Application of BIM - Optimizing BIM Processes – BIM Execution Plan - Identifying and Planning BIM Uses Practice 1 : Introduction to software and Basic setup Practice 2 : Create level, grids and sections, Modify and edit tools Practice 3 : Family creation Practice 4 : Creation of wall and its types, Wall articulation with materials, Plastering Practice 5 : Curtain wall and Wall Openings, Doors and Windows	
Module-2 - BIM Tools and Modelling	12 Hour
Creating the vision - Opening line of communication - Design structure matrix - Constructability review - Schedules for Estimating - Sustainability Analysis Practice 6 : Methods of modelling of floors and massing Practice 7 : Roofs and ceiling Practice 8 : Staircase and railings Practice 9 : Annotations – Dimensions, Texts, Views, Cutoffs, Tags and legends Practice 10 : Extrusion of elements	

Module-3 - BIM Collaborations	12 Hour
Defining project organization – BIM site coordination activity tracking – System installation for management and verification - Collaborating with a team - Managing the coordination process	
Practice 11 : Structural components and detailing	
Practice 12 : MEP components	
Practice 13 : Quantity takeoff of materials and components	
Practice 14 : Rendering	
Practice 15 : Reports and printing	
Module-4 - BIM Applications	12 Hour
BIM for Owners, Architects & Engineers - Contractors, Sub-contractors and fabricators - BIM Scheduling - Field issue management - BIM and Safety - Document control	
Practice 16 : Navisworks setup, interface and importing file	
Practice 17 : Append and merge model	
Practice 18 : Walk through	
Practice 19 : Sectioning and viewpoints	
Practice 20 : Clash detections of MEP	
Module-5 – BIM Integrated Project	12 Hour
Artifact and constant deliverables – Handover information - New culture of innovation – AI in construction & Virtual walk-throughs – Sustainable construction – Digital Twin - Case studies	
Practice 21 : Merge Scheduling	
Practice 22 : Find item, hold, switch back, move	
Practice 23 : Time liner simulation with MS project link	
Practice 24 : Animation	
Practice 25 : Navisworks quantification take off	

Learning Resources	1. Brad Hardin, Dave McCool, <i>BIM and Construction Management proven tools, method and workflow</i>, John Wiley & Sons, Inc., Indianapolis, Indiana, Second edition, 2015 2. Rafael Sacks, Charles Eastman, Ghang Lee, Paul Teicholz, <i>BIM Handbook A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers</i>, John Wiley & Sons, Inc., Hoboken, New Jersey, Third edition, 2018 3. Dana K Smith, Michael Tardif, <i>Building Information Modeling A Strategic Implementation Guide for Architects, Engineers, Constructors, and Real Estate Asset Managers</i>, John Wiley & Sons, Inc., Hoboken, New Jersey, 2009 4. Robert Yori, Marcus Kim, Lance Kirby <i>Mastering Autodesk Revit 2020</i>, John Wiley & Sons, Inc., Indianapolis, Indiana, 2020 5. Nawari O. Nawari & Michael Kuenstle, <i>Building Information Modeling: Framework for Structural Design</i>, CRC Press, Taylor and Francis group, Boca Raton, 2015.
---------------------------	--

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (45%)		Life-Long Learning CLA-2 (15%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	-	20%	20%	-
Level 2	Understand	20%	-	-	20%	20%	-
Level 3	Apply	20%	-	-	20%	20%	-
Level 4	Analyze	20%	-	-	20%	20%	-
Level 5	Evaluate	10%	-	-	10%	10%	-
Level 6	Create	10%	-	-	10%	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. K. M. Nanthan, L&T, R KMNNN@Intecc.com	1. Dr. S.Kandasamy, Vel Tech Rangarajan Dr. Sagunthala R&D Institute of Science and Technology, Chennai, drskandasamy@veltech.edu.in	1. Dr. N.Pannirselvam, SRM IST
2. Dr.C. Velan, Ascendas, Taramani, velan62@yahoo.com	2. Dr.G.Vijayakumar, Puducherry Technological University, Puducherry, gvk@ptuniv.edu.in	2. Dr. S.Manikandaprabhu alias Saravanan, SRMIST

Course Code	21CEE550T	Course Name	SYSTEM DYNAMIC MODELING IN CONSTRUCTION	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	<i>The purpose of learning this course is to:</i>
CLR-1:	<i>understand the fundamental concepts and historical evolution of system dynamics.</i>
CLR-2:	<i>learn the steps for building, validating, and simulating models in system dynamics.</i>
CLR-3:	<i>apply system dynamics principles to various aspects of construction management.</i>
CLR-4:	<i>explore advanced topics and theories related to complex systems in construction.</i>
CLR-5:	<i>investigate current research, future trends, and technological advancements in construction.</i>

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	<i>explain the importance and basic concepts of system dynamics in construction.</i>	1	2	3
CO-2:	<i>develop and validate dynamic models using various simulation techniques.</i>	3	3	3
CO-3:	<i>apply system dynamics for effective management of construction projects and resources.</i>	2	2	3
CO-4:	<i>analyze advanced theories and techniques to optimize construction processes.</i>	3	2	3
CO-5:	<i>evaluate emerging trends and technologies impacting the future of construction.</i>	2	2	3

Module-1 - Introduction to System Dynamics	9 Hour
Overview of system dynamics - History and evolution - Basic concepts and definitions - Importance in construction - System thinking - Feedback loops - Flow diagrams - Stock and flow diagrams - Causal loop diagrams - Time delays - Nonlinearity in systems- System archetypes	
Module-2 - Modeling and Simulation	9 Hour
Introduction to modeling - Steps in building a model - Model validation and verification - Simulation of models - Sensitivity analysis - Scenario analysis - Monte carlo simulation - Agent-based modeling - Discrete event simulation - Hybrid simulation - Model documentation - Model deployment	
Module-3 - System Dynamics in Construction	9 Hour
Role of system dynamics in construction - Construction project management - Resource management - Risk management - Supply chain management - Sustainability in construction - Lean construction - Construction safety - Quality management - Cost estimation - Project scheduling - Case studies	
Module-4 - Advanced Topics	9 Hour
Complex systems theory - Chaos theory - Fractal theory - Network theory - Game theory - Decision theory - Operations research - Optimization techniques - Artificial intelligence in construction - Machine learning in construction - Big data in construction - Internet of things in construction	
Module-5 - Research and Future Trends	9 Hour
Current research in system dynamics - Future trends in construction - Digital twins in construction - Building information modeling (BIM) - Virtual reality and augmented reality in construction - Drones in construction - Robotics in construction - 3D printing in construction - Smart cities - Green buildings - Research methodology - Writing a research paper	

Learning Resources	1. Kamopp, D. C., Margolis, D. L., & Rosenberg, R. C. (2012). <i>System Dynamics: Modeling, Simulation, and Control of Mechatronic Systems</i> . John Wiley & Sons.	4. Seeler, K. A. (2014). <i>System Dynamics: An Introduction for Mechanical Engineers</i> . Springer.
	2. Stermann, J. (2000). <i>Business Dynamics: Systems Thinking and Modeling for a Complex World</i> . McGraw-Hill.	5. Chaturvedi, D. K. (2010). <i>Modeling and Simulation of Systems Using MATLAB and Simulink</i> . CRC Press.
	3. Richardson, G. P., & Pugh, A. L. (1981). <i>Introduction to System Dynamics Modeling with Dynamo</i> . MIT Press.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. G Muneeswaran, L&T, gmeswar@Intecc.com	1. Dr. Nikhil Bugalia, IIT Madras, nbugalia@civil.iitm.ac.in	1. Dr. K.S. Anandh, SRMIST
2. Er. P. Jahanathan, UCON PT Structural System, Pvt. Ltd., jegan@utraconindia.com	2. Dr. S. Kamal, BITS Trichy, kamalselva21@gmail.com	2. Dr. A. Arokiaprakash, SRMIST

Course Code	21CEE551T	Course Name	CONTRACT LAWS AND REGULATIONS	Course Category	E	PROFESSIONAL ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Civil Engineering	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	understand the types of contracts and their role in the construction
CLR-2:	identify the various steps in the process of tendering
CLR-3:	identify the various key aspects of arbitration
CLR-4:	know the various types of taxes and construction approval
CLR-5:	explore the knowledge of various labour laws

Course Outcomes (CO):	At the end of this course, learners will be able to:	Programme Outcomes (PO)		
		1	2	3
CO-1:	accrue knowledge of construction contracts	2	1	3
CO-2:	develop a skill for the tendering process of various projects	3	2	3
CO-3:	accrue the knowledge of duties of the arbitrator.	2	2	3
CO-4:	develop an idea on the various legal requirements to be met with land and construction	2	1	3
CO-5:	identify and apply the provisions provided in the labour welfare schemes.	2	3	3

Module-1 - Contract Agreements	9 Hour
Introduction to contract agreements- Important sections and act- Functions of contracts in engineering-Contract system - Introduction to contract agreements, Terms involved in contract agreements - Negotiated rates- Elements of contracts -Types of engineering contracts – Types of legal contract - Comparison of legal contracts- Standard contract document - K2 agreements - Conditions of contract- Special conditions of contract - Design of contract document- international contract document- FIDIC - Types of FIDIC contract- BOT, BOOT, BOLT- Turnkey projects- Case Study- Law of Torts.	
Module-2 - Tendering concepts	9 Hour
Tendering Concepts - tender documents – requirements for tendering –Methods of inviting tenders - Notice inviting tender- Prequalification process- Requirements for Tendering - Tender document- Refund of deposits- Evaluation of Tender from Technical and Financial Aspects- Evaluation of Tender from commercial point of view- Preparation of the Documentation- Earnest Money Deposit - Security Deposit - Potential contractual problems - Contract formation - Contract interpretation - World bank procedures – Guidelines - Transparency in tender's act - -Evaluation of Tender from Technical, financial aspects – One cover and two cover system - Case Study.	
Module-3 - Appointment of Arbitrator	9 Hour
Arbitration - Arbitrator- Concepts- Advantages- Types of arbitration - Modes of arbitration - Comparison of actions and laws - Subject matter- appointment of arbitrator-power and duties of arbitrator – Rules of evidence- Enforcement of award- Cost- dispute review board- Violations – Violation certificates - Violation forms – Violation schedules - Third arbitrator - Sources of powers - Procedure for investigation - Case Study.	

Module-4 - Types of Tax Involved in Construction**9 Hour**

Introduction to tax - Patta and Chita - Potential contractual problems – Insurance and bonding - price variation clause – Laws governing cells-Purchase of urban and rural land- Use of urban and rural land- tax laws- fine and Liquidated Damages – Excise and custom duties Costs- Influence on construction cost- Property law income tax – sales tax – VAT – Agency law- Statutory regulations- Legal requirements of planning – Health policies - Local government approval- Land and revenue codes - Case study.

Module-5 – Labour Laws**9 Hour**

Indian Contracts Act - Introduction to Labor Laws – Advantages of labor loss- Social security- applications, limitations and uses- Welfare legislation Indian contracts law- Applications, Limitations and uses - Labor laws - Applications, Limitations and uses - workmen compensation act – Minimum wages Act – Applications, Limitations and uses- Child labour Act- Applications, Limitations and uses- Industrial dispute Act- Applications, Limitations and uses- Maternity benefit Act – Applications, Limitations and uses Domestic emerging on misconduct. Applications, Limitations and uses- Indian Factory Act- Applications, limitations and uses- Tamil Nadu Factory Act- Applications, limitations and uses- Case Study.

Learning Resources	1. John G. Betty., "Engineering Contracts", McGraw Hill, 2003.	5. Lecture Notes, "Legal Aspects for Civil Engineers, Short Term Course organized by SRMEC", 29 th May to 4 th June, 2002.
	2. Gajaria G.T., "Laws Relating to Building and Engineering Contracts in India", M.M. Tripathi Private Ltd., Bombay, 1982 Tamilnadu PWD Code, 2006.	6. Oxley Rand Posicit, "Management Techniques applied to the Construction Industry", Granda Publishing Ltd., 2000.
	3. Jimmie Hinze, "Construction Contracts", McGraw Hill, 2001	
	4. Joseph T. Bockrath, "Contracts, the Legal Environment for Engineers and Architects", McGraw Hill, 2000.	

Learning Assessment							
	Bloom's Level of Thinking	Continuous Learning Assessment (CLA)				Summative Final Examination (40% weightage)	
		Formative CLA-1 Average of unit test (50%)		Life-Long Learning CLA-2 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-
Level 3	Apply	20%	-	20%	-	20%	-
Level 4	Analyze	20%	-	20%	-	20%	-
Level 5	Evaluate	10%	-	10%	-	10%	-
Level 6	Create	10%	-	10%	-	10%	-
	Total	100 %		100 %		100 %	

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr.C. Velan, Taramani, velan62@yahoo.com	1. Dr. S. Kamal, University college of Engineering, Ramnad, kamalselva21@gmail.com	1. Dr. S. Anandh, SRMIST
2. Mr. K. M. Nanthan, Planning Manager south Factories, L&T, rkmmnn@Intecc.com	2. Dr. K.Yogeswari, B.S. Abdur Rahman Crescent Institute of Science and technology, yogeswari@crescent.education	2. Dr. M. Balasubramanian, SRMIST



SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur, Chengalpattu District 603203, Tamil Nadu,
India