Course Structure & Syllabus

Of

M.Tech Programme

In

CONSTRUCTION TECHNOLOGY AND MANAGEMENT

(2022 Admission Batch)

(Approved by Academic Council and Board of Studies)

GIFT Autonomous, Bhubaneswar
(Approved by AICTE, New Delhi, Affiliated to BPUT, Odisha)
Recognized under section 2(f) of the UGC act,1956
At. Gramadiha, Po. Gangapada,
Via. Janla, Dist- Khorda,
Pincode:752054

(Specialization: Construction Technology and Management)

GIFT Autonomous , Bhubaneswar

1ST SEMESTER				2ND SEMESTER			
CODE	SUBJECTS	L-T-P	CREDITS	Code	SUBJECTS	L-T-P	CREDITS
MT-CE-T- PC-101	Contract Management	3-1-0	4	MT-CE-T- PC-201	Material Technology	3-1-0	4
MT-CE-T- PC-102	Construction Equipment Management	3-1-0	4	MT-CE-T- PC-202	Advance Construction Materials	3-1-0	4
MT-CE-T- PC-103	Project Planning & Management	3-1-0	4	MT-CE-T- PC-203	Construction Economics and Finance Management	3-1-0	4
MT-CE-T- PC-104	Construction Techniques	3-1-0	3	MT-CE-T- PC-204	Computational Methods and Techniques	3-1-0	4
MT-CE-T- PE-105	Quality and Safety Management /Strategic Management in Construction/ Internet of Things/ Risk and value management	3-1-0	3	MT-CE-T- PE-205	Building information Management/ Infrastructure Valuation/ Human resource development for Construction/ Sustainability in Construction Projects.	3-1-0	4
CREDIT (THEORY)			**18**	**CREDIT (THEORY)**			**20**
MT-CE-P- PC-101	Construction Software lab- MS Project	0-0-2	2	MT-CE-P- PC-201	Construction Material Lab	0-0-2	2
MT-CE-P- PS-102	Report Writing and Seminar- I	0-0-2	4	MT-CE-P- PS-202	Report Writing and Seminar- II	0-0-2	4
MT-CE-P- PC-102	Computational lab	0-0-2	2				
CREDIT (PRACTICAL/SESSIONAL)			**8**	**CREDIT (PRACTICAL/SESSIONAL)**			**6**
TOTAL SEMESTER CREDITS			**26**	**TOTAL SEMESTER CREDITS**			**26**
TOTAL CUMULATIVE CREDITS			**26**	**TOTAL CUMULATIVE CREDITS**			**52**
3RD SEMESTER				**4TH SEMESTER**			
CODE	SUBJECTS	L-T-P	CREDITS	Code	SUBJECTS	L-T-P	CREDITS
MT-MB-T-ES-301	Research Methodology and Intellectual Property Rights	0-0-4	4	MT-P-PS- 401	Dissertation Evaluation and Open Defense.	0-0-4	16
MT-CE-T- PC-301	Maintenance and rehabilitation of Constructed facilities/ Airport Management system and Design/ Construction of Metro	0-0-4	4	MT-P-PS- 402	Viva Voce.	0-0-4	4
MT-CC-P- PS-303	Pre Dissertation Evaluation	0-0-4	10				
TOTAL SEMESTER CREDITS			**18**	**TOTAL SEMESTER CREDITS**			**20**
TOTAL CUMULATIVE CREDITS			**70**	**TOTAL CUMULATIVE CREDITS**			**90**

1st Semester

Contract Management			
Course Code	MT-CE-T- PC-101	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03

Module-1 – (8 Hours)

Introduction to contracts:
Definitions, Essentials for a legally valid contract, Salient features of contract, Discharging of a contract. Documents for an Engineering Contract; Types of contracts: Classification Based on Tendering Process, Economic Consideration, Applicability of the various types of contracts in Construction.

Module -2 – (8 Hours)

BOQs, drawings, and conditions of contract. **Types of contracts** are classified by tendering (open, selective, negotiated), economic considerations (fixed price, cost-plus), and construction applicability (EPC, BOT, turnkey), chosen based on project scale, financial and technical needs.

Module -3 –(6 Hours)

Tendering process:
Definitions, List of Documents, EMD, Security Deposit, Invitation for Tenders and sale of Documents, Preparation of Tender Documents and its submission, Receipt of Tender Documents and its opening, Evaluation of Tender and Award of contract–

Module -4 – (10 Hours)

Letter of Award, Letter of Intent, Issues in tendering process: Pre - Registration, Pre-Qualification, Nominated Tendering, Rejection of Tenders, Repeat Orders, Revocation of Tenders, Unbalanced Bidding.
Administration/Performance of contract:
Responsibilities (Duties and Liabilities) of Principal & Contractor, Monitoring and Quality control/assurance, Settlement of claims – Advances, Bills, Extension for time, Extras & Variations, Cost Escalations. Security Deposit, Retention Money, Performance Bond, Liquidated Damages, Penalties, Statutory Requirements.

Module -5 – (6 Hours)

Introduction to Breach of Contract Definition and meaning of breach of contract.
Types of breach: Actual breach and anticipatory breach. Legal Remedies for Breach of Contract. Damages: Types of damages (compensatory, nominal, punitive, liquidated, and unliquidated).
Principles for assessing damages. Specific performance: Conditions where specific performance is applicable.
Injunction: Temporary and permanent injunctions in contract law. Quantum meruit: Compensation for work already performed.

Module -6 - (8 Hours)

Consequences of Breach of Contract, Case Studies on Breach of Contract, Breach of Contract in Construction Projects, Prevention and Risk Mitigation, Strategies to minimize breach risks in contracts. Relevant Laws and Acts
Overview of contract law provisions related to breach (e.g., Indian Contract Act 1872, English Common Law).
Application in engineering and construction projects.

Text Books:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, M.M. Tripathi Private Ltd., Bombay, 1982.
2. Jimmie Hinze, Construction Contracts, 2nd Ed., McGraw Hill, 2001.
3. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, 6th Edition, McGraw Hill, 2000.

Course Outcomes:

CO1	Explain the fundamental concepts of contracts, including their definitions, essential requirements, and types, and evaluate their applicability in engineering and construction projects.
CO2	Interpret and prepare key documents related to engineering contracts, such as BOQs, drawings, and contract conditions, and demonstrate their use in different types of contracts.
CO3	Examine the tendering process by identifying the required documents, evaluating tender submissions, and understanding the steps leading to the award of a contract.
CO4	Assess the issues involved in the tendering process, including pre-registration, qualification, revocation, and unbalanced bidding, and evaluate their impact on contract administration.
CO5	Formulate strategies to address breach of contract scenarios in construction projects, including legal remedies, specific performance, and mitigation techniques, while adhering to relevant laws.
CO6	Critically assess real-world case studies on breach of contract and apply contract law principles to resolve disputes and minimize risks in construction projects.

Construction Equipment Management

Course Code	MT-CE-T- PC-102	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03

Module-1 – (8 Hours)

Introduction to Equipment Planning- Importance of equipment planning in construction projects.
Role of equipment in achieving project timelines and cost efficiency.
Factors influencing equipment selection: Project requirements (scale, scope, and complexity).
Site conditions and constraints. Equipment capacity and compatibility with other resources., Planning of construction equipment, Equipment Management in Projects, Equipment Maintenance Management , Replacement of Equipment.

Module -2 – (8 Hours)

Cost Control of Equipment - Definition and importance in construction projects.
Types of equipment costs: Fixed, operating, and ownership costs. Factors influencing equipment cost control . Depreciation Analysis – Safety Management

Module -3 –(6 Hours)

EQUIPMENT FOR EARTHWORK - Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth .Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers.

Module -4 – (10 Hours)

OTHER CONSTRUCTION EQUIPMENTS -Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment –Equipment for Demolition.

Module -5 – (6 Hours)

MATERIALS HANDLING EQUIPMENT - Definition and scope of materials handling equipment.
Importance of materials handling in construction, manufacturing, and logistics.
Objectives of effective materials handling: Safety, efficiency, and cost reduction.
Forklifts and related equipment - Introduction to Forklifts, components, Portable Material Bins- Types of Portable Material Bins, Applications of Portable Bins, Advantages of Portable Bins. Conveyors - Applications in Construction and Industry, Selection Criteria for Conveyors. Hauling Equipment - Types of Hauling Equipment, Selection and Capacity Planning , Safety and Efficiency in Hauling.

Module -6 - (8 Hours)

EQUIPMENT FOR PRODUCTION OF AGGREGATE AND CONCRETING -Crushers – types, selection, efficiency. Feeders - types, selection, efficiency.
Screening Equipment - types, selection, efficiency . Handling Equipment - types, selection, efficiency . Batching and Mixing Equipment - types, selection, efficiency . Hauling, Pouring and Pumping Equipment – types, selection, efficiency. Transporters- types, selection, efficiency.

Text Books :

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2006.
2. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 1988.
3. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.
4. Dr. Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi. 1983.

CO1	Understand equipment planning importance and apply selection factors like project needs, site conditions, and equipment compatibility.
CO2	Analyze equipment costs (fixed, operating, ownership) and evaluate cost control and depreciation methods for efficient management.
CO3	Explain earthwork operations and analyze the selection and use of earth-moving equipment like tractors, graders, and scrapers.
CO4	Evaluate construction equipment (dredging, tunneling, demolition) and apply selection criteria based on project requirements.
CO5	Understand materials handling equipment roles and apply selection and management strategies for forklifts, conveyors, and hauling equipment.
CO6	Analyze the selection and efficiency of equipment for aggregate production and concreting, including crushers, feeders, and mixers.

Project Planning & Management			
Course Code	MT-CE-T- PC-103	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03

Module-1 – (8 Hours)

Introduction to Project Management , Project Management as a Process, What is a Project, The Project Environment & Ecosystem -- Essential Elements, Kinds of Projects (Examples).

Module -2 – (8 Hours)

Project Planning and Scheduling - Bar Charts: Preparation, advantages, and limitations.

Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Comparison of CPM and PERT , Processes of project planning, scheduling – progress control - project planning and scheduling techniques.

Module -3 –(6 Hours)

Network and Scheduling Techniques –CPM AND PERT, Network diagram, time estimates, activity floats, and determination of the critical path Concept, event and activity times, probability of project completion.

Module -4 – (10 Hours)

Use of computer based models - Principles of Project management - Resource Management and Inventory - Implementation of Project Planning Management - Analysis and design of planning and control system.

Module -5 – (6 Hours)

The 6 Constraints Of Project Management. The Project Management Cycle, Project Management Processes (Core & Supportive), Project Management Roles & Cultural Differences Project, Management Skills.

Module -6 - (8 Hours)

Introduction to Risk Assessment: Contingency planning, A model for adaptive Project management. Disputes and Claims Management - Use of computer based project management tools.

Text Books:

1. Project Management , Kumar NeerajJha
2. Callahan, M. T., Quackenbush, D. G., and Rowings, J. E., Construction Project Scheduling, McGraw- Hill, New York, 1992.
3. Cleland, D. I. and Ireland, L. R., Project Management: Strategic Design and Implementation, 4th Edition, McGraw Hill, New York, 2002

CO1	Define the fundamental concepts of project management, including project processes, environments, and types of projects.
CO2	Explain the techniques of project planning and scheduling, such as bar charts, CPM, and PERT, highlighting their applications and limitations.
CO3	Develop network diagrams, estimate activity times, and determine the critical path using CPM and PERT for effective scheduling.
CO4	Analyze resource management techniques, inventory systems, and project control methods to optimize project implementation.
CO5	Evaluate the constraints, roles, and processes in project management, incorporating cultural and skill-based considerations.
CO6	Design adaptive project management models, including risk assessment, contingency planning, and dispute resolution using software tools.

Construction Techniques			
Course Code	MT-CE-T- PC-104	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	03	Exam Hours	03

Module-1 – (8 Hours)

Reinforced and pre-stressed concrete construction - Prefabricated structures - Production of ready mixed concrete - Productivity analysis, Economics of form work, Design of Formwork and their reusability.

Module -2 – (8 Hours)

Modular construction Practices, Fibonacci series, its handling and other reliable proportioning concepts. Modular coordination, Standardization, system building, Lamination and Advantages of modular construction.

Module -3 –(6 Hours)

Features of Recent Advances in Concrete. Guidelines for Mix design and use of following concretes: Light weight concrete, High strength concrete, Ultra-high strength concrete. Guidelines for Mix design and use of following concretes: High density concrete, Shrinkage compensating concrete, Mass concrete, Roller compacted concrete.

Module -4 – (10 Hours)

MECHANIZATION IN CONSTRUCTION - Introduction to mechanization: Definition, advantages and limitations of mechanization, Indian scenario and Global scenario. Mechanization in aggregate manufacturing: Natural aggregates and recycled aggregates

Module -5 – (6 Hours)

Choice of production setup – Manufacturing methods –Stationary and mobile production – Planning of production setup – Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening.

Module -6 - (8 Hours)

Pre-Engineered Buildings : Introduction – Advantages - Pre Engineered Buildings Vs Conventional Steel Buildings - Design of Pre Engineered Buildings (PEB) – Applications.

Text Books:

1. Project Management , Kumar Neeraj Jha
2. Callahan, M. T., Quackenbush, D. G., and Rowings, J. E., Construction Project Scheduling, McGraw- Hill, New York, 1992.
3. Cleland, D. I. and Ireland, L. R., Project Management: Strategic Design and Implementation, 4th Edition, McGraw Hill, New York, 2002
4. L. Mokk, “Prefabricated Concrete for Industrial and Public Structures, ”Publishing House of the Hungarian Academy of Sciences, Budapest, 2007.
5. T. Koncz, “Manual of Precast Concrete Construction”, Vol. I, II, III & IV, Berlin,1971.

CO1	Define the principles of reinforced, pre-stressed, and prefabricated concrete construction, including modular construction practices and proportioning concepts.
CO2	Explain the guidelines for mix design and applications of advanced concretes such as lightweight concrete, high-strength concrete, and roller-compacted concrete.
CO3	Apply concepts of construction mechanization to aggregate production, incorporating both natural and recycled aggregates.
CO4	Analyze the choice of production setups, manufacturing methods, and storage processes for precast concrete elements.
CO5	Evaluate the advantages and limitations of pre-engineered buildings (PEB) compared to conventional steel buildings for practical applications.
CO6	Develop solutions for planning and optimizing concrete hardening processes, ensuring dimensional tolerances and improved productivity in construction.

Quality and Safety Management			
Course Code	MT-CE-T- PE-105	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	03	Exam Hours	03

Module-1 – (8 Hours)

Quality policy in construction industry-Consumer satisfaction-Ergonomics-Time of Completion Statistical Tolerance-Taguchi's concept of quality- Contract and construction programming Inspection procedures- Total QA/QC Program and cost implication.

Module -2 – (8 Hours)

Techniques and needs of QA/QC, Different aspects of quality, Appraisals, Factors influencing construction quality, Critical, major failure aspects and failure mode analysis, Stability methods and tools, optimum design, Reliability testing, Reliability coefficient and reliability prediction - Life cycle costing, Value engineering and value analysis.

Module -3 –(6 Hours)

Quality Improvement Tools and Techniques. Seven Basic Tools of Quality: Check Sheets, Histograms, Pareto Charts, Cause-and-Effect (Fishbone) Diagrams, Scatter Diagrams, Control Charts, Flowcharts. Applications and case studies for problem-solving using these tools.

Module -4 – (10 Hours)

SAFETY MANAGEMENT SYSTEMS: Fundamental of safety management, construction safety, safety in scaffolding and working platform, welding and handling, excavation work, concreting and cementing work. Building construction, TAC and NBC rules, High rise building.

Module -5 – (6 Hours)

Evolution of modern safety concept- Safety policy - Safety Organization. Safety survey, safety inspection, safety sampling, Safety Audit. Concept of an accident, Reportable and nonreportable accidents, unsafe act and condition principles of accident prevention, Overall accident investigation process.

Module -6 - (8 Hours)

Introduction to Risk Management in Construction:
Concept of risk, uncertainty, and opportunity. Types and sources of risks in construction projects (technical, financial, legal, environmental, etc.). Impact of risks on construction projects: time, cost, quality, and safety. Risk Identification and Classification, Risk Analysis Techniques, Risk Mitigation and Response Planning.

Text Books :

1. Danny Myers, Construction Economics: A New Approach, Taylor and Francis Publisher,2004
2. Ofori, G, The Construction Industry Aspects of its economics and Management, Singapore, University Press, 1990.
3. Managing Risk in Construction Projects – Nigel J. Smith, Tony Merna, and Paul Jobling.
4. Construction Project Management – Frederick Gould and Nancy Joyce.

CO1	Describe quality policies, inspection procedures, and total QA/QC programs in the construction industry to ensure consumer satisfaction and cost optimization.
CO2	Explain the techniques, tools, and factors influencing construction quality, including reliability testing, life cycle costing, and value engineering.
CO3	Apply quality improvement tools such as Pareto charts, fishbone diagrams, and control charts to analyze and solve construction-related quality problems.
CO4	Analyze safety management systems, safety rules, and accident prevention measures for various construction activities such as scaffolding, concreting, and excavation work.
CO5	Evaluate safety policies, accident investigation processes, and modern safety concepts to identify unsafe conditions and minimize accidents in construction projects.
CO6	Develop risk management plans by identifying, analyzing, and mitigating risks related to time, cost, quality, and safety in construction projects.

Strategic Management in Construction			
Course Code	MT-CE-T- PE-106	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	03	Exam Hours	03
Module-1 – (8 Hours)			
Introduction to Strategic Management Concepts, Strategy Formation and Implementation, External and Internal Environment Analysis.			
Module -2 – (8 Hours)			
Strategy formulation. Business vision and mission, Importance, Characteristics and components. Evaluating mission statements.			
Module -3 –(6 Hours)			
Corporate Level Strategies: Concentration, integration, diversification, expansion strategies, retrenchment and combination strategies, internationalization, cooperation and restructuring.			
Module -4 – (10 Hours)			
Structural Implementation: Types of organizational structures, organizational design and change, structures for strategies.			
Module -5 – (6 Hours)			
. Behavioral Implementation: stakeholders and strategy, stakeholder's management, strategic leadership, corporate culture and strategic management, personal values and ethics, social responsibility and strategic management.			
Module -6 - (8 Hours)			
Financial Strategies, Decision and Analytical Tools, Corporate Strategic Events, Leadership and Decision-making, Corporate Social Responsibility.			

Text Books :

1. David Langford, Steven Male, Strategic Management in Construction, 2nd Edition, John Wiley and Sons, 2008.
2. Richard Fellows, Construction Management in Practice, 2nd Edition, Blackwell Science, 2001.
3. Vipin Gupta, Kamala Gollakota and R. Srinivasan, Business Policy and Strategic Management, Prentice-Hall of India, New Delhi, 2005.
4. Wheelen Thomas L, David Hunger J, Krish Rangaraja, Concepts in Strategic Management and Business Policy, New Delhi, Pearson Education, 2006.

CO1	Explain strategic management concepts, including formulation, implementation, and environmental analysis.
CO2	Evaluate business vision and mission statements based on their importance and components.
CO3	Analyze and recommend corporate strategies like integration, diversification, and retrenchment.
CO4	Design organizational structures aligned with strategic goals and evaluate structural changes.
CO5	Assess stakeholders, leadership, culture, and ethics in behavioral strategy implementation.
CO6	Apply financial strategies and tools to align corporate events with social responsibility.

Internet of Things			
Course Code	MT-CE-T- PE-107	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	03	Exam Hours	03

Module-1 – (8 Hours)

Introduction to Internet of Things Introduction-Definition & Characteristics of IoT , Physical Design of IoT- Things in IoT , IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , IoT Enabling Technologies- Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, IoT Levels & Deployment Templates.

Module -2 – (8 Hours)

Domain Specific IoTs Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities-Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response, Environment-Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , Energy- Smart Grids , Renewable Energy Systems , Prognostics , Retail-Inventory Management

Module -3 –(6 Hours)

Smart Payments , Smart Vending Machines , Logistics-Route Generation & Scheduling , Fleet Tracking ,Shipment Monitoring , Remote Vehicle Diagnostics, Agriculture-Smart Irrigation ,Green House Control ,Industry -Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,Health &Lifestyle - Health & Fitness Monitoring, Wearable Electronics IoT and M2M Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT Software ,Defined Networking , Network Function Virtualization.

Module -4 – (10 Hours)

IoT Platforms Design Methodology IoT Design Methodology-Purpose & Requirements Specification ,Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification,

Module -5 – (6 Hours)

Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, Case Study on IoT System for Weather Monitoring, Motivation for Using Python

Module -6 - (8 Hours)

IoT Physical Devices & Endpoints What is an IoT Device-Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces – Serial, SPI , I2C , Programming Raspberry Pi with Python-Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , Other IoT Devices-pcDuino, Beagle Bone Black , Cubieboard.

Text Books :

1. Internet of Things, A Hands on Approach, by Arshdeep Bahga& Vijay audisetti, University Press.
2. The Internet of Things, by Michael Millen, Pearson

CO1	Explain IoT concepts, characteristics, functional blocks, communication models, and enabling technologies.
CO2	Analyze domain-specific IoT applications in areas like home automation, smart cities, environment, and energy systems.
CO3	Evaluate IoT and M2M differences, and explore applications in health, logistics, agriculture, and industry.
CO4	Design IoT systems using methodologies for requirements, process, domain, and service specifications.
CO5	Develop IoT applications by integrating devices, components, and operational specifications, demonstrated through case studies.
CO6	Implement IoT physical devices, such as Raspberry Pi, by interfacing sensors and programming with Python.

Risk and value management			
Course Code	MT-CE-T- PE-107	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	03	Exam Hours	03

Module-1 – (8 Hours)

Risk analysis and Management for projects (RAMP) – Identifying risk events. Probability distribution. Stages in Investment lifecycle; Determination of NPV and its standard deviation for perfectly co-related, moderately co-related and un-correlated cash flows.

Module -2 – (8 Hours)

Sensitivity analysis Scenario analysis simulation, decision tree analysis, risk profile method, certainly equivalent method; risk adjusted discount rate method, certainty index method, 3 point estimated method; use of risk prompts, use of Risk Assessment tables, details of RAMP process, utility of Grading of construction entities for reliable risk assessment.

Module -3 –(6 Hours)

Risk Mitigation – by elimination, reducing, transferring, avoiding, absorbing or pooling. Residual risk, mitigation of unquatified risk. Coverage of risk through CIDC's MOU with the Actuarial Society of India through risk premium such as (BIP) – Bidding Indemnity Policy (DIMO) – Delay in meeting obligation by client policy, (SOC) – Settlement of claims policy (LOP)- Loss of profit policy (TI).

Module -4 – (10 Hours)

Value : Meaning of value, basic and secondary functions, factor contributing to value such as aesthetic, ergonomic, technical, economic : identifying reasons or unnecessary costs.

Module -5 – (6 Hours)

Value Analysis: value analysis team; principles of value analysis, elements of a job plan viz. orientation, Information, presentation. Implementation, follow up action, benefits of value analysis, various applications; assessing effectiveness of value analysis

Module -6 - (8 Hours)

Value Analysis: value analysis team; principles of value analysis, elements of a job plan viz. orientation, Information, presentation. Implementation, follow up action, benefits of value analysis, various applications; assessing effectiveness of value analysis

Text Books :

1. Seetharaman (2000);" Construction Engineering and Management", ISBN: 9788188114061.487p.
2. Prasanna Chandra (1986); "Projects preparation, appraisal, budgeting & implementation", Tata McGraw Hill. ISBN-13: 978-0074516287. 543p.
3. Dr.Surendra Kumar "Industrial Engineering and Management of manufacturing systems" .Satya Prakashan.
4. Zimmerman & Hart (1982);" Value engineering - a practical approach for owners, designers &contractors", CBS Publishers. ISBN:9780442295875.279p.
5. S C Rangwala ,Estimating Costing and valuation, Charotar Publishing House. 6. Del Younke, Value Engineering: Analysis And Methodology

CO1	Identify and analyze risk events using probability distributions and lifecycle stages in project investments.
CO2	Evaluate risk assessment methods such as sensitivity analysis, decision trees, and certainty equivalent approaches.
CO3	Develop risk mitigation strategies through techniques like elimination, transfer, and pooling, including coverage through risk policies.
CO4	Explain the concept of value and factors contributing to value, identifying unnecessary costs in project scenarios.
CO5	Apply principles of value analysis and elements of job planning to enhance project efficiency and effectiveness.
CO6	Assess the benefits and applications of value analysis, measuring its impact on project outcomes.

Construction Software lab- MS Project			
Course Code	MT-CE-P- PC-101	IE Marks	100
Teaching Hours/Week (L:T:P)	0:0:2		
Credits	02		
Experiment 1: Creating a New Project Plan - Experiment with setting up a project, entering project information, and defining the project start date.			
Experiment 2: Defining Tasks and Milestones - Learn how to create a task list, define milestones, and differentiate between tasks and milestones in a project timeline.			
Experiment 3: Setting Task Dependencies - Establish task dependencies (e.g., finish-to-start, start-to-start) and observe how changes affect the project schedule.			
Experiment 4: Allocating Resources - Assign resources to tasks, define resource types (e.g., work, material, cost), and observe resource allocation impacts on the schedule.			
Experiment 5: Establishing a Work Breakdown Structure (WBS)- Organize tasks hierarchically and create a WBS to provide a structured view of the project.			
Experiment 6: Setting and Adjusting Task Durations - Input task durations and use the Gantt chart to visualize the effect of duration changes on the overall schedule.			
Experiment 7: Tracking Project Progress - Learn to set a baseline, update task progress, and compare actual progress against the baseline.			
Experiment 8: Critical Path Analysis - Identify the critical path and observe how task delays impact the overall project timeline.			
Experiment 9: Resource Leveling - Experiment with resource leveling to resolve overallocation issues and optimize the project schedule.			
Experiment 10: Generating Reports and Visualizations - Explore built-in reporting tools to generate summary reports, resource usage reports, and project progress dashboards.			

Text Books :

1. “Microsoft Project Step by Step" Author: Carl Chatfield, Timothy Johnson , Publisher: Microsoft Press.
2. "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" Author: Harold Kerzner, Publisher: Wiley.
3. "Microsoft Project For Dummies", Author: Cynthia Snyder Dionisio, Publisher: For Dummies (Wiley).

CO1	Understand the basics of project planning, including task creation, milestones, and dependencies.
CO2	Apply resource allocation techniques to effectively assign and manage project resources.
CO3	Develop a structured Work Breakdown Structure (WBS) to organize and visualize project tasks.
CO4	Analyze the project schedule using tools like critical path and resource leveling to optimize timelines.
CO5	Evaluate project progress by setting baselines and comparing actual performance against planned schedules.
CO6	Generate and interpret project reports to monitor performance and communicate project status.

Report Writing and Seminar- I			
Course Code	MT-CE-P- PS-102	IE Marks	100
Teaching Hours/Week (L:T:P)	0:0:4		
Credits	02		

CO1	Identify and gather relevant information from credible sources to support seminar topics.
CO2	Organize and structure content effectively for seminar presentations and written reports.
CO3	Analyze audience needs to tailor presentation styles and content for effective communication.
CO4	Develop and deliver impactful seminar presentations using appropriate visual aids and technology.
CO5	Evaluate the quality of reports and presentations through peer review and self-assessment.
CO6	Demonstrate professional writing skills by producing clear, concise, and well-formatted reports.

Computational lab			
Course Code	MT-CE-P- PC-102	IE Marks	100
Teaching Hours/Week (L:T:P)	0:0:2		
Credits	02		
Experiment 1: Review of Basic Numerical Methods.			
Experiment 2: Introduction to construction project models			
Experiment 3: Analytical and numerical.			
Experiment 4: Application software for project planning			
Experiment 5: Scheduling & control			
Experiment 6: Programming exercises for estimation			
Experiment 7: Network planning and control			
Experiment 8: MATLAB Programming in linear and non-linear programming.			
Experiment 9: Finite difference and Finite volume methods			
Experiment 10: An Introduction to the Solution of Linear Systems			

Text Books :

1. Numerical Methods for Partial Differential Equations: Finite Difference and Finite Volume Methods, Author: V. S. S. Sastry Publisher: PHI Learning Pvt. Ltd., Edition: 2012**.**
2. Finite Difference Methods for Ordinary and Partial Differential Equations: Steady-State and Time-Dependent Problems Author: Randall J. LeVeque, Publisher: Society for Industrial and Applied Mathematics (SIAM) Edition: 2007
3. Numerical Solution of Partial Differential Equations: An Introduction, Authors: K. W. Morton and D. F. Mayers, Publisher: Cambridge University Press, Edition: 2nd Edition, 2005

CO1	Understand basic numerical methods and their applications in construction project models.
CO2	Apply analytical and numerical techniques to solve problems in project scheduling and control.
CO3	Utilize application software for project planning and estimation in real-world scenarios.
CO4	Analyze network planning and control methods to optimize project workflows.
CO5	Develop MATLAB programs to solve linear and non-linear programming problems.
CO6	Evaluate the effectiveness of finite difference and finite volume methods in solving linear systems.

2nd Semester

Material Technology			
Course Code	MT-CE-T- PC-201	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03

Module-1 – (8 Hours)

Cement and Concrete:
Portland Cement: Chemical Composition, hydration of cement, structure of hydrated cement, mechanical strength of cement gel, water held in hydrated cement paste and heat of hydration.

Module -2 – (8 Hours)

Cements of different types. Factors affecting the strength of concrete. Elasticity, shrinkage and creep of concrete.

Module -3 –(6 Hours)

Durability of concrete: Permeability of concrete, chemical attack of concrete, air-entrained concrete and thermal properties of concrete. Mechanical test of hardened concrete. light weight and high density concrete. Mix Design. Statistical quality control: Biaxial strength of concrete, Fiber reinforced concrete.

Module -4 – (10 Hours)

Metals: Behavior of common constructional metals in tension and compression. True stress-strain curve for mild steel in simple tension. Theories of failure and yield surfaces.

Module -5 – (6 Hours)

Fatigue Properties:
Nature of fatigue failure, fatigue strength for completely reversed stresses, fatigue strength with super imposed static stress and factor influencing fatigue strength.

Module -6 - (8 Hours)

Temperature and creep properties: Low temperature properties, high temperature properties, creep stress -time-temperature relation for simple tension, mechanics of creep in tension. structure of materials and imperfection, deformation of crystals and theory of dislocation.

Text Books :

1. Concrete Technology, M.L.Gambhir, Tata Mc-Graw-Hill, New Delhi,2002
2. Concrete Technology, M S Shetty, S.Chand Publisher, 2013
3. Properties of Concrete, A M Neville-Pearson Education,2008
4. Mechanical Behaviour of Engineering Materials, AJ Martin

Course Outcomes:

CO1	Understand the chemical composition, hydration, and mechanical properties of Portland cement and concrete.
CO2	Analyze the factors affecting the strength, elasticity, shrinkage, and creep of concrete.
CO3	Evaluate the durability of concrete through tests on permeability, chemical attack, and thermal properties.
CO4	Examine the behavior of construction metals under tension and compression, including yield theories.
CO5	Assess fatigue properties and factors influencing fatigue strength in materials subjected to cyclic stresses.
CO6	Apply knowledge of temperature and creep properties to understand material behavior under different thermal conditions.

Advanced Construction Materials			
Course Code	MT-CE-T- PC-202	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03
Module-1 – (8 Hours)			
Fresh concrete and its rheology. Mechanical, deformational behavior and microstructure of hardened concrete. Creep and shrinkage. Testing of concrete.			
Module -2 – (8 Hours)			
Mix design and properties of concrete; High strength concrete; High density and lightweight concretes; admixtures.			
Module -3 –(6 Hours)			
Industrial waste materials in concrete, their influence on physical and mechanical properties and durability of concrete, Concreting under extreme weather conditions, High strength concrete. Changes in concrete with time, Corrosion of concrete in various environments. Corrosion of reinforcing steel. Ferro-cement, material and properties.			
Module -4 – (10 Hours)			
Foams and light weight materials, fibre reinforced concrete. Types of fibres, workability, mechanical and physical properties of fibre reinforced concrete. Polymers in Civil Engineering, Polymers, fibres and composites.			
Module -5 – (6 Hours)			
Fibre reinforced plastic in sandwich panels, modeling. Architectural use and aesthetics of composties. Adhesives and sealants.			
Module -6 - (8 Hours)			
Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building, Polymer concrete composites.			

Text Books :

1. Neville A.M., 'Properties of concrete', 3rd ed., 1985, ELBS Lea F.M.,
2. 'Chemistry of cement and concrete', 3rd ed., 1970, Edward Arnold Proceedings of recent seminars etc. and journals.

CO1	Understand the rheology, mechanical behavior, and microstructure of fresh and hardened concrete, including creep and shrinkage.
CO2	Apply mix design principles to produce concrete with desired properties, including high strength, high density, and lightweight concrete.
CO3	Analyze the impact of industrial waste materials and extreme weather conditions on the properties and durability of concrete.
CO4	Evaluate the properties and applications of fiber reinforced concrete and polymers in civil engineering.
CO5	Examine the use of fibre reinforced plastics in sandwich panels and their architectural, aesthetic, and functional properties.
CO6	Apply knowledge of elastomeric bearings, moisture barriers, and polymer-based materials in building and construction.

Construction Economics and Finance Management			
Course Code	MT-CE-T- PC-203	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03
Module-1 – (8 Hours)			
Construction accounting - Income statement - Depreciation and amortization – Engineering economics -Benefit-cost analysis - Replacement analysis.			
Module -2 – (8 Hours)			
Break even analysis - Risks and uncertainties and management decision in capital budgeting.			
Module -3 –(6 Hours)			
Taxation and inflation – Work pricing - contract - bidding and award – revision - escalation - Turnkey activities – Project appraisal and yield - Working capital management – International finance - Budgeting and budgetary control - Performance - appraisal.			
Module -4 – (10 Hours)			
Comparison of alternatives: Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return, Break-even comparisons, Capitalized cost analysis , Benefit-cost analysis.			
Module -5 – (6 Hours)			
Cost estimating: Types of Estimates, Approximate estimates – Unit estimate, Factor estimate, Cost indexes, Parametric estimate, Life cycle cost.			
Module -6 - (8 Hours)			
Financial management: Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management.			

Text Books :

1. Danny Myers, Construction Economics: A New Approach, Taylor and Francis Publisher,2004
2. Ofori, G, The Construction Industry Aspects of its economics and Management, Singapore University Press, 1990.

CO1	Understand key concepts in construction accounting, including income statements, depreciation, amortization, and benefit-cost analysis.
CO2	Apply engineering economics techniques such as replacement analysis and break-even analysis to make informed capital budgeting decisions.
CO3	Analyze the effects of taxation, inflation, and work pricing on contract bidding, project appraisal, and international finance.
CO4	Evaluate different methods for comparing project alternatives, including present and future worth, rate of return, and benefit-cost analysis.
CO5	Develop accurate cost estimates using various estimating techniques, including unit, factor, and life-cycle cost estimates.
CO6	Assess financial performance through financial statements, ratios, and working capital management in construction projects.

Computational Methods and Techniques			
Course Code	MT-CE-T- PC-204	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03

Module-1 – (8 Hours)
Neural Networks: Artificial Neural Network and Introduction, Learning Rules, Knowledge Representation and Acquisition, Different Methods of Learning.
Module -2 – (8 Hours)
Algorithms of Neural Network: Feed-forward Error Back Propagation, Hopfield Model, Kohonen's Featrure Map, K-Means Clustering, ART Networks, RBFN, Application of Neural Network to the relevant field.
Module -3 –(6 Hours)
Fuzzy Logic: Basic Concepts of Fuzzy Logic, Fuzzy vs Crisp Set, Linguistic variables ,Membership Functions, Operations of Fuzzy Sets, Fuzzy If-Then Rules, Variable Inference Techniques, Defuzzification, Basic Fuzzy Inference Algorithm, Fuzzy System Design, FKBC and PID Control, Antilock Breaking System(ABS), Industrial Applications.
Module -4 – (10 Hours)
Optimization Fundamentals: Definition, Classification of Optimization Problems, Unconstrained and Constrained Optimization, Optimality Conditions. LINEAR Programming: Simplex Method, Duality, Sensitivity Methods.
Module -5 – (6 Hours)
NON-LINEAR Programming: Newton's Method, GRG Method, Penalty Function Method, Augmented Langrange Multiplier Method, Dynamic Programming and Integer Programming, Interior Point Methods, Karmakar's Algorithm, Dual Affine, Primal Affine.
Module -6 - (8 Hours)
Genetic Algorithm: GA and Genetic Engineering, Finite Element based Optimization, PSO,BFO, Hybridization of Optimization Technique, Application of Optimization Technique for Solving Projects(Project solutions). Implementation of Branch Relevant Industrial Applications by Mat lab Code.

Text Books :

1. Neural Networks- by Simon Haykin
2. Fuzzy Logic with Engineering Application- by ROSS J.T (Tata Mc)
3. Neural Networks and Fuzzy Logic – by Bart Kosko
4. An introduction Fuzzy Control – by D.Driankor, H. Hellendorn, M.Reinfrank (Narosa Pub)
5. Fuzzy Neural Control – by Junhong NIE & Derek Linkers (PHI) Related IEEE/IEE Publications.
6. Fuzzy System Design Principles, Building Fuzzy IF-THEN Rule Bases – by Riza C. Berikiu and Trubatch, IEEE Press
7. Ashok D. Begundu & chandrapatla T.R "Optimization concept and application in engineering", Prentice Hall,1999
8. Rao S.S "Engineering Optimization"
9. Gill,Murray and Wright ,"Practical Optimization"
10. James A.Memoh. "Electric Power System Application Of Optimization".
11. Song Y.,"Modern Optimization Techniques In Power System"
12. Optimization Research;Prabhakar Pai,Oxford University Press.

CO1	Understand the fundamentals of neural networks, including their learning rules, knowledge representation, and acquisition methods.
CO2	Apply neural network algorithms, such as feed-forward error back propagation and K-means clustering, to solve real-world problems.
CO3	Analyze fuzzy logic concepts, including fuzzy sets, membership functions, and fuzzy inference techniques for designing fuzzy systems.
CO4	Evaluate optimization problems using linear programming techniques, such as the Simplex method and sensitivity analysis.
CO5	Solve non-linear programming problems using methods like Newton's method, dynamic programming, and integer programming.
CO6	Create solutions using genetic algorithms, particle swarm optimization, and other hybrid optimization techniques for industrial applications.

Building Information Management			
Course Code	MT-CE-T- PE-205	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03
Module-1 – (8 Hours)			
Structural :Structural System, Systems for enclosing Buildings, Functional aesthetic system, Materials Selection and Specification.			
Module -2 – (8 Hours)			
Qualities of enclosure necessary to maintain a specified level of interior environmental quality – weather resistance – Thermal infiltration – Acoustic Control – Transmission reduction			
Module -3 –(6 Hours)			
Air quality – Illumination – Relevant systems integration with structural systems, Plumbing Electricity – Vertical circulation and their interaction.			
Module -4 – (10 Hours)			
Maintenance and Safety :Component longevity in terms of operation performance and resistance to deleterious forces - Planning systems for least maintenance materials and construction – access for maintenance			
Module -5 – (6 Hours)			
Feasibility for replacement of damaged components – equal life elemental design – Maintenance free exposed and finished surfaces.			
Module -6 - (8 Hours)			
Ability of systems to protect fire – preventive systems – fire escape system design – planning for pollution free construction environmental – Hazard free Construction execution.			

Text Books :

1. E.C. Butcher and A.C. Parnell, Designing for Fire Safety, John Wiley and Sons, 1993.
2. William T. Mayer, Energy Economics and Build Design, McGraw-Hill Book Company, 1983.
3. Peter R. Smith and Warren G. Julian, Building Services, Applied Science Publishers Ltd., London.
4. A.J.Elder and MartizVindenBarg, Handbook of Building Enclosure, McGraw- Hill Book Company, 1983.
5. Jane Taylor and Gordin Cooke, The Fire Precautions Act in Practices, 1987. L T P Cr

CO1	Understand the principles of structural systems, building enclosures, and the role of material selection in functional and aesthetic design.
CO2	Analyze the qualities of building enclosures needed to maintain interior environmental quality, such as weather resistance, thermal infiltration, and acoustic control.
CO3	Apply knowledge of air quality, illumination, and systems integration (plumbing, electricity, vertical circulation) within the context of structural systems.
CO4	Evaluate maintenance strategies and safety considerations for enhancing component longevity and reducing operational performance degradation.
CO5	Assess the feasibility of replacing damaged components and design for equal life elemental systems in construction projects.
CO6	Design fire prevention systems and pollution-free construction methods while ensuring safety and hazard-free execution.

Infrastructure Valuation			
Course Code	MT-CE-T- PE-206	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03
Module-1 – (8 Hours)			
Function analysis; FAST diagramming; brain storming; criteria scoring matrices; an introduction to value theory.			
Module -2 – (8 Hours)			
Introduction to value management; definition of the creative and structured phases of value engineering; the workshop approach to achieving value; teambuilding theory; target setting; time management.			
Module -3 –(6 Hours)			
Definitions of infrastructure; Typical infrastructure planning steps; Planning and appraisal of major infrastructure projects; Screening of project ideas.			
Module -4 – (10 Hours)			
Life cycle analysis; Multi-criteria analysis for comparison of infrastructure alternatives; Procurement strategies; Scheduling and management of planning activities.			
Module -5 – (6 Hours)			
Demand curves and price elasticities; Benefit-cost ratio and internal rate of return; Shadow pricing; Accounting for risk and uncertainty; Financial Evaluation - Time value of money, Investment criteria.			
Module -6 - (8 Hours)			
Project cash flows – elements and basic principles of estimation, Financial estimates and projections, Cost of capital, Rate of return; Project risk analysis; Political and social perspectives of infrastructure planning.			

Text Books :

1. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006
2. J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
3. P. Chandra, Projects: Planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill, New Delhi, 2009.
4. J. D. Finnerty, Project financing - Asset-based financial engineering, John Wiley & Sons, NewYork, 1996.
5. A. S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.

CO1	Understand and apply function analysis, FAST diagramming, and brainstorming techniques for effective value management.
CO2	Analyze the creative and structured phases of value engineering and utilize the workshop approach for achieving value through teambuilding and target setting.
CO3	Evaluate infrastructure planning steps, including the appraisal and screening of major infrastructure projects.
CO4	Apply life cycle analysis and multi-criteria analysis to compare infrastructure alternatives and select appropriate procurement strategies.
CO5	Assess financial evaluation techniques, including demand curves, benefit-cost ratio, internal rate of return, and time value of money in infrastructure projects.
CO6	Create financial estimates, projections, and risk analyses for infrastructure projects, considering political and social perspectives.

Human Resource Development for Construction			
Course Code	MT-CE-T- PE-207	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03
Module-1 – (8 Hours)			
Introduction: Need of HRD in the context of globalization, Organization Policies various HRD parameters viz. Elements of the ICDP i.e. integrated construction development paradigm.			
Module -2 – (8 Hours)			
Key elements37of HRD such as basic literacy, functional skills, supervisory skills, entrepreneurship skills. Database concept & application in Human Resource Information System.			
Module -3 –(6 Hours)			
Challenges of managing people in construction; organization and management theory; HRM theory; Strategic. HRM approaches; operational HRM approaches; employee relations; employee empowerment; diversity			
Module -4 – (10 Hours)			
Work/life balance; employee welfare; strategic human resource development; employment legislation.			
Module -5 – (6 Hours)			
Recruitment policies, Pre requisites skills- Soft and technical skills. Employee testing & selection Personal Management .			
Module -6 - (8 Hours)			
.Training: –Training of multi-skilled workforce, quality, productivity and employee relations in construction, contractors & sub-contractors – selection, training & development, performance appraisal, potential appraisal, training rewards and recognition etc.			

Reference Books:

1. Neville A.M., 'Properties of concrete', 3rd ed., 1985, ELBS Lea F.M.,
2. 'Chemistry of cement and concrete', 3rd ed., 1970, Edward Arnold Proceedings of recent seminars etc. and journals.

CO1	Understand the need for Human Resource Development (HRD) in the context of globalization and organizational policies, focusing on the Integrated Construction Development Paradigm (ICDP).
CO2	Analyze the key elements of HRD, such as literacy, functional, supervisory, and entrepreneurship skills, and their application in Human Resource Information Systems.
CO3	Evaluate the challenges of managing people in construction, including HRM theory, strategic and operational HRM approaches, employee relations, and empowerment.
CO4	Assess the importance of work-life balance, employee welfare, and strategic HRD, including the impact of employment legislation.
CO5	Apply recruitment policies and evaluate the skills needed for effective employee testing, selection, and personal management in construction organizations.
CO6	Design training programs for a multi-skilled workforce, focusing on quality, productivity, employee relations, performance, potential appraisal, and rewards.

Sustainability in Construction Projects.			
Course Code	MT-CE-T- PE-208	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03

Module-1 – (8 Hours)

Climate system, Human impacts on the climate, Modeling-interpretation and prediction of climate, Long term climate monitoring, Concepts of climate change, Potential causes of climate change, Integrated approach and Sectoral approach.

Module -2 – (8 Hours)

Natural building design consideration – Energy efficient design strategies – Contextual factors – Longevity and process Assessment – Renewable Energy Sources and design – Advanced building Technologies – Smart buildings – Economies and cost analysis.

Module -3 –(6 Hours)

Energy in building design – Energy efficient and environment friendly building – Thermal phenomena – thermal comfort – Indoor Air quality – Climate, sun and Solar radiation, - Psychometrics – passive heating and cooling systems.

Module -4 – (10 Hours)

Energy Analysis – Active HVAC systems - Preliminary Investigation – Goals and policies – Energy audit– Types of Energy audit – Analysis of results – Energy flow diagram – Energy consumption / Unit Production – Identification of wastage- Priority of conservative measures – Maintenance of energy management programme.

Module -5 – (6 Hours)

Energy management of electrical equipment - Improvement of power factor – Management of maximum demand – Energy savings in pumps – Fans – Compressed air systems – Energy savings in Lighting systems – Air conditioning systems – Applications .

Module -6 - (8 Hours)

Facility operation and maintenance –Facility modifications – Energy recovery dehumidifier – Waster heat recovery – Steam plants and distribution systems – Improvement of boiler efficiency – Frequency of blow down – Steam leakage– steam Flash and condense return.

Text Books :

1. Anil Markandya, Climate Change and Sustainable Development: Prospects for Developing Countries, Routledge, 2002.
2. Heal, G. M., Interpreting Sustainability, in Sustainability: Dynamics and Uncertainty, Kluwer Academic Publ., 1998.
3. Jepma, C.J., and Munasinghe, M., Climate Change Policy - Facts, Issues and Analysis, Cambridge University Press, 1998.
4. Munasinghe, M., Sustainable Energy Development: Issues and Policy in Energy, Environment and Economy: Asian Perspective, Kleindorfor P. R. et. al (ed.), Edward Elgar, 1996.

CO1	Understand the climate system and methods for predicting climate change.
CO2	Analyze energy-efficient building strategies and renewable energy sources.
CO3	Evaluate environment-friendly building designs and passive heating/cooling systems.
CO4	Apply energy analysis techniques and conduct energy audits for conservation.
CO5	Assess energy management practices for electrical equipment and systems.
CO6	Design and manage facility operations focusing on energy recovery and efficiency.

Construction Material Lab			
Course Code	MT-CE-P- PC-201	IE Marks	100
Teaching Hours/Week (L:T:P)	0:0:2		
Credits	02		
Experiment 1: In situ testing of concrete structures, test methods available, planning of in situ tests.			
Experiment 2: Basic properties of structural steel.			
Experiment 3: Exposure to IS and other relevant codes, Calibration and interpretation of results, applications and limitations,			
Experiment 4: L Box test for Self compacting Concrete.			
Experiment 5: V funnel test for Self compacting Concrete.			
Experiment 6: Surface hardness methods- Rebound Hammer equipment, its operation and procedure for testing, factors influencing rebound no.			
Experiment 7: Casting and testing of stack bonded masonry prisms and obtaining the stress strain behavior (Modulus of Elasticity) under compression.			
Experiment 8: Mix design, casting and testing High Performance/Strength concrete cylinders and obtaining the stress-strain behavior (Modulus of Elasticity) under compressive loading			
Experiment 9: Design of Fiber reinforced Concrete.			
Experiment 10: Ultrasonic methods- UPV testing equipment, its use, different transducer arrangements, tests calibration and interpretation of results			

CO1	Plan and perform in-situ tests on concrete structures using appropriate methods.
CO2	Evaluate the basic properties of structural steel through experiments.
CO3	Interpret and calibrate test results using IS codes and standards.
CO4	Conduct and analyze L-Box and V-Funnel tests for Self-Compacting Concrete.
CO5	Determine stress-strain behavior of masonry prisms and high-performance concrete under compression.
CO6	Apply rebound hammer and UPV methods for non-destructive testing of concrete.

Report Writing and Seminar - II			
Course Code	MT-CE-P- PS-202	IE Marks	100
Teaching Hours/Week (L:T:P)	0:0:2		
Credits	04		

CO1	Understand the basics of project planning, including task creation, milestones, and dependencies.
CO2	Apply resource allocation techniques to effectively assign and manage project resources.
CO3	Develop a structured Work Breakdown Structure (WBS) to organize and visualize project tasks.
CO4	Analyze the project schedule using tools like critical path and resource leveling to optimize timelines.
CO5	Evaluate project progress by setting baselines and comparing actual performance against planned schedules.
CO6	Generate and interpret project reports to monitor performance and communicate project status.

3RD Semester

Research Methodology and Intellectual Property Rights

Course Code	MT-MB-T- ES-301	IE Marks	100
Teaching Hours/Week (L:T:P)	3:1:0	ESE Marks	100
Credits	04	Exam Hours	03

Module-1 – (8 Hours)

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentation.

Module -2 – (8 Hours)

Effective literature studies approaches, analysis, Plagiarism, Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Module -3 –(6 Hours)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

Module -4 – (10 Hours)

International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, patenting under PCT.

Module -5 – (6 Hours)

PATENT RIGHTS Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Module -6 - (8 Hours)

NEW DEVELOPMENTS IN IPR New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books :

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
5. Mayall, “Industrial Design”, McGraw Hill, 1992.
6. Niebel, “Product Design”, McGraw Hill, 1974.
7. Asimov, “Introduction to Design”, Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.

Course Outcomes:

CO1	Identify and formulate research problems and objectives using systematic approaches.
CO2	Analyze literature, ensure ethical practices, and develop research proposals and reports.
CO3	Explain the nature and process of intellectual property rights, including patents and copyrights.
CO4	Apply international patenting procedures, including PCT processes.
CO5	Evaluate patent rights, licensing, and the use of patent information databases.
CO6	Examine new developments in IPR, including biological systems and traditional knowledge.

Maintenance And Rehabilitation of Constructed Facilities			
MT-CE-P- PC -301	MT-CE-P- PC -301	IE Marks	100
3:0:0	3:0:0	ESE Marks	100
04	04	Exam Hours	03
Module-1 – (8 Hours)			
Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspect of Inspection Assessment procedure for evaluating a damage structure, causes of deterioration.			
Module -2 – (8 Hours)			
Quality assurance for concrete Strength, Durability and Thermal properties, of concrete , Cracks different types, causes – Effects due to climate , temperature, Sustained elevated temperature, Corrosion - Effects of cover thickness.			
Module -3 –(6 Hours)			
Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete – Different types of fibers used for preparing FRC , High strength concrete, High performance concrete, Vacuum concrete.			
Module -4 – (10 Hours)			
SCC - Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.			
Module -5 – (6 Hours)			
Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings on reinforcement, cathodic protection.			
Module -6 - (8 Hours)			
Strengthening of Structural elements, Repair of structure distressed due to corrosion, fire , Leakage, earthquake – DEMOLITION TECHNIQUES - Engineered demolition methods - Case studies .			

Text Books :

1. Denison Campbell l , Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical UK, 1991 .
2. Allen R. T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, U K, 1987
3. REFERENCES:
4. Shetty M. S., "Concrete Technology - Theory and Practices ", S.Chand and Company, 2008.
5. CPWD and Indian Building Congress, Hand book on seismic retrofitting of Building, Narosa Publishers, 2008.
6. Gambhir M.L. , “Concrete Technology”, McGraw Hill, 2013.

Course Outcomes:

CO1	Assess structural damage and explain the importance of maintenance.
CO2	Analyze factors affecting concrete quality and durability.
CO3	Classify advanced concretes and their applications.
CO4	Apply innovative concretes like SCC and geopolymer for sustainability.
CO5	Use NDT methods and corrosion protection techniques.
CO6	Plan and execute repair, strengthening, and demolition of structures.

Pre Dissertation Evaluation			
Course Code	MT-CC-PPS-303	IE Marks	100
Teaching Hours/Week (L:T:P)	0:0:4		
Credits	10		

CO1	Identify and analyze a well-defined research problem.
CO2	Develop a suitable research methodology.
CO3	Conduct and evaluate a detailed literature review.
CO4	Apply advanced concepts to propose solutions.
CO5	Present interim findings effectively.
CO6	Improve research through critical feedback.

4th Semester

Dissertation Evaluation and Open Defense.			
Course Code	MT-P-PS-401	IE Marks	100
Teaching Hours/Week (L:T:P)	0:0:4		
Credits	16		

CO1	Identify and analyze a well-defined research problem.
CO2	Develop a suitable research methodology.
CO3	Conduct and evaluate a detailed literature review.
CO4	Apply advanced concepts to propose solutions.
CO5	Present interim findings effectively.
CO6	Improve research through critical feedback.

Viva Voce.			
Course Code	MT-P-PS-402	IE Marks	100
Teaching Hours/Week (L:T:P)	0:0:4		
Credits	04		

CO1	Demonstrate a comprehensive understanding of core concepts and principles related to the research or subject matter.
CO2	Apply theoretical knowledge and methodologies to justify the research approach and findings.
CO3	Analyze and critically evaluate questions posed during the viva to provide logical and evidence-based responses.
CO4	Synthesize information from various sources to present coherent and well-structured answers.
CO5	Effectively communicate research objectives, methodology, and conclusions to the examiners.
CO6	Reflect on the feedback and questions received to identify areas for further improvement.