SR UNIVERSITY

Department of Civil Engineering

R25 Course Structure- M.Tech Civil (Construction Technology and Management [CTM])

I SEM

S.No.	Course Code	Course	Hours / Week			
			L	T	P/D	C
1	25CE400PC501	Infrastructure Planning	4	0	0	4
2	25CE301PC502	Advanced Construction Materials and Testing	3	0	2	4
3	25CE310PC503	Construction Methods and Equipment Management	3	1	0	4
4	25CS203ES501	AI Assisted Problem Solving Using Python	2	0	6	5
5	25BM400RM501	Sustainability, Critical Thinking, Research Methodology and IPR	4	0	0	4
6	25EN301LS501	Life Skills: Entrepreneurship, Language, Communication and Personality	3	0	2	4
		Total	**20**	**1**	**8**	**25**

II SEM

S.No.	Course Code	Course	Hours / Week			
			L	T	P/D	C
1	25CE401PC504	Construction Project Management	4	0	2	5
2	25CE401PC505	Building Information Modeling (BIM) For Sustainable Construction	4	0	2	5
3	25CE310PC506	Lean Construction and Productivity Improvement	3	1	0	4
4	25CE300PC507	Building Services	3	0	0	3
5	25CE310PC508	Construction Finance Management	3	1	0	4
6	25HS202CR501	Aptitude and Reasoning	2	0	4	4
		Total	**19**	**2**	**8**	**25**

III SEM

S.No.	Course Code	Course	Hours / Week			
			L	T	P/D	C
1	25CE006PR601	Capstone Project	0	0	12	6
2		Program Elective-I	3	0	0	3
3		Program Elective- II	3	0	0	3
4		Open Elective	3	0	0	3
		OR				
	25CE015PR601	Industry Internship/R and D Project/Startup	0	0	30	15

Total			9	0	42	15
IV SEM						
S.No.	**Course Code**	**Course**	**Hours / Week**			
			L	**T**	**P/D**	**C**
1	25CE015PR602	Major Project / Industry Internship/R and D Project/Startup/Externship	0	0	30	15
Total						
		Total Credits				**80**
Program Electives						
S.No.	**Course Code**	**Program Electives**	**Hours / Week**			
			L	**T**	**P/D**	**C**
1	25CE300PE501	Human Resource Management for Construction	3	0	0	3
2	25CE300PE502	Contracts, Claims and Dispute Management	3	0	0	3
3	25CE300PE503	Occupational Hazards, Health and Safety Management	3	0	0	3
4	25CE300PE504	Formwork Design and Practice	3	0	0	3
Open Electives						
S.No.	**Course Code**	**Course**	**Hours / Week**			
			L	**T**	**P/D**	**C**
1	25CE300OE501	Disaster Management	3	0	0	3
2	25CE201OE502	Smart Cities	2	0	2	3
3	25CE300OE503	Pollution and Control Engineering	3	0	0	3

INFRASTRUCTURE PLANNING (25CE400PC501)			L	R	P	C
			4	0	0	4
Course type	Program Core	**Pre-requisite**	NA			

Unit 1: Introduction to Infrastructure Planning

1. Definition and Scope of Infrastructure
2. Types of Infrastructure: Physical, Social, and Economic
3. Role of Infrastructure in Economic Development
4. Infrastructure Planning: Goals and Objectives
5. Steps in Typical Infrastructure Planning
6. Institutional Frameworks for Infrastructure Projects
7. Stakeholders in Infrastructure Development
8. Screening of Infrastructure Project Ideas
9. Prioritization Techniques in Project Screening
10. Introduction to Life Cycle Analysis of Infrastructure

Unit 2: Infrastructure Evaluation Techniques

11. Life Cycle Costing: Methodology and Applications
12. Environmental and Social Impact Assessments
13. Multi-Criteria Decision Analysis (MCDA): Concepts and Tools
14. Weighting and Scoring Methods in MCDA
15. Comparative Evaluation of Infrastructure Alternatives
16. Planning and Appraisal of Major Infrastructure Projects
17. Introduction to Procurement Strategies
18. Public-Private Partnership (PPP) Models
19. Contracting Methods and Risk Allocation
20. Scheduling and Management of Planning Activities

Unit 3: Economic Analysis of Infrastructure Projects

21. Economic Analysis: Concepts and Applications
22. Welfare Economics and Public Works
23. Social Welfare Function and Use
24. Trade-Off Analysis
25. Demand Curves and Price Elasticities
26. Estimation of Project Benefits and Costs
27. Benefit - Cost Ratio Concepts (BCR) and Computation
28. Internal Rate of Return (IRR): Theory and Calculation

29. Shadow Pricing in Economic Analysis
30. Accounting for Risk and Uncertainty in Economic Evaluations

Unit 4: Financial Evaluation of Infrastructure Projects

31. Time Value of Money: Principles and Applications
32. Investment Criteria
33. Project Cash Flows: Components and Estimation Techniques
34. Principles for Estimating Revenues and Costs
35. Operating Cost Estimations
36. Financial Projections: Income Statement, Cash Flow, Balance Sheet
37. Cost of Capital and Financing Sources
38. Project Risk Analysis
39. Project Sensitivity Analysis
40. Techniques for Managing Financial Risks

Unit 5: Socio-Political and Managerial Perspectives

41. Political Economy of Infrastructure Planning
42. Social and Environmental Considerations in Project Planning
43. Institutional and Regulatory Constraints
44. Community Participation and Stakeholder Engagement
45. Ethics and Governance in Infrastructure Projects
46. Infrastructure Planning under Uncertainty
47. Legal Framework and Approvals for Infrastructure
48. Role of Technology in Infrastructure Management

Textbook

1. Pravin Jadhav, Rahul Nath Choudhury, "Infrastructure Planning and Management in India: Opportunities and Challenges", Springer, 2022.

Reference Book

1. J. C. Edison, "Infrastructure Development and Construction Management", Routledge; 1st Edition, 2020.

ADVANCED CONSTRUCTION MATERIALS AND TESTING (25CE301PC502)			L	R	P	C
			3	0	2	4
Course type	Program Core	**Pre-requisite**	NA			

UNIT 1: Special Concretes

1. High Strength Concrete – classification and Applications
2. High Performance Concrete – Key Characteristics
3. Fibre Reinforced Concrete – Types & Behavior
4. Self-Compacting Concrete – Mix Design & Workability
5. Geo-Polymer Concrete – Chemistry & Advantages
6. Light-weight Concrete – Types & Applications
7. Recycled Aggregates in Concrete
8. Nanomaterials in Special Concretes

UNIT 2: Metals

9. High Strength Deformed (HSD) Bars – Grades & Properties
10. IS Code Provisions for Reinforcement Steel
11. Manufacturing Process of HSD Steels
12. Corrosion-Resistant Steel – Types & Performance
13. Modern Alloy Steels – Use in Construction
14. Aluminium in Construction – Mechanical Properties
15. Coating Technologies (Epoxy, Zinc, Polymeric)
16. Reinforcement Coatings – Application & Life Expectancy
17. Galvanization Techniques for Steel

UNIT 3: Composites

18. Plastics in Construction – Types and Usage
19. Manufacturing of Thermoset and Thermoplastics
20. Fibre Reinforced Polymers (FRP) – Types & Behavior
21. Properties of Carbon, Glass, and Aramid FRPs
22. Applications of FRP in Beams, Columns, and Slabs
23. Retrofitting of Structures using FRP
24. Sustainability & Durability of Polymer Composites
25. Fire and Thermal Performance of FRP

UNIT 4: Smart & Intelligent Materials

26. Smart Materials – Definition & Examples
27. Intelligent Materials – Self-Healing, Shape Memory Alloys
28. Embedded Sensors for Structural Health Monitoring
29. Photochromic and Thermochromic Materials
30. Adaptive Materials in Green Building Design
31. Case Studies on Smart Concrete and Smart Bridges

UNIT 5: Testing of Modern Materials

32. Aggregate Grading – Fine and Coarse
33. Concrete Penetration Resistance – Initial & Final Setting
34. Determination of spread test of mortar
35. Determine the Non-Destructive Testing of concrete (UPV, Rebound Hammer)
36. Pozzolanic Activity Index & Permeability of Concrete

LABORATORY

1. Grading Limits of Fine and Coarse Aggregates
2. Mix Design for High Strength Concrete as per IS 10262
3. Design of High strength concrete with inclusion of mineral admixtures
4. Flow Characteristics of Self-Compacting Concrete (Slump Flow, T50, V-Funnel)
5. Tests on SCC (L-Box, J ring)
6. Setting Time of Concrete using Penetration Resistance Method
7. Non-Destructive Testing using Rebound Hammer & USPV
8. Pozzolanic Activity Index of Mineral admixture
9. Permeability Test on Hardened Concrete
10. Compressive Strength of FRC
11. Flexural Strength Test of Fibre Reinforced Concrete Beam
12. Sorptivity test on concrete

Textbooks

1. M. S. Shetty and A K Jain, “Concrete Technology: Theory and Practice”, S Chand and Company Ltd, 2022.
2. S. S. Bhavikatti, “Concrete Technology”, Dream tech Press (Wiley), 2021.

Reference Books

1. M.N. Jacob , “Concrete Technology”, Arihant Books, 2023.

CONSTRUCTION METHODS AND EQUIPMENT MANAGEMENT (25CE310PC503)			L	R	P	C
			3	1	0	4
Course type	Program Core	**Pre-requisite**	NA			

UNIT I-Introduction to Construction Equipment

1. Construction Equipment Planning
2. Equipment Selection Factors
3. Standard vs. Special Equipment
4. Ownership Cost of Equipment
5. Depreciation Analysis Methods
6. Operating Cost of Equipment
7. Investment Cost Calculation Methods
8. Average Annual Investment Method

UNIT II-Engineering Fundamentals of Moving Earth

9. Fundamentals of Earth Work Operations
10. Rolling Resistance in Earth Moving
11. Grade Resistance & Tractive Effort
12. Types of Earth Work Equipment
13. Bulldozers – Types and Applications
14. Scrapers – Functions and Usage
15. Backhoes – Structure and Operation

UNIT III-Concrete Construction Equipment

16. Concrete Production Operations
17. Batching of Concrete Materials
18. Mixing of Concrete – Types and Methods
19. Batch Production Calculation

20. Concrete Compaction Methods
21. Handling and Transporting Concrete
22. Placing of Concrete
23. Transit Mixer & Ready-Mixed Concrete

UNIT IV-Concrete Plants and Materials Handling Equipment

24. Aggregate Production Process
25. Jaw Crusher – Structure and Function
26. Roller Crusher – Working Principle
27. Cone Crusher – Features and Uses
28. Blasting
29. Asphalt Production
30. Asphalt Batch Plant
31. Peurifoy's Method for Equipment Productivity

UNIT V-Advanced Equipment and Technologies

32. Anatomy of a Tower Crane
33. Types of Cranes & Lifting Mechanisms
34. Principles of Lifting in Cranes
35. Underwater Concreting Equipment – Tremie Method
36. Additive Manufacturing (3D Printing) in Construction

RECITATION

1. Role of Construction Equipment in Project Planning
2. Factors Influencing Equipment Selection
3. Comparison of Standard and Specialized Equipment
4. Cost Analysis: Ownership vs. Operational Costs
5. Depreciation Methods and Their Impact on Investment
6. Resistance and Effort in Earth-Moving Operations
7. Applications of Bulldozers, Scrapers, and Backhoes
8. Concrete Batching, Mixing, and Production Efficiency
9. Transportation and Placement of Concrete in Construction
10. Crushing Equipment: Jaw, Roller, and Cone Crushers
11. Advanced Lifting Mechanisms and Tower Cranes

12. 3D Printing and Automation in Modern Construction

Textbooks

1. R. L. Peurifoy, C. J. Schexnayder, A. Shapira and R. Schmitt, "Construction planning, equipment, and methods", 10th Edition, McGraw Hill, New York, 2023.
2. Douglas D. Gransberg, Jorge A. Rueda Benavides, "Construction Equipment Management for Engineers, Estimators, and Owners", CRC Press, 2nd Edition, 2020.

Reference Books

1. P. S. Gahlot, B. M. Dhir, "Construction Planning and Management", New Age International Publishers, 3rd Edition, 2024.
2. John E. Schaufelberger, Giovanni C. Migliaccio, "Construction Equipment Management", Routledge Publisher, 2021.

CONSTRUCTION PROJECT MANAGEMENT (25CE401PC504)			L	R	P	C
			4	0	2	5
Course type	Program Core	**Pre-requisite**	NA			

UNIT I: Introduction to Project Management and Integration Processes

1. Overview of Project Management
2. Project Life Cycle and Process Groups
3. Introduction to Initiating, Planning, Executing, Controlling & Closing
4. Role of a Project Manager
5. Project Integration Management
6. Developing the Project Charter
7. Project Plan Development: Tools and Techniques
8. Project Plan Execution: Managing Deliverables
9. Overall Change Control: Change Requests and Approvals
10. Case Study: Project Integration in Real-world Projects

UNIT II: Scope, Time, and Cost Management

11. Scope Planning and Scope Definition
12. Creating Work Breakdown Structure (WBS)
13. Scope Verification and Control
14. Time Management
15. Scheduling Logic & Precedence Diagramming Method (PDM)
16. Arrow Diagramming Method (ADM)
17. Schedule Development: CPM, PERT, and LoB
18. Forward Pass method, Backword Pass method
19. EST, LST, EFT, LFT and Float
20. Schedule Control and Progress Tracking

UNIT III: Advanced Scheduling and Cost Management

21. Resource Planning and Allocation Strategies
22. Cost Estimating Techniques

23. Cost Budgeting and Baselines
24. Cost Control and Earned Value Management (EVM)
25. Production Curves and Learning Curves
26. Duration Compression Techniques: Crashing and Fast Tracking
27. Resource-Constrained Scheduling Techniques
28. Resource Aggregation and Leveling
29. Resource Smoothing
30. Case Study: Cost Overrun and Schedule Delay Management

UNIT IV: Quality, Risk, and Resource Management

31. Quality Planning in Projects
32. Quality Assurance and ISO Standards
33. Quality Control Techniques
34. Project Risk Management
35. Risk Identification Techniques (Checklists, SWOT)
36. Risk Quantification: Probability & Impact Matrix
37. Risk Response Development and Control
38. Resource Management: Concepts and Challenges
39. Knowledge Management in Project Environments

UNIT V: Procurement and Value Engineering

40. Procurement Management: Overview and Importance
41. Procurement Planning and Contract Types
42. Solicitation Planning and Documentation
43. Source Selection and Bid Evaluation
44. Contract Administration and Legal Aspects
45. Contract Close-out and Audits
46. Material Management in Projects
47. Value Engineering and Value Management Concepts
48. Future Trends in Project Management

LABORATORY

1. Gantt Chart and Network diagram using MS Project
2. Developing a Project Charter – Using MS Project
3. Creating a WBS and Project Scope Statement
4. Activity Sequencing and Dependency Mapping
5. Duration Estimation and Task Scheduling
6. Analysis of Critical Path
7. Float Calculation
8. Duration Compression – Crashing
9. Resource Allocation using MS Project
10. Resolve Resource overallocation

11. Cost Estimation using Analogous and Parametric Methods
12. EVM Analysis and Interpretation to track Project Performance

Textbooks

1. Sridhara Munimakula “Construction Projects - Towards Successful Completion: Practical Construction Project Management”, Clever Fox Publishing, 2024.

Reference Books

1. K. B. Rajoria, H. K. Srivastava, “Case Studies in Construction Project Management”, Khanna Book Publishing, 2024.

BUILDING INFORMATION MODELING (BIM) FOR SUSTAINABLE CONSTRUCTION (25CE401PC505)			L	R	P	C
			4	0	2	5
Course type	Program Core	**Pre-requisite**	Infrastructure Planning			

UNIT I: Fundamentals of BIM and Sustainable Design

1. Introduction to BIM: Concepts and Dimensions
2. BIM and the AEC Industry: Evolution and Trends
3. Sustainable Building Design: Principles and Objectives
4. Introduction to Low/Zero-Impact Buildings
5. BIM in Energy Modeling and Analysis
6. Daylighting and Indoor Comfort Using BIM
7. BIM for Passive Design Strategies
8. Renewable Energy Integration using BIM
9. Assessment Methods: IGBC, BREEAM, LEED, EPC
10. Case Studies: Net-Zero Energy Buildings using BIM

UNIT II: BIM for Construction Planning and Operations

11. BIM in Pre-construction Planning
12. Construction Sequencing and Simulation
13. Clash Detection and Resolution Strategies
14. BIM for Logistics and Site Utilization Planning
15. Buildability Analysis using BIM Models
16. Quantity Takeoff and Cost Estimation (5D BIM)
17. BIM-based Safety Planning and Risk Assessment
18. BIM for Temporary Works Planning
19. Integration of BIM with Construction Management Tools
20. Case Studies: BIM in Mega Projects and Real-Time Tracking

UNIT III: BIM for Design Coordination and Decision Making

21. Collaborative Design Process Using BIM
22. Model-Based Decision Support Systems

23. BIM Tools for Structural, MEP, and Architectural Coordination
24. Interoperability Challenges and Solutions
25. BIM for Multidisciplinary Data Integration
26. Federated Models vs. Integrated Models
27. BIM Execution Plans and Modeling Standards
28. Clash Avoidance during Design Stage
29. Advanced Parametric Design using BIM Tools
30. Case Studies: Coordinated Design Delivery

UNIT IV: BIM for Facility Operation and Maintenance

31. Role of BIM in Post-Construction Phases
32. BIM-Facility Management Integration Models and Frameworks
33. Data Requirements for O&M Phase
34. Construction-to-Operations Building Information Exchange for Asset Management
35. Preventive and Predictive Maintenance Using BIM
36. BIM-Enabled Smart Building Management
37. Challenges in Adopting BIM for Facility Management
38. BIM for Space and Energy Management in Operations & Management
39. Case Studies: BIM-Facility Management Integration in Commercial Buildings

UNIT V: BIM in Organizational Strategy and Practice

40. Organizational BIM Maturity Levels
41. Creating a BIM Implementation Strategy
42. Standards and Protocols: ISO 19650
43. Roles and Responsibilities in a BIM-Enabled Organization
44. Legal and Contractual Implications of BIM Adoption
45. BIM Training and Skill Development Framework
46. Organizational Change Management for BIM Integration
47. Evaluation of BIM ROI and Business Benefits
48. Global Trends and Future of BIM in Sustainable Construction

LABORATORY

1. Level of Detail (LOD) in BIM
2. Architectural BIM Modeling including wall, doors, windows, floors
3. Structural framework including columns, beams, and slabs.
4. Mechanical, Electrical, and Plumbing systems (MEP) using BIM Modeling
5. 3D Spatial Interference
6. Clash Detection using BIM
7. Material Take-Off (MTO) Extract quantities and material specifications from the BIM model.
8. Bill of Quantity (BOQ) Generation
9. Project Scheduling with BIM

10. 4D Simulation in BIM
11. Model Coordination and Review
12. Integrated BIM Workflow for a Building Project

Textbooks

1. Harshul Savla, Chandrahauns Chavan, Pallavi Patil,"Building Information Modeling : Global & Indian Perspective", Notion Press, 2021.

Reference Books

1. Rafael Sacks, Ghang Lee, Luciana Burdi, Marzia Bolpagni, "BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers", Wiley, 4th Edition, 2025.

LEAN CONSTRUCTION AND PRODUCTIVITY IMPROVEMENT (25CE310PC506)			L	R	P	C
			3	1	0	4
Course type	Program Core	**Pre-requisite**	NA			

Unit I- Foundations of Lean Construction

1. Introduction to Lean Construction Principles
2. Evolution and History of Lean Construction (Toyota Production System & Beyond)
3. Understanding the Eight Wastes in Construction
4. Lean Thinking and its Application in the Built Environment
5. Traditional vs Lean Construction: Key Differences
6. Lean Construction Implementation Process

Unit II- Lean Tools and Techniques

7. Value Stream Mapping (VSM) in Construction
8. The Last Planner System (LPS) – Concepts and Implementation
9. Just-in-Time (JIT) in Construction Supply Chain
10. Pull Planning and Flow Efficiency
11. 5S Methodology for Site Organization
12. Kanban and Visual Management Techniques
13. Prefabrication and Modular Construction with Lean
14. Integrated Project Delivery (IPD)
15. Lean Building Information Modeling (Lean BIM)
16. Target Value Design (TVD) for Cost Efficiency

Unit III- Productivity Improvement Strategies

17. Construction Productivity Metrics and KPIs

18. Work Sampling and Productivity Analysis
19. Labor Productivity and Workforce Optimization
20. Equipment Productivity and Optimization Strategies
21. Lean Scheduling and Time Management in Projects
22. Role of Digital Tools and Automation in Productivity Enhancement
23. Benchmarking Productivity in Construction Projects
24. Decision-Making Techniques for Productivity Optimization

Unit IV- Implementing Lean in Construction Projects

25. Change Management in Lean Construction Implementation
26. Overcoming Barriers to Lean Adoption in Construction
27. Enhancing Stakeholder Collaboration and Communication
28. Legal and Contractual Considerations in Lean
29. Measuring the Success of Lean Construction Projects
30. Sustainable Lean Construction: Environmental and Economic Benefits

Unit V-Future Trends and Innovations in Lean Construction

31. Artificial Intelligence and Lean Construction
32. Automation and Robotics in Lean Efficiency
33. Advanced Data Analytics and Predictive Modeling in Lean Construction
34. Lean Safety Management and Risk Mitigation Strategies
35. Circular Economy and Lean Sustainability in Construction
36. Future Roadmap for Lean Adoption in the Construction Industry

RECITATION

1. Challenges in Adopting Lean Practices
2. Analyzing Global Case Studies of Lean Construction
3. Creating a Value Stream Map
4. Simulating the Last Planner System in a Construction Project
5. Group Activity: Applying 5S Methodology to a Construction Site
6. Prefabrication in Lean Construction
7. Modular Techniques in Lean Construction

8. Conducting a Productivity Assessment Exercise
9. Discussion on Digital Tools for Lean and Productivity Improvement
10. Exercise on Change Management Strategies
11. Evaluating Real-World Lean Construction Projects
12. Brainstorming on Future Innovations in Lean Construction

Textbooks

1. Patricia Tzortzopoulos, Mike Kagioglou, and Lauri Koskela, Lean Construction: Core Concepts and New Frontiers", Routledge Publishing, 2020.

Reference Books

1. Lincoln H. Forbes and Syed M. Ahmed, “Lean Project Delivery and Integrated Practices in Modern Construction", Routledge Publishing, 2024.

BUILDING SERVICES (25CE300PC507)			L	R	P	C
			3	0	0	3
Course type	Program Core	**Pre-requisite**	NA			

Unit 1: Orientation and Planning of Buildings

1. Principles of Site Selection
2. Climatic Factors in Building Orientation
3. Solar Path and Building Orientation
4. Principles of Residential Building Design
5. Grouping of Spaces in Residential Buildings
6. Circulation Systems in Building Design
7. Functional Zoning and Layout Planning

Unit 2: General Building Requirements

8. Lighting and Ventilation in Building Design
9. Open Space Requirements Around Buildings
10. Minimum Room Dimensions and Roof Heights
11. Building Codes and Standards for Openings
12. Techniques for Rat-Proofing Buildings
13. Termite Control Methods in Construction
14. Lightning Protection: Concepts and Installation

Unit 3: Fire Protection in Buildings

15. Fire Safety Design Principles
16. Classification of Fire and Fire Loads
17. Fire-Resisting Properties of Building Materials
18. Passive and Active Fire Protection Systems
19. Design of Fire Escape Routes and Staircases
20. Fire Exit Requirements and Occupancy Load
21. Regulatory Codes for Fire Safety (NBC Guidelines)

Unit 4: Vertical Transportation Systems

22. Staircase Design and Construction Details
23. Lift Systems: Types and Design Considerations
24. Design and Operation of Escalators
25. Ramps: Accessibility Standards and Design
26. Safety Regulations in Vertical Transportation
27. Smart Elevators and Automation in Buildings

Unit 5: Building Services and Smart Systems

28. Lighting Systems and Natural Illumination
29. Mechanical Ventilation and HVAC Design
30. Electrical Installation and Circuit Design Basics
31. Acoustics in Building Design and Soundproofing
32. Plumbing Layouts and Water Supply Systems
33. Sewage and Drainage Systems in Buildings
34. Security and Access Control Systems
35. IoT Integration in Smart Buildings
36. Design of Car Parking and Laundry Systems

Textbooks

1. Kracherl Sowieso , "Building Services Engineering", Discovery Publishing House, 2025.

Reference Book

1. Fred Hall, Roger Greeno, "Building Services Handbook", Routledge, 10th Edition, 2024.

CONSTRUCTION FINANCE MANAGEMENT (25CE310PC508)			L	R	P	C
			3	1	0	4
Course type	Program Core	**Pre-requisite**	NA			

Unit I- Basic Engineering Economics Principles

1. Time Value of Money
2. Cash Flow Diagrams
3. Interest Rate and Discounting
4. Single Payment Compound Amount (F/P)
5. Single Payment Present Worth (P/F)
6. Uniform Series Present Worth (P/A)
7. Uniform Series Capital Recovery (A/P)
8. Uniform Series Future Worth (F/A)
9. Sinking Fund Factor (A/F)
10. Arithmetic Gradient Series
11. Geometric Gradient Series
12. Nominal vs. Effective Interest Rates

Unit II-Alternatives Comparison & Decision Making

13. Present Worth Method
14. Future Worth Method
15. Annual Worth Method
16. Rate of Return (ROR)
17. Incremental Rate of Return
18. Capitalized Cost Method

Unit III-Depreciation, Inflation & Taxation

19. Depreciation – Basic Concepts
20. Straight Line Method
21. Declining Balance Method
22. Sum-of-the-Years'-Digits Method
23. Replacement Analysis – Minimum Cost Method
24. Maximum Profit Method
25. Payback Period Method
26. Impact of Inflation on Cash Flow
27. Tax Considerations in Economic Evaluation

Unit IV-Financial Management & Construction Accounting

28. Introduction to Construction Accounting
29. Chart of Accounts
30. Journal Entries and Ledger Posting
31. Profit and Loss Statement
32. Balance Sheet Structure
33. Financial Ratios (Liquidity, Solvency, Profitability)
34. Working Capital Management
35. Cash Flow Statement in Projects
36. Project Financial Monitoring & Reporting

RECITATION

1. Interpret and Create Cash Flow Diagrams
2. Time Value of Money Calculations Using Excel/Manual
3. Solve Problems Using (P/F), (F/P), (P/A), (A/P) Factors
4. Compare Two Alternatives Using Present Worth Method
5. Evaluate Alternatives Using Annual Worth Method
6. Conduct Rate of Return and Incremental ROR Analysis
7. Prepare Break-even Analysis for a Construction Scenario
8. Estimate Capitalized Cost for Long-Term Investments
9. Analyze Depreciation Schedules Using SL & DB Methods
10. Develop a Basic Chart of Accounts for a Project

11. Interpret Financial Statements (P&L, Balance Sheet)

12. Calculate and Interpret Key Financial Ratios

Textbooks

1. Steven M. Bragg, "Construction Accounting", Accounting Tools, Inc, 4th Edition, 2023.

Reference Books

1. Frederick Barnes Muehlhausen and Yunfeng Chen, "Practical Construction Accounting and Financial Management", Purdue University Press, 2023.

HUMAN RESOURCE MANAGEMENT FOR CONSTRUCTION (25CE300PE501)			L	R	P	C
			3	0	0	3
Course type	Program Elective	**Pre-requisite**	NA			

Unit 1: Fundamentals of Human Resource Management

1. Introduction to HRM and Its Core Functions
2. Organization and Classical Management Theory
3. Contemporary Management Theories in HRM
4. Production Efficiency and the Classical Approach
5. Human Behavior Theory in Construction Management
6. Challenges in Managing People in Construction
7. Managerial Attitudes Towards Construction Workforce
8. Employment Relationship: Expectations and Realities

Unit 2: Strategic and Operational HRM Approaches

9. Strategic vs. Operational HRM
10. Models of Human Resource Management
11. Employee Resourcing and Planning
12. Recruitment and Selection in Construction Projects
13. Employee Orientation and Onboarding
14. Training and Development: Need and Implementation
15. Performance Appraisal Systems and Feedback
16. Reward Management Strategies
17. Mentoring Systems in Construction HRM
18. Case Study: Career Development in Construction Management

Unit 3: Employee Relations and Empowerment

19. Foundations of Employee Relations
20. Changing Role and Influence of Trade Unions
21. Collective Bargaining in the Construction Sector
22. Empowerment in Modern HRM Practices

23. Evolution of Employee Empowerment in Construction
24. Managing Workforce Expectations and Engagement

Unit 4: Diversity, Work-Life Balance, and Legal Framework

25. Workforce Diversity and Inclusion in Construction
26. Equal Opportunity Practices in the Industry
27. Case Study: Balancing Work and Life in the Construction Sector
28. Occupational Health and Safety in the Workplace
29. Employment Legislation Overview
30. Employee Welfare Policies and Legal Compliance

Unit 5: Strategic HR Development and Industry Integration

31. Linking HRM to Business Performance
32. Measuring HR Effectiveness: HR Audit and Metrics
33. HR Scorecard and Analytics in Decision Making
34. Digital HRM: Tools and Technologies
35. Current HRM Challenges in the Construction Industry
36. Future Trends and Innovations in Construction HRM

Textbooks

1. K Aswathappa, Sadhna Dash, "Human Resource Management: Text and Cases", McGraw Hill, 10th Edition, 2023.

Reference Books

1. Gary Dessler & Biju Varrkey, "Human Resource Management", Pearson Education, 16th Edition, 2020.

CONTRACTS, CLAIMS, AND DISPUTE MANAGEMENT (25CE300PE502)			L	R	P	C
			3	0	0	3
Course type	Program Elective	**Pre-requisite**	NA			

Unit I-Introduction to Construction Contracts

1. Fundamentals of Contracts: Definition, Importance, and Types
2. Standard Forms of Construction Contracts
3. Key Contractual Clauses: Scope, Payment Terms, Time, and Quality
4. Responsibilities and Liabilities of Stakeholders
5. Legal Framework Governing Construction Contracts
6. Common Challenges in Contract Implementation
7. Case Study: Analysing a Sample Construction Contract

Unit II- Construction Claims and Risk Management

8. Types of Claims: Time Extension, Variation, Acceleration, Disruption, and Quantum Claims
9. Causes of Claims: Design Errors, Delays, Force Majeure, and Unforeseen Conditions
10. Claim Preparation: Documentation, Notices, and Substantiation
11. Risk Identification and Mitigation in Construction Projects
12. Role of Project Managers in Handling Claims
13. Case Study: Real-World Construction Claims Management
14. Workshop: AI in Contract Drafting and Review
15. AI-Powered contract generation
16. AI based Automated contract review and risk assessment
17. Advanced Risk Management Strategies for Large Projects

Unit III-Delay Analysis and Cost Evaluation

18. Types of Delays: Excusable, Non-Excusable, Compensable, and Concurrent

19. Delay Analysis Techniques: Critical Path Method
20. Delay Analysis Techniques: Time Impact and Windows Analysis
21. Liquidated Damages vs. Penalties
22. Cost Overruns and Methods for Evaluating Extra Costs
23. Case Studies: Major Construction Claims and Cost Implications
24. Practical Session: Delay Analysis on a Sample Project

Unit IV-Dispute Resolution Mechanisms

25. Dispute Prevention Strategies
26. Alternative Dispute Resolution (ADR) Methods: Negotiation, Mediation, and Adjudication
27. Arbitration: Process, Rules, and Case Laws
28. Litigation: Legal Procedures, Court Systems, and Precedents
29. International Dispute Resolution and Role of Institutions
30. Comparison of Dispute Resolution Methods: ADR vs. Litigation
31. Case Study: Resolving Disputes in Real-World Projects with AI

Unit V-Legal and Ethical Considerations in Construction

32. Contract Law and Construction Law Essentials
33. Ethical Issues in Contracts and Claims
34. Role of Expert Witnesses in Dispute Resolution
35. Case Laws and Landmark Legal Judgments
36. Sustainability and Legal Compliance in Construction Projects

Textbooks

1. S.B. Saraswat,"Construction Arbitration", Taxmann Publications Pvt. Ltd., 1st Edition, 2021.

Reference Book

1. Dondi M Day, "Workshop & Study Guide: The Practical Guide to Contracts & Other Essential Knowledge", Emerald Isle Publishing, 2024.

OCCUPATIONAL HAZARDS, HEALTH AND SAFETY MANAGEMENT (25CE300PE503)			L	R	P	C
			3	0	0	3
Course type	Program Elective	**Pre-requisite**	NA			

UNIT 1: Fundamentals of Safety, Health & Motivation

1. Introduction to Occupational Safety and Health (OSH)
2. Occurrence and Sequence of Accidents
3. Types and Analysis of Occupational Injuries
4. Key Principles of Industrial Accident Prevention
5. Principles of Environmental Management Systems (EMS)
6. Behavior-Based Safety and Self-Motivation
7. Heinrich's Domino Theory in Accident Causation
8. Lean Practices and Sustainability Benefits in Safety

UNIT 2: Hazard Identification and Risk Analysis

9. Fundamentals of Hazard Identification
10. Types and Classifications of Hazards
11. Hazard Reporting Systems and Documentation
12. Safety Audits for Hazard Detection
13. Root Cause Analysis Techniques
14. Job Hazard Analysis (JHA)
15. Risk vs. Cost Considerations in Safety
16. Life Cycle Analysis and Safety Evaluation

UNIT 3: Occupational Injuries, Illness & Environmental Hazards

17. Occupational Injury and Death Statistics (BLS Data)
18. Analysis of Trauma Death and Injury Costs
19. Effects of Temperature Extremes on Worker Health
20. Hazards of Ionizing Radiation and Vibration
21. Noise-Induced Hearing Loss in Industry
22. Chemical Hazards and Flammable Liquids
23. Biological Monitoring and Exposure Control

UNIT 4: Industrial Hygiene and Ergonomic Principles

24. Strategies for Preventing Occupational Illness
25. Industrial Routes of Contaminant Entry
26. Air Contaminants: Types and Effects
27. Monitoring Exposure Levels and Units of Concentration
28. Limits of Exposure and Regulatory Guidelines
29. Ergonomic Risk Factors and Their Impacts
30. Physical Work Conditions and Ergonomic Interventions

UNIT 5: Accident Prevention and OSHA Compliance

31. Hazard Prevention and Control Strategies
32. Elimination, Substitution, and Use of Awareness Devices
33. Personal Protective Equipment (PPE): Types and Use
34. Safe Operating Procedures and Fleet Safety
35. OSHA Standards and Compliance Requirements
36. Employer's Legal Responsibilities and Worker's Compensation

Textbooks

1. Elliot Laratonda, "Occupational Safety and Health for the Young Professional", Bernan Pr, 2022.

Reference Books

1. Ali R. Taherian, Ebrahim Noroozi, "Occupational Health and Safety in the Food and Beverage Industry", Taylor & Francis Ltd; 1st Edition, 2023.

FORMWORK DESIGN AND PRACTICE (25CE300PE504)			L	R	P	C
			3	0	0	3
Course type	Program Elective	**Pre-requisite**	NA			

Unit 1: Fundamentals of Formwork and Falsework

1. Introduction to Formwork and Falsework
2. Temporary Work Systems in Construction
3. Requirements and Functions of Formwork
4. Construction Planning and Site Constraints
5. Selection Criteria for Formwork Systems
6. Classification and Types of Formwork
7. Comparison between Traditional and Modern Formwork
8. Overview of IS Codes Related to Formwork

Unit 2: Materials and Components of Formwork Systems

9. Formwork Materials: Timber, Plywood, Steel, Aluminum
10. Use of Plastics and Fabric in Formwork
11. Shoring Towers: Types and Applications
12. Scaffolding Systems and Safety Guidelines
13. Reusability and Life Cycle of Formwork Materials
14. Handling, Storage, and Maintenance of Formwork
15. Material Performance Under Load and Weather Conditions
16. Cost and Efficiency Analysis of Formwork Materials

Unit 3: Formwork Design and Load Considerations

17. Conventional and Proprietary Formwork Design Principles
18. Formwork Design for Foundations
19. Formwork Design for Columns and Walls
20. Slab and Beam Formwork Systems
21. Design of Decks and Falsework
22. Load Calculations and Load Transfer Mechanisms
23. Moment Considerations in Formwork Design

24. IS Code Provisions for Load and Safety in Formwork

Unit 4: Specialized Formwork Applications

25. Formwork for Shell Structures and Domes
26. Formwork for Folded Plates and Overhead Water Tanks
27. Tunnel and Lift Shaft Formwork Techniques
28. Formwork for Natural Draft Cooling Towers
29. Formwork in Nuclear Reactor Construction
30. Bridge Formwork Systems and Temporary Support Structures
31. Failures in Formwork Systems: Case Studies and Lessons

Unit 5: Advanced Systems, Safety, and Management

32. Flying Formwork Systems: Table Forms and Tunnel Forms
33. Slipform and Gang Form Systems
34. Column-Mounted Shoring and Precast Formwork
35. Construction Sequence and Formwork Safety Protocols
36. Pre-Award and Post-Award Formwork Management in High-Rise Projects

Textbooks

1. A Wynn, “Design and Contruction of Formwork for Concrete Structures”, Anatiposi Verlag, 2023.

Reference Books

1. William E Hubbard, “Bridge Falsework, Concrete Formwork, and Practical Earth Shoring”, Dorrance Publishing Co., 2021.

DISASTER MANAGEMENT (25CE300OE501)			L	R	P	C
			3	0	0	3
Course type	Open Elective	**Pre-requisite**	NA			

Unit I: Introduction to Disaster Management

1. Introduction to Disaster Management (DM)
2. Key Concepts: Disaster, Hazard, Vulnerability, Risk, and Capacity
3. Impact of Disasters: Social, Economic, and Environmental Aspects
4. Prevention and Mitigation Strategies
5. The Disaster Management Act, 2005: Overview and Importance
6. Institutional Framework for Disaster Management in India
7. Role of Government and International Organizations in Disaster Management

Unit II: Natural Disasters

8. Definition and Nature of Natural Disasters
9. Floods: Causes, Effects, and Management Strategies
10. Drought: Causes, Consequences, and Mitigation Measures
11. Cyclones: Formation, Impact, and Preparedness
12. Earthquakes: Causes, Effects, and Seismic Zoning
13. Tsunamis and Volcanoes: Causes and Impact
14. Climate Change: Global Warming, Sea-Level Rise, and Ozone Depletion

Unit III: Man-Made Disasters

15. Nuclear Disasters: Causes, Consequences, and Safety Measures
16. Chemical Disasters: Industrial Accidents and Chemical Spills
17. Building and Coal Fires: Causes, Prevention, and Control
18. Forest Fires and Oil Spills: Environmental and Economic Impact
19. Air and Water Pollution: Sources, Effects, and Control Measures
20. Deforestation: Causes and Consequences
21. Epidemics and Pandemics: Case Studies and Response Strategies

Unit IV: Disaster Preparedness Plan

22. Introduction to Disaster Preparedness Plans: Importance and Scope
23. Essentials of a Disaster Preparedness Plan and risk management strategies
24. Community-Based Disaster Preparedness Plans
25. Disaster Prediction and Early Warning Systems
26. Safety Measures and Response Strategies for Various Disasters
27. Role of Information, Education, and Training in Disaster Preparedness
28. Government and NGO Involvement in Disaster Management
29. Role of Information Technology (IT) in Disaster Management (Satellite data, IoT)

Unit V: Case Study with Survey

30. Methodology for Conducting Disaster Case Studies
31. Analysis of Disaster Impact and Recovery Processes
32. Best Practices in Disaster Management from Global Case Studies
33. Floods Control
34. Earthquake
35. Nuclear Disaster
36. Chemical Disaster

Text Book

1. R. Subramanian, "Disaster Management", 2nd Edition, Vikas Publishing House, 2023.

Reference Book

2. Gerry FitzGerald, "Disaster Health Management: A Primer for Students and Practitioners", Routledge Publishers, 2022.

SMART CITIES (25CE201OE502)			**L**	**R**	**P**	**C**
			2	0	2	3
Course type	Open Elective	**Pre-requisite**	NA			

UNIT I: Introduction to Smart Cities

1. Concept and Definition of Smart Cities
2. Pillars of Smart Cities
3. Need for Developing Smart Cities
4. Smart Solutions for Smart Cities
5. Smart City Features and Selection Process

UNIT II: Urban Governance and Development Management (UGDM)

6. Background and Basic Definitions of UGDM
7. Components of UGDM
8. Municipal Laws: Municipal Corporation Act
9. Metropolitan Planning Committee and District Planning Committee Acts
10. Smart City Policies and Regulations

UNIT III: Planning and Development of Smart City Infrastructure

11. Energy and Ecology in Smart Cities
12. Solar Energy for Smart Cities
13. Sustainable Green Buildings in Smart Cities
14. Safety and Security in Smart City Infrastructure
15. Economy and Infrastructure Planning

UNIT IV: Smart Grids, Energy Management, IoT, and Automation

16. Concept and Components of Smart Grids
17. Renewable Energy Integration and Energy Storage Systems
18. Demand Response, Load Forecasting, and Energy Management

19. IoT in Smart Cities: Wireless Sensor Networks and Embedded Systems

20. Automation Technologies: SCADA, Smart Homes, and Smart Street Lighting

UNIT V: Cybersecurity and Data Analytics in Smart Cities

21. Cybersecurity Challenges in Smart Cities

22. Data Analytics for Urban Planning

23. Artificial Intelligence and Machine Learning in Smart Cities

24. Blockchain for Secure Transactions in Smart Cities

LABORATORY

1. Smart City Concept and Design Simulation

2. Smart City Feature Identification and Selection

3. Urban Governance Policy Analysis

4. Smart City Regulations and Data Management

5. Solar Power Integration for Smart Cities

6. Sustainable Building Design for Smart Cities

7. Smart City Traffic Management Simulation

8. Smart Metering and Energy Consumption Monitoring

9. IoT-Based Smart Home Automation

10. Renewable Energy and Smart Grid Simulation

11. SCADA System for Smart City Infrastructure

12. Cybersecurity Vulnerability Assessment in Smart City Systems

Textbooks

1. Clark, Jennifer, “Uneven Innovation: The Work of Smart Cities”. Columbia University Press, 2021.

2. Shmelev S., “Sustainable Cities Reimagined: Multidimensional Assessment and Smart Solutions”. Routledge, 2020.

Reference Books

1. Kiran Jalem, S. Chaudhary, Jatin Prasad, “Urban Planning and Development, Smart Cities and Ease of Living in India”, New Century Publications, New Delhi, 2024.

POLLUTION AND CONTROL ENGINEERING (25CE300OE502)			L	R	P	C
			3	0	0	3
Course type	Open Elective	**Pre-requisite**	NA			

UNIT I-Air Pollution and Control

1. Atmosphere and atmospheric chemistry
2. Air pollutants: types and sources
3. Health effects of air pollutants
4. Environmental impacts of air pollution
5. Pollutant concentration measurement and dispersion
6. Plume Behavior
7. Air pollution control methods: particulate and gaseous emissions
8. Mechanical Separation Method
9. Fabric filter
10. Electrostatic precipitation method (ESP)

UNIT II-Water and Wastewater Treatment

11. Water pollution: sources and contaminants
12. Physical treatment methods: sedimentation, filtration, coagulation
13. Disinfection techniques: chlorination, ozonation, UV treatment
14. Wastewater treatment processes
15. Trickling filter
16. Activated sludge
17. Biological treatment: lagoons, septic tanks
18. Septic Tank design and its operation

UNIT III-Soil Pollution and Control

19. Soil contamination: sources and pollutants
20. Remediation: phytoremediation, bioremediation
21. Factors affecting contaminant uptake
22. Solid waste management: composting, landfill
23. Advanced waste disposal methods

24. Gasification method
25. Incineration method

UNIT IV-Noise Pollution and Control

26. Basics of sound and noise propagation
27. Effects of noise pollution on health
28. Noise control at the source
29. Noise control along the source-receiver pathway
30. Noise control at the receiver
31. Reverberation
32. Assessing and Predicting Noise

UNIT V-Environmental Management and Sustainability

33. Environmental law and sustainability
34. Sustainable Development Goals (SDGs)
35. Hazardous waste management
36. Water Pollution prevention and control strategies

Text Book

1. A.Yerramilli, "Air pollution: Prevention and Control Technologies", 2nd Edition, BS Publication, 2020.
2. Anita Singh, Madhoolika Agrawal and Shashi Bhushan Agrawal, "Water Pollution and Management Practices",1st Edition, Springer Verlag, Singapore, 2022.

Reference Book

1. Naveen Garg, "Environmental Noise Control: The Indian Perspective in an International Context", 1st Edition, Springer Verlag, Singapore, 2022.
2. Sebastian Brown, "Soil Pollution: Origin, Monitoring and Remediation", Larsen and Keller Education, 2022.