MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
(Deemed to be University)
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Estd 1998

MASTER OF TECHNOLOGY
Construction Engineering and Management
Course Structure
&
Detailed Syllabi

For the students admitted to

Master of Technology in Construction Engineering and Management from the Academic Year 2026 – 27 Batch onwards

M.Tech Regular Two Year P.G. Degree Course

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE

(Deemed to be University)

MADANAPALLE

M. Tech Two Year Curriculum Structure

Branch: Construction Engineering and Management

Total Credits	80 Credits for 2026 Admitted Batch onwards

M. Tech Construction Engineering and Management

R25 - Curriculum Structure
I Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PC	25MBCEMTC01	Advanced Construction Materials and Practices	3	0	0	3	3
2	PC	25MBCEMTC02	Modernistic Approaches in Construction Management	3	0	0	3	3
3	DE		**Discipline Elective-I** *(Refer ANNEXURE - I)*	3	0	0	3	3
4	DE		**Discipline Elective-II** *(Refer ANNEXURE - I)*	3	0	0	3	3
5	ESC	25MBCOMTC01	Research Methodology and IPR	2	0	0	2	2
6	PC	25MBCEMLC01	Advanced Construction Materials Laboratory	0	0	4	4	2
7	PC	25MBCEMLC02	BIM and Construction Informatics Laboratory	0	0	4	4	2
8	SEC	25MBENGSC01	Technical Report Writing	1	0	2	3	2
9	MC	25MBCIVMC01	Disaster Management	2	0	0	2	0
10	EEC		**NSDC - Certification Course – I** *(Refer ANNEXURE – III)*	0	0	2	2	0
Total				**17**	**0**	**10**	**27**	**20**

I Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PC	25MBCEMTC03	Statistical Applications in Construction Engineering	3	0	0	3	3
2	PC	25MBCEMTC04	Construction Planning and Scheduling	3	0	0	3	3
3	DE		**Discipline Elective-III** *(Refer ANNEXURE - I)*	3	0	0	3	3
4	DE		**Discipline Elective-IV** *(Refer ANNEXURE - I)*	3	0	0	3	3
5	OE		**Open Elective-I** *(Refer ANNEXURE – II)*	2	0	0	2	2
6	PC	25MBCEMLC03	Construction Engineering and Management Statistics Laboratory	0	0	4	4	2
7	SEC	25MBCEMSC01	Construction Scheduling and Project Management	1	0	2	2	2
8	PR	25MBCEMPC01	Mini Project	0	0	4	4	2
9	EEC		**NSDC - Certification Course – II** *(Refer ANNEXURE – III)*	0	0	2	2	0
Total				**15**	**0**	**10**	**25**	**20**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

M. Tech Construction Engineering and Management

Tentative R25 - Curriculum Structure
II Year I Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PC	25MBCEMTC05	Infrastructure and Real Estate Management	3	0	0	3	3
2	DE		**Discipline Elective – V** *(Refer ANNEXURE - I)*	3	0	0	3	3
3	OE		**Open Elective- II** *(Refer ANNEXURE - II)*	3	0	0	3	3
4	SEC	25MBCSESC03	Prompt Engineering	1	0	2	3	2
5	PR	25MBCEMIC01	Summer Internship*	0	0	6	6	3
6	PR	25MBCEMPC02	Capstone Project Phase I	0	0	20	20	10
7	EEC		**NSDC - Certification Course – III** *(Refer ANNEXURE – III)*	0	0	2	2	0
Total				**10**	**0**	**28**	**38**	**24**

* 6 Weeks Internship during I Year II Semester Summer Break and to be evaluated in II Year I Semester

II Year II Semester

S. No.	Category	Course Code	Course Title	Hours Per Week				Credits
				L	T	P	Total	
1	PR	25MBCEMPC03	Capstone Project Phase II	0	0	32	32	16
Total				**0**	**0**	**32**	**32**	**16**

(L = Lecture, T = Tutorial, P = Practical, C = Credit

ANNEXURE - I

LIST OF DISCIPLINE ELECTIVE COURSES

Discipline Elective – I		
Sl. No.	**Course Code**	**Course Title**
1.	25MBCEMDC01	Advanced Construction Engineering Techniques
2.	25MBCEMDC02	Contracts Management and Regulations
Any advanced courses can be appended in future.		

Discipline Elective – II		
Sl. No.	**Course Code**	**Course Title**
1.	25MBCEMDC03	Organizational Behaviour
2.	25MBCEMDC04	Building Rehabilitation and Forensic Engineering
Any advanced courses can be appended in future.		

Discipline Elective – III		
Sl. No.	**Course Code**	**Course Title**
1.	25MBCEMDC05	Construction Quality and Safety Management
2.	25MBCEMDC06	Lean Construction Concepts, Tools and Practices
Any advanced courses can be appended in future.		

Discipline Elective – IV		
Sl. No.	**Course Code**	**Course Title**
1.	25MBCEMDC07	Environmental Impact Assessment for Construction Engineering
2.	25MBCEMDC08	Construction Equipment, Automation and Robotics
Any advanced courses can be appended in future.		

M. Tech Construction Engineering and Management

Discipline Elective – V (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1.	25MBCEMDM01	Operation Research and Decision Theory
2.	25MBCEMDM02	Sustainability in Built Environment
Any other new Disciplinary Course which doesn't exist in the Curriculum can be appended in future.		

ANNEXURE - II

LIST OF OPEN ELECTIVE COURSES

Open Elective - I (To be offered under MOOC's Category from SWAYAM – NPTEL)		
Sl. No.	**Course Code**	**Course Title**
1.	25MBMECOM01	Product Engineering and Design Thinking
2.	25MBMBAOM01	Innovation, Business Models and Entrepreneurship
3.	25MBMBAOM02	AI in Human Resource Management
Any other new Inter-Disciplinary Course offered by SWAYAM NPTEL which doesn't exist in the Curriculum can be appended in future.		

Open Elective - II (To be offered under Conventional Mode)		
Sl. No.	**Course Code**	**Course Title**
1.	25MBCSEOC01	Advanced Data Visualization Techniques
2.	25MBCSEOC02	Enterprise Cloud Computing
3.	25MBECEOC01	Community Radio Technology
4.	25MBMECOC01	Automation and Robotics
Any new Interdisciplinary Course can be appended in future.		

I Year I Semester

M. Tech I Year I Semester

25MBCEMTC01 ADVANCED CONSTRUCTION MATERIALS AND PRACTICES

L	T	P	C
3	0	0	3

Pre-Requisites: None

Course Description:

This course provides an in-depth understanding of advanced construction materials, special concretes, composites, smart materials, and sustainable construction practices used in modern infrastructure development. It covers the properties, performance evaluation, selection and applications of advanced cementitious systems, admixtures, functional building materials and innovative construction materials. The course also emphasises sustainability, durability, circular economy concepts and emerging material technologies to meet current industrial demands and future construction challenges.

Course Objectives:

To understand advanced cementitious materials, mineral admixtures and chemical admixtures used in modern concrete.

1. To explain the properties and applications of special concretes in sustainable construction.
2. To analyse the characteristics and applications of advanced metallic materials, composites, polymers and smart materials in contemporary construction practices.
3. To evaluate architectural and functional building materials for improving durability, safety and building performance.
4. To understand sustainable materials, circular economy concepts and resource-efficient practices in modern construction.

UNIT I ADVANCED CEMENTITIOUS MATERIALS, MINERAL AND CHEMICAL ADMIXTURES **9 hours**

Evolution of construction materials – Advanced cementitious materials: Types and performance requirements of modern cementitious systems – ordinary Portland cement and blended cements.
Mineral admixtures: Fly ash, Ground Granulated Blast Furnace Slag (GGBFS), Silica Fume, Metakaolin, Rice Husk Ash, Nano-silica and their influence on fresh, hardened and durability properties of concrete.
Chemical admixtures: Plasticizers, superplasticizers, retarders, accelerators, air entraining agents, shrinkage reducing admixtures and viscosity modifying agents – Selection, characterization and applications of admixtures in modern concrete technology.

UNIT II SPECIAL CONCRETES **9 hours**

Special concretes – Properties and Advantages of High Strength Concrete (HSC), High Performance Concrete (HPC), Ultra-High Performance Concrete (UHPC), Self Compacting Concrete (SCC), Fibre Reinforced Concrete (FRC), Lightweight Concrete, Geopolymer Concrete, Alkali Activated Concrete, Self-healing Concrete, Recycled Aggregate Concrete and Ready Mix Concrete – Practical applications of special concretes in modern infrastructure and sustainable construction.

UNIT III METALS, COMPOSITES AND SMART MATERIALS **9 hours**

Advanced metallic materials in construction – Types and manufacturing processes of structural steel, alloy steels and aluminium products – Corrosion-resistant reinforcement systems, coatings for reinforcement and metallic surfaces.

Polymer materials, structural plastics and reinforced polymer composites – Types of FRP systems – applications of FRP.
Smart and intelligent materials – Application of Shape Memory Alloys (SMA), self-sensing materials, self-healing systems, nano materials, photocatalytic materials in modern construction practices.

UNIT IV ARCHITECTURAL AND FUNCTIONAL BUILDING MATERIALS **9 hours**

Architectural materials – Wood and engineered wood products, glass and advanced glazing systems, ceramics, decorative laminates, flooring materials, facade materials and composite panels.
Functional building materials – Waterproofing compounds, sealants, engineering grouts, protective coatings, paints and varnishes, thermal insulation materials, acoustic materials and fire-resistant materials.

UNIT V SUSTAINABLE MATERIALS AND CONSTRUCTION PRACTICES **9 hours**

Sustainable construction materials – Bio-based materials, bamboo composites, recycled construction materials, low-carbon materials and circular economy concepts in material selection – Performance evaluation and applications of sustainable materials in buildings and infrastructure.
Circular economy and sustainable practices – Construction waste recycling – Material reuse and resource efficiency – Net-zero materials and carbon accounting.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain the properties, performance and applications of advanced cementitious materials, mineral admixtures and chemical admixtures in concrete technology **(L1–L3)**.

CO2: Analyse the behaviour, advantages and applications of special concretes used in modern and sustainable construction **(L2–L4)**.

CO3: Explain the characteristics and applications of metals, composites and smart materials in advanced construction practices **(L2–L4)**.

CO4: Evaluate architectural and functional building materials based on performance, durability and service requirements **(L3–L4)**.

CO5: Assess sustainable construction materials and apply resource-efficient and circular economy concepts in construction practices **(L3–L5)**.

Text Books:

1. M. S. Shetty, *Concrete Technology*, New Delhi: S. Chand and Company Ltd., 2017.

2. C. Ganapathy, *Modern Construction Materials*, Eswar Press, 2015.

3. A. M. Neville, *Properties of Concrete*, New Delhi: Pearson Education, 2012.

Reference Books:

1. ACI Committee 211, *ACI 211.1–91 (Reapproved 2009): Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete*, USA: American Concrete Institute, 2009.

2. D. Menon, *Advanced Concrete Design*, 2nd Edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2010.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

M. Tech I Year I Semester

25MBCEMTC02 MODERNISTIC APPROACHES IN CONSTRUCTION MANAGEMENT

L	T	P	C
3	0	0	3

Pre-Requisites: None

Course Description:

This course introduces modern approaches and emerging technologies in construction management for improving project delivery, productivity and sustainability. It covers lean and agile management, BIM, AI, automation, digital construction systems and smart infrastructure applications. The course emphasises data-driven decision-making and future trends shaping Construction 4.0 practices.

Course Objectives:

1. To understand modern construction management practices, BIM concepts and collaborative project delivery approaches.
2. To explain lean, agile and sustainable construction management principles for improving project efficiency and resource utilisation.
3. To analyse AI, data analytics and smart systems for construction planning, monitoring and decision making.
4. To understand automation, robotics and emerging digital technologies in modern construction operations.
5. To evaluate digital tools, intelligent construction systems and future practices in Construction 4.0 environments.

UNIT I MODERN TRENDS IN CONSTRUCTION MANAGEMENT 9 hours

Evolution of construction management practices – Fast-track construction and integrated project delivery – Collaborative project management approaches – Building Information Modelling (BIM): concepts, applications and implementation – BIM in planning and project execution – Challenges BIM adoption.

UNIT II LEAN, AGILE AND SUSTAINABLE CONSTRUCTION MANAGEMENT 9 hours

Lean construction principles and waste minimisation – Last Planner System (LPS), workflow improvement and practical lean implementation strategies – Lean applications through case studies – Agile project management concepts – Sustainable construction, green building practices and circular construction approaches.

UNIT III AI, DATA ANALYTICS AND SMART CONSTRUCTION SYSTEMS 9 hours

Artificial Intelligence in construction management – Machine learning applications for cost, schedule and risk prediction – Data analytics and decision-support systems – Digital dashboards and smart project monitoring – Smart buildings, infrastructure systems and AI-enabled asset management.

UNIT IV EMERGING CONSTRUCTION TECHNOLOGIES 9 hours

Construction automation and robotic systems – Autonomous equipment and prefabrication technologies – 3D concrete printing and additive manufacturing – UAVs (drones), IoT and sensor-based monitoring – AR/VR and digital twin applications in construction.

UNIT V SMART AND DIGITAL CONSTRUCTION ECOSYSTEMS 9 hours

Cloud-based construction management platforms – Construction 4.0 concepts and intelligent construction systems – 3D scanning and BIM-integrated digital models for construction planning and execution – Digital supply chain management and smart city applications – Case studies on digital construction practices.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain modern construction management approaches, BIM concepts and integrated project delivery systems **(L1–L3)**.

CO2: Apply lean, agile and sustainable construction management practices for improving project performance **(L2–L4).**

CO3: Analyse AI, data analytics and smart monitoring systems for construction management applications **(L3–L4).**

CO4: Evaluate automation, robotics and emerging technologies used in modern construction projects **(L3–L4).**

CO5: Apply digital tools, Construction 4.0 concepts and intelligent systems in future construction management practices **(L3–L5).**

Text Books:

1. *BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers*, 2nd Edition, John Wiley & Sons, 2011.
2. Alexander Lange, *Lean Construction: Practical Insights for Innovating Construction Management*, 2016.
3. Charles J. Kibert, *Sustainable Construction: Green Building Design and Delivery*, 4th Edition, John Wiley & Sons, 2016.

Reference Books:

1. *BIM Fundamentals for Engineers*, Coursera.
2. *Construction Management Specialisation*, Coursera

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

M. Tech I Year I Semester

25MBCOMTC01 RESEARCH METHODOLOGY AND IPR

L	T	P	C
2	0	0	2

Pre-requisite Nil

Course Description:

This course aims to provide students with a comprehensive understanding of research methodology and the principles and practices of intellectual property rights (IPR). The course will equip students with the skills needed to design, conduct, and evaluate research effectively while also understanding the legal and ethical considerations surrounding intellectual property.

Course Objectives:

To impart knowledge on

1. Formulation of research problems, design of experiment, collection of data, interpretation and presentation of result
2. Intellectual property rights, patenting and licensing

UNIT I RESEARCH PROBLEM FORMULATION 9 hours

Objectives of research, types of research, research process, approaches to research; conducting literature review- information sources, information retrieval, tools for identifying literature, Indexing and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap

UNIT II RESEARCH DESIGN AND DATA COLLECTION 9 hours

Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools

UNIT III DATA ANALYSIS, INTERPRETATION AND REPORTING 9 hours

Sampling, sampling error, measures of central tendency and variation,; test of hypothesis- concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research

UNIT IV INTELLECTUAL PROPERTY RIGHTS 9 hours

Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR, IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance.

UNIT V PATENTS 9 hours

Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filling, examination of patent, grant of patent,

revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

Course Outcomes:

Upon completion of the course, the student can

CO1: Describe different types of research; identify, review and define the research problem
CO2: Select suitable design of experiment s; describe types of data and the tools for collection of data
CO3: Explain the process of data analysis; interpret and present the result in suitable form
CO4: Explain about Intellectual property rights, types and procedures
CO5: Execute patent filing and licensing

Text Book(s)

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Soumitro Banerjee, "Research methodology for natural sciences", IISc Press, Kolkata, 2022.
3. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.

Reference Books

1. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
2. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

Mode of Evaluation: Assignments, Mid Term Tests, End Semester Examination.

M. Tech I Year I Semester

25MBCEMLC01 ADVANCED CONSTRUCTION MATERIALS LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite: None

Course Description:

This laboratory course provides hands-on exposure to advanced construction materials, modern testing methods and performance assessment techniques relevant to construction engineering applications. It covers material characterisation, advanced concrete mix design, SCC testing, durability evaluation, testing of construction materials, non-destructive evaluation and advanced characterisation techniques for research, quality assessment and industrial applications.

Course Objectives:

1. To understand the testing and characterisation of cementitious materials, aggregates and construction materials.
2. To develop advanced concrete mixes using standard mix design methods, mineral admixtures and chemical admixtures.
3. To evaluate fresh, mechanical and durability properties of advanced concretes used in modern construction.
4. To perform destructive and non-destructive testing of concrete and construction materials.
5. To gain exposure to advanced material characterisation techniques and modern testing practices used in research and industrial applications.

List of Experiments:

1. Determination of fineness, standard consistency and specific gravity of cementitious materials.
2. Determination of setting time and compressive strength of cement mortar cubes.
3. Determination of sieve analysis and bulk density of fine and coarse aggregates.
4. Determination of specific gravity and water absorption of fine and coarse aggregates.
5. Mix design and preparation of advanced concrete mixes using IS/British/ASTM/European standard methods with mineral and chemical admixtures.
6. Determination of fresh properties of Self-Compacting Concrete (SCC) using slump flow, L-box and V-funnel tests.
7. Determination of mechanical properties of advanced concrete mixes using compressive, split tensile, flexural strength and modulus of elasticity tests.
8. Durability assessment of advanced concretes using water absorption and permeability tests.
9. Assessment of concrete performance under aggressive environments using sulfate attack, acid attack and elevated temperature exposure tests.
10. Determination of physical and mechanical properties of steel reinforcement using diameter, weight and tensile tests.
11. Determination of dimensions, visual inspection, compressive strength and water absorption of bricks/blocks.
12. Determination of moisture content, density, compressive and/or bending strength properties of timber.
13. Non-destructive evaluation of concrete and welded joints using Rebound Hammer, Ultrasonic Pulse Velocity (UPV) and ultrasonic testing techniques.

14. Microstructural characterisation of construction materials using SEM, XRD and FTIR techniques (demonstration).

A minimum of 10 experiments shall be performed from the prescribed list.

Course Outcomes:

After successful completion of this course, the student will be able to:

CO1: Determine physical and engineering properties of cementitious materials, aggregates and construction materials using standard testing methods **(L2–L4)**.

CO2: Prepare advanced concrete mixes and evaluate fresh and mechanical properties of special concretes **(L3–L5)**.

CO3: Analyse durability and environmental performance of advanced construction materials **(L3–L5)**.

CO4: Apply destructive and non-destructive testing methods for assessment of concrete quality and material performance **(L3–L5)**.

CO5: Gain exposure to advanced material characterisation techniques and interpret their applications in construction materials evaluation **(L2–L3)**.

Text Books:

1. P. Kumar Mehta and Paulo J. M. Monteiro, *Concrete: Microstructure, Properties and Materials*, 4th Edition, New Delhi: McGraw-Hill, 2014.
2. S. K. Duggal, *Building Materials*, 2nd Edition, New Delhi: New Age International Publishers.
3. A. R. Santhakumar, *Concrete Technology*, New Delhi: Oxford University Press, 2018.

Reference Books:

1. ACI 211.1-91 (Reapproved 2009), *Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete*, USA: American Concrete Institute, 2009.
2. B. Vidivelli, *Rehabilitation of Concrete Structures*, Standard Publishers Distributors.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

M. Tech I Year I Semester

25MBCEMLC02 BIM AND CONSTRUCTION INFORMATICS LABORATORY

L	T	P	C
0	0	4	2

Pre-requisite: **None**

Course Description:

This laboratory course provides practical exposure to Building Information Modelling (BIM) and construction informatics for digital construction workflows. It covers BIM-based building modelling, site development, visualisation, quantity take-off, documentation, model coordination, and applications of BIM in construction planning, scheduling, cost estimation and project management.

Course Objectives:

1. To understand BIM concepts, workflows, project setup, and Levels of Development (LOD) for digital construction applications.
2. To develop architectural building models, site models, and building components using BIM software tools.
3. To apply BIM tools for detailing, visualisation, rendering, and project presentation.
4. To generate quantity take-offs, cost estimates, schedules, and construction documentation using BIM tools.
5. To perform BIM coordination, model review, clash detection, and apply BIM for construction management applications.

List of Experiments:

1. Create project setup with levels, grids, sections and basic BIM interface configuration.
2. Create and modify walls, doors, windows and material properties for a building model.
3. Create floors, roofs, staircases, railings and ceiling components for a multistorey building model.
4. Develop curtain walls and wall openings for architectural models.
5. Create conceptual massing models, site topography and building placement for site development studies.
6. Create callouts, masking regions, filled regions, detail components, insulation lines and break lines.
7. Perform solar study, rendering and walkthrough generation for a building model.
8. Generate schedules, quantity take-off and cost estimation for building components.
9. Prepare room schedules, legends, tags, sheets and printable construction drawings.
10. Import BIM models into Navisworks and perform model review, walkthrough and viewpoint analysis.
11. Perform clash detection and coordination review using Navisworks.
12. Apply BIM tools for 4D scheduling, 5D cost estimation, constructability review and project visualisation.

A minimum of 10 experiments shall be performed from the prescribed list.

Course Outcomes:

After completing this course, students will be able to:

CO1: Apply BIM concepts, workflows, project setup procedures, and Levels of Development (LOD) in digital construction projects **(L1–L3)**.

CO2: Create architectural building models, site development models, and building components using BIM software tools **(L3–L5)**.

CO3: Develop BIM-based visualisations, renderings, walkthroughs, and presentation models for construction projects **(L3–L5)**.

CO4: Generate quantity take-offs, cost estimates, schedules, and construction documentation using BIM tools **(L3–L5)**.

CO5: Perform BIM model coordination, clash detection, and apply BIM for construction planning, 4D scheduling, 5D cost integration, and project management applications **(L3–L5).**

Text Books:

1. Brad Hardin and Dave McCool, *BIM and Construction Management: Proven Tools, Methods and Workflows*, 2nd Edition, Indianapolis, Indiana: John Wiley & Sons, Inc., 2015.
2. Rafael Sacks, Charles Eastman, Ghang Lee and Paul Teicholz, *BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, Engineers, Contractors, and Facility Managers*, 3rd Edition, Hoboken, New Jersey: John Wiley & Sons, Inc., 2018.
3. Dana K. Smith and Michael Tardif, *Building Information Modeling: A Strategic Implementation Guide for Architects, Engineers, Constructors, and Real Estate Asset Managers*, Hoboken, New Jersey: John Wiley & Sons, Inc., 2009.

Reference Books:

1. Elise Moss, *Autodesk Revit 2020 Architecture Basics*, SDC Publications, 2020.
2. Eric Wing, *Autodesk Revit Architecture 2011*, Indianapolis, Indiana: Wiley Publishing Inc., 2011

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

M. Tech I Year I Semester
Skill Enhancement Course - I

25MBENGSC01 TECHNICAL REPORT WRITING

L	T	P	C
1	0	2	2

Pre-Requisites: None

Course Description:
This course develops technical writing, documentation and communication skills required for engineering practice, research and professional reporting. It covers technical document preparation, referencing, data presentation, research writing, publication ethics, technical presentations and project report preparation using modern documentation tools and standard academic practices.

Course Objectives:

1. To understand the principles, formats and styles of technical writing and professional communication.
2. To develop skills in organising, formatting and referencing technical documents using standard citation practices.
3. To present engineering data effectively through tables, figures, graphs and technical discussions.
4. To apply ethical research writing practices, literature review techniques and publication guidelines.
5. To prepare and communicate project, internship and research reports through technical presentations and professional documentation.

UNIT I FUNDAMENTALS OF TECHNICAL WRITING 9 hours

Principles of technical communication – Modes of technical communication: technical reports, technical papers, review articles, manuals and posters – Structure and components of technical documents – Writing style, clarity, conciseness and objectivity – Common errors in technical writing and scientific English.

Sample Experiments:

1. Preparation of a technical note on an engineering topic following standard technical writing guidelines.
2. Identification and correction of grammatical, formatting and technical writing errors in a sample document.

UNIT II TECHNICAL REPORT STRUCTURE AND REFERENCING 9 hours

Structure and formatting of technical reports – Title page, abstract, keywords, synopsis, table of contents and appendices – Preparation of tables, figures, captions and equations – Citation and referencing styles (APA/IEEE/ASCE) – Reference management tools (Mendeley/Zotero/EndNote).

Sample Experiments:

3. Preparation and formatting of a technical report including title page, abstract, table of contents, citations and references.
4. Creation of citations, bibliography and reference lists using reference management software.

UNIT III DATA PRESENTATION AND VISUAL COMMUNICATION 9 hours

Presentation of engineering data using tables, charts and graphs – Interpretation and discussion of experimental and field data – Preparation of engineering drawings, photographs and illustrations – Results and discussion writing – Use of spreadsheets and documentation tools for technical reporting.

Sample Experiments:

5. Preparation and presentation of engineering data using graphs, charts, tables and visualisation tools.

6. Development of results and discussion sections using experimental or project data.

UNIT IV RESEARCH WRITING, ETHICS AND PUBLICATION PRACTICES 9 hours

Literature review preparation – Structure of research articles and review papers – Copyright and publication ethics – Plagiarism awareness and prevention – Paraphrasing and summarising techniques – Journal selection, manuscript submission and peer-review process.

Sample Experiments:

7. Preparation of a literature review summary from selected journal articles.

8. Similarity checking, paraphrasing and plagiarism reduction exercises.

UNIT V PROJECT REPORT WRITING AND TECHNICAL PRESENTATION 9 hours

Preparation of project reports, internship reports and dissertation chapters – Executive summary, cover letter and response to reviewer comments – Technical presentation skills – Peer review and revision of technical documents – Report evaluation and final submission procedures.

Sample Experiments:

9. Preparation of a mini project/internship report following the prescribed format.

10. Preparation and presentation of a technical presentation based on the report.

11. Preparation of an abstract, keywords and cover letter for a technical paper/report.

12. Peer review, revision and final submission of a technical report incorporating reviewer comments.

A minimum of ten experiments shall be conducted as part of the laboratory course.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain the principles, structure and modes of technical communication used in engineering and research documentation **(L1–L3)**.

CO2: Prepare and format technical reports with appropriate citations, references, tables, figures and equations using standard documentation practices **(L2–L4)**.

CO3: Present and interpret engineering data through graphs, charts, tables and technical discussions for effective communication **(L3–L5)**.

CO4: Apply literature review, ethical writing, plagiarism control and publication practices in research documentation **(L3–L5)**.

CO5: Develop and present professional project, internship and research reports using accepted technical writing and presentation standards **(L3–L5)**.

Text Books:

1. R. C. Sharma and Krishna Mohan, *Business Correspondence and Report Writing*, Tata McGraw-Hill Education, New Delhi, 2017.
2. M. Ashraf Rizvi, *Effective Technical Communication*, McGraw Hill Education, New Delhi, 2018.
3. David F. Beer and David A. McMurrey, *A Guide to Writing as an Engineer*, 5th Edition, John Wiley & Sons, New York, 2019

Reference Books:

1. Robert A. Day and Barbara Gastel, *How to Write and Publish a Scientific Paper*, 9th Edition, Cambridge University Press, Cambridge, 2022.
2. Charles Lipson, *Cite Right: A Quick Guide to Citation Styles, Plagiarism and Academic Ethics*, 3rd Edition, University of Chicago Press, Chicago, 2018.

Mode of Evaluation: Continuous Internal Evaluation, Assignments, Mid-Term Tests and End Semester Examination.

M. Tech Construction Engineering and Management

Mandatory Course

26BFCIVVC01 DISASTER MANAGEMENT

L	T	P	C
2	0	0	2

Pre-requisite: Nil

Course Description:

This course provides a comprehensive understanding of natural and human-induced disasters, their causes, characteristics, and consequences. It examines the social, economic, environmental, and life-safety impacts of disasters with emphasis on disaster-prone regions in India. The course introduces disaster preparedness and management through monitoring, risk evaluation, remote sensing, meteorological information, and community participation. It develops knowledge of disaster risk assessment, disaster risk reduction, early warning, and national and global cooperation. The course also focuses on structural and non-structural mitigation strategies and emerging approaches for reducing disaster vulnerability and impacts.

Course Objectives:

Upon the completion of subject student will be able to-

1. Develop fundamental knowledge of different natural and man-made disasters, their characteristics, causes, and associated hazards.
2. Examine the economic, environmental, ecological, and human consequences of disasters and identify disaster-prone regions in India.
3. Develop an understanding of disaster preparedness and management using monitoring systems, remote sensing, meteorological information, and community-based approaches.
4. Introduce the concepts, elements, and techniques of disaster risk assessment, risk reduction, early warning, and national and global cooperation.
5. Develop knowledge of structural and non-structural disaster mitigation strategies, emerging mitigation practices, and disaster mitigation programmes in India.

UNIT I DISASTER CLASSIFICATION **6 hours**

Disaster: definition, factors and significance; difference between hazard and Disaster; natural disaster: earthquakes, volcanisms, cyclones, tsunamis, floods, droughts and famines, landslides and avalanches; man-made disasters: nuclear reactor meltdown, industrial accidents, oil slicks and spills, outbreaks of disease and epidemics, war and conflicts

UNIT II REPERCUSSIONS OF DISASTERS **6 hours**

Economic damage, loss of human and animal life, destruction of ecosystem. Disaster Prone Areas in India: Study of seismic zones; areas prone to floods and droughts, landslides and Avalanches; areas prone to cyclonic and coastal hazards with special reference to tsunami.

UNIT III DISASTER PREPAREDNESS AND MANAGEMENT **6 hours**

Preparedness: monitoring of phenomena triggering a disaster or hazard; Evaluation of risk: application of remote sensing, data from meteorological and Other agencies, media reports: governmental and community preparedness.

UNIT IV RISK ASSESSMENT **6 hours**

Disaster risk: concept and elements, disaster risk reduction, global and national disaster risk situation. Techniques of risk assessment, global co-operation in risk assessment and warning.

UNIT V DISASTER MITIGATION **6 hours**

Meaning, concept and strategies of disaster mitigation, emerging trends in Mitigation. Structural mitigation and non-structural mitigation, programs of Disaster mitigation in India.

Course outcomes:

After the completion of the subject following outcomes can be achieved-

CO1: Classify natural and man-made disasters and explain their causes, characteristics, and associated hazards.

CO2: Assess the major economic, environmental, ecological, and human impacts of disasters and identify disaster-prone regions in India.

CO3: Explain disaster preparedness and management practices using hazard monitoring, remote sensing, meteorological data, and community preparedness mechanisms.

CO4: Apply appropriate techniques for disaster risk assessment and explain disaster risk reduction, early warning systems, and national and global cooperation mechanisms.

CO5: Evaluate and recommend suitable structural and non-structural mitigation measures for reducing disaster risk and impacts.

Reference Books:

1. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
2. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
3. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
4. Goel S. L., Disaster Administration And Management Text and Case Studies" ,Deep&Deep Publication Pvt. Ltd., New Delhi

Mode of Evaluation: Assignments, Mid Term Tests

I Year II Semester

M. Tech I Year II Semester

25MBCEMTC03 STATISTICAL APPLICATIONS IN CONSTRUCTION ENGINEERING

L	T	P	C
3	0	0	3

Pre-Requisites: None

Course Description:

This course introduces statistical concepts and analytical techniques used in construction engineering and management applications. It covers data analysis, sampling, regression modelling, multivariate methods, quality control and reliability assessment for construction problems. The course emphasises statistical decision making for construction planning, quality improvement and performance evaluation.

Course Objectives:

1. To understand statistical concepts, probability methods and data analysis techniques used in construction engineering.
2. To explain sampling, estimation and hypothesis testing methods for construction data evaluation.
3. To analyse correlation, regression and predictive models for construction engineering applications.
4. To apply multivariate analysis and experimental design methods in construction research and optimisation studies.
5. To understand statistical quality control and reliability methods for construction systems and processes.

UNIT I INTRODUCTION TO STATISTICS IN CONSTRUCTION ENGINEERING **9 hours**

Role of statistics in construction engineering and management – Types of data and data collection methods – Descriptive statistics: Measures of central tendency and dispersion – Data visualisation techniques – Probability concepts, conditional probability and Bayes' theorem – Random variables and probability distributions: Binomial, Poisson and Normal distributions.

UNIT II SAMPLING, ESTIMATION AND HYPOTHESIS TESTING **9 hours**

Sampling methods and sampling distributions – Central limit theorem and statistical estimation – Point and interval estimation – Confidence intervals for means and variances – Hypothesis testing using Z, t, χ^2 and F tests – Applications in material testing, quality control and construction performance evaluation.

UNIT III CORRELATION, REGRESSION AND MODEL DEVELOPMENT **9 hours**

Correlation analysis and regression concepts – Simple, multiple and nonlinear regression models – Least squares method and parameter estimation – Regression diagnostics and model validation – Applications in cost estimation, productivity analysis, project scheduling and risk assessment.

UNIT IV MULTIVARIATE ANALYSIS AND DESIGN OF EXPERIMENTS **9 hours**

Multivariate statistical methods – Principal component analysis and factor analysis – Analysis of variance (ANOVA): One-way and two-way classification – Experimental design: Completely randomised, randomised block and Latin square designs – Applications in concrete mix optimisation, site investigations and construction process analysis.

UNIT V STATISTICAL QUALITY CONTROL AND RELIABILITY IN CONSTRUCTION **9 hours**

Statistical quality control tools – Control charts for variables and attributes – Process capability analysis and Six Sigma concepts – Reliability engineering principles and life data analysis – Reliability-based assessment of construction equipment, structural systems and material performance – Applications in maintenance planning and construction quality assurance.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain statistical concepts, probability distributions and data analysis methods used in construction engineering **(L1–L3)**.

CO2: Apply sampling, estimation and hypothesis testing techniques for construction data analysis and quality evaluation **(L2–L4)**.

CO3: Analyse correlation, regression and predictive modelling approaches for construction engineering applications **(L3–L4)**.

CO4: Apply multivariate analysis and experimental design techniques for optimisation and decision making in construction studies **(L3–L5)**.

CO5: Evaluate statistical quality control and reliability methods for construction quality assurance and performance assessment **(L3–L5)**.

Text Books:

1. J. L. Devore, *Probability and Statistics for Engineering and the Sciences*, 6th Edition, Boston: Thomson and Duxbury, 2004.
2. S. C. Gupta and V. K. Kapoor, *Fundamentals of Mathematical Statistics*, 11th Edition (Reprint), New Delhi: Sultan Chand and Sons, 2019.
3. R. A. Johnson and C. B. Gupta, *Miller & Freund's Probability and Statistics for Engineers*, 8th Edition, New Delhi: Pearson Education Asia, 2015.

Reference Books:

1. R. A. Johnson and D. W. Wichern, *Applied Multivariate Statistical Analysis*, 6th Edition, New Delhi: Pearson Education, 2013.
2. M. R. Spiegel and L. J. Stephens, *Schaum's Outline of Statistics*, 6th Edition, New York: Tata McGraw-Hill, 2018

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

M. Tech I Year II Semester

25MBCEMTC04 CONSTRUCTION PLANNING AND SCHEDULING

L	T	P	C
3	0	0	3

Pre-Requisites: None

Course Description:

This course introduces the principles and practices of construction project planning, estimation, scheduling, procurement, cost management, and project control. It covers quantity surveying, preparation of DSR, JCR, and BOQ, productivity analysis, resource planning, procurement methods, risk assessment, and project performance evaluation. The course also emphasises the use of digital tools such as Primavera, MS Project, Construction Management Information Systems (CMIS), and BIM for effective planning, monitoring, and control of construction projects.

Course Objectives:

1. To understand construction planning principles, project organization, quantity surveying, and estimation techniques used in construction projects.
2. To explain construction scheduling methods, productivity analysis, and network-based planning techniques for project execution.
3. To analyse resource management, procurement strategies, risk assessment, and time–cost optimisation in construction projects.
4. To evaluate construction project costs, budgeting, cash flow, profit and loss analysis, and project control techniques.
5. To apply digital project management tools, BIM, and modern information systems for planning, monitoring, and controlling construction projects.

UNIT I CONSTRUCTION PLANNING, ESTIMATION AND PROJECT ORGANIZATION **9 hours**

Introduction to AEC industry and project life cycle – Project objectives, scope definition and planning process – Work Breakdown Structure (WBS) and activity identification – Quantity surveying and estimation principles – Preparation of DSR, JCR and BOQ – Project organization and role of project manager.

UNIT II CONSTRUCTION SCHEDULING AND PRODUCTIVITY ANALYSIS **9 hours**

Project scheduling concepts and bar charts – CPM and PERT techniques – Critical path analysis and float concepts – Precedence relationships and network development – Work study and productivity analysis – Labour, equipment and material productivity assessment.

UNIT III RESOURCE AND PROCUREMENT MANAGEMENT **9 hours**

Resource planning, allocation and levelling – Procurement planning and procurement methods – Tendering and contract procedures – Time–cost trade-off and project crashing – Risk identification and assessment – Cost impact of risks on construction projects.

UNIT IV PROJECT COSTING AND CONTROL **9 hours**

Construction cost estimation and budgeting – Direct and indirect costs – Cost analysis and cash flow management – Profit and loss analysis using statistical approaches – Project monitoring and control techniques – Earned Value Management (EVM) and corrective actions.

UNIT V DIGITAL TOOLS IN CONSTRUCTION PROJECT MANAGEMENT **9 hours**

Project management using Primavera and MS Project – Resource and cost tracking – Construction Management Information Systems (CMIS) – BIM for project planning and scheduling – 3D scanning and BIM integration for progress monitoring – Case studies in construction planning and project control.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain construction planning processes, project organization, quantity surveying principles, and preparation of DSR, JCR, and BOQ for construction projects **(L1–L3)**.

CO2: Apply scheduling techniques, network analysis methods, and productivity assessment tools for effective construction project planning and execution **(L2–L4)**.

CO3: Analyze resource allocation, procurement methods, risk assessment, and time–cost trade-off concepts in construction projects **(L3–L4)**.

CO4: Evaluate project costs, budgeting, cash flow, profit and loss analysis, and project performance using monitoring and control techniques **(L3–L5)**.

CO5: Apply Primavera/MS Project, CMIS, BIM, and related digital tools for construction planning, scheduling, monitoring, and project control **(L3–L5)**.

Text Books:

1. Albert Lester, *Project Management, Planning and Control*, 7th Edition, USA: Butterworth-Heinemann, 2017.
2. K. K. Chitkara, *Construction Project Management: Planning, Scheduling and Control*, 4th Edition, New Delhi: McGraw-Hill (India) Publishers, 2019.
3. Chris Hendrickson and Tung Au, *Project Management for Construction: Fundamental Concepts for Owners, Engineers, Architects and Builders*, Pittsburgh: Prentice Hall, 2000.
4. D. W. Halpin, *Financial and Cost Concepts for Construction Management*, New York: John Wiley & Sons, 1989.

Reference Books:

1. Calin M. Popescu and Chotchai Charoenngam, *Project Planning, Scheduling and Control in Construction: An Encyclopedia of Terms and Applications*, New York: Wiley, 1995.
2. Jerome D. Wiest, *A Management Guide to PERT/CPM*, 2012.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

M. Tech I Year II Semester

25MBCEMLC03 CONSTRUCTION ENGINEERING AND MANAGEMENT STATISTICS LABORATORY

L	T	P	C
3	0	0	3

Pre-requisite: None

Course Description:

This laboratory course provides practical exposure to statistical methods and data analysis techniques used in construction engineering and management. The course focuses on descriptive statistics, regression, hypothesis testing, design of **experiments**, quality control, reliability analysis and forecasting using Minitab software for construction applications.

Course Objectives:

1. To understand and apply descriptive statistical methods and data visualisation techniques for construction datasets using Minitab.
2. To perform correlation, regression and hypothesis testing for analysing construction engineering and management data.
3. To apply Design of Experiments (DOE) and Taguchi optimisation techniques for construction materials and process optimisation.
4. To analyse construction quality, reliability, risk and process performance using statistical quality control tools.
5. To use forecasting and integrated statistical analysis techniques for construction project evaluation and decision making.

List of Experiments:

1. Descriptive statistics and graphical analysis of construction datasets.
2. Correlation analysis of construction cost, productivity and project duration data.
3. Hypothesis testing using t-test, ANOVA and chi-square methods for construction engineering data.
4. Simple and multiple regression modelling for construction cost estimation, productivity analysis and project forecasting.
5. Cross tabulation and contingency analysis for construction quality, safety and management data.
6. Design of Experiments (DOE) for construction engineering applications using factorial designs.
7. Taguchi optimisation analysis for construction materials, mix design and process parameter optimisation.
8. Statistical process control and control chart analysis for construction quality monitoring.
9. Process capability, reliability and risk analysis of construction systems and material performance.
10. Time series analysis, forecasting and integrated project performance evaluation using construction datasets.

Course Outcomes:

After successful completion of this course, the student will be able to:

CO1: Perform descriptive statistical analysis and graphical interpretation of construction datasets using Minitab **(L2–L4)**.

CO2: Apply correlation, regression and hypothesis testing methods for analysing construction engineering and management problems **(L3–L5)**.

CO3: Conduct DOE and Taguchi optimisation studies for construction materials, processes and engineering applications using Minitab **(L3–L5)**.

CO4: Analyse construction quality, process capability, reliability and risk using statistical quality control tools **(L3–L5)**.

CO5: Apply forecasting and integrated statistical analysis techniques for project performance evaluation and decision support in construction engineering **(L3–L5)**.

Text Books:

1. Douglas C. Montgomery and George C. Runger, *Applied Statistics and Probability for Engineers*, John Wiley & Sons, 7th Edition, 2018.
2. Devore, J.L., *Probability and Statistics for Engineering and the Sciences*, Cengage Learning, 9th Edition, 2016.
3. Gupta, S.C. and Kapoor, V.K., *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, 11th Edition, New Delhi, 2019.

Reference Books:

1. Johnson, R.A. and Wichern, D.W., *Applied Multivariate Statistical Analysis*, Pearson Education, 6th Edition, New Delhi, 2013.
2. Montgomery, D.C., *Introduction to Statistical Quality Control*, John Wiley & Sons, 8th Edition, 2019.

Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination.

M. Tech I Year II Semester

25MBCEMSC01 CONSTRUCTION SCHEDULING AND PROJECT MANAGEMENT

L	T	P	C
1	0	2	2

Pre-Requisites: None

Course Description:

This laboratory course provides hands-on exposure to construction project planning, scheduling, resource optimisation, cost management, and project control using digital tools and project management software. It includes spreadsheet-based planning applications, Primavera P6 project setup and scheduling, resource and cost tracking, project monitoring, earned value analysis, dashboard reporting, and data integration techniques for efficient and technology-driven construction project management.

Course Objectives:

1. To understand spreadsheet tools for project planning, costing and resource management.
2. To apply Primavera P6 for project setup, scheduling and WBS development.
3. To develop skills in resource planning, cost control and project tracking using Primavera P6.
4. To perform project monitoring, reporting and earned value analysis for construction projects.
5. To use digital tools for dashboards, multi-project scheduling and data integration in project management.

UNIT I SPREADSHEET APPLICATIONS FOR PROJECT MANAGEMENT **9 hours**

Use of spreadsheet tools (MS Excel) for construction planning and management – Preparation of WBS, activity lists and project data sheets – Cost estimation and budgeting using spreadsheets – Resource planning and cash flow analysis.

Sample Experiments:

1. Preparation of Work Breakdown Structure (WBS) and activity list using spreadsheet tools.

2. Preparation of project cost estimate, resource sheet and cash flow statement using spreadsheet tools.

UNIT II PRIMAVERA PROJECT SETUP AND ORGANISATIONAL STRUCTURE **9 hours**

Introduction to Primavera P6 environment – Enterprise Project Structure (EPS) – Organisational Breakdown Structure (OBS) – Project creation and setup – Calendars and project configuration.

Sample Experiments:

3. Creation of Enterprise Project Structure (EPS) for a construction organisation using Primavera P6.

4. Creation of Organisational Breakdown Structure (OBS), project creation under EPS, and linking OBS to projects.

5. Creation of global, project and resource calendars and assignment to projects.

UNIT III PROJECT PLANNING, WBS AND SCHEDULING USING PRIMAVERA **9 hours**

WBS development – Activity creation – Activity relationships – CPM scheduling – Constraints and float analysis.

Sample Experiments:

6. Creation of Work Breakdown Structure (WBS) and activities for a construction project.

7. Development of CPM network, activity relationships and identification of critical path.

8. Preparation and analysis of project schedules with constraints, leads/lags and float analysis.

UNIT IV RESOURCE, COST AND PROJECT CONTROL USING PRIMAVERA **9 hours**

Roles and Resource creation and assignment – Resource levelling – Cost loading and budgeting – Baselines – Project updating and performance analysis.

Sample Experiments:

9. Roles and Resource creation, assignment, resource levelling and cost loading using Primavera P6.

10. Budgeting, baseline preparation, schedule updating and project tracking using Primavera P6.

11. Earned Value Analysis (EVA), variance analysis and project performance evaluation using Primavera P6.

UNIT V PROJECT MONITORING, REPORTING, BIM AND DIGITAL APPLICATIONS **9 hours**

Project monitoring and reporting using Primavera P6 – BIM-based quantity extraction and schedule integration – Exporting Revit schedules to Excel and assigning element IDs – Linking BIM models with project schedules for project tracking – Real-time progress monitoring and reporting – Power BI dashboards for schedule, cost and progress visualisation.

Sample Experiments:

12. Preparation of project monitoring reports, dashboards and graphical progress analysis using Primavera P6/Power BI/MS Visio.

13. Multi-project scheduling, project portfolio management and risk analysis using Primavera P6.

14. Exporting BIM schedules and quantity take-offs from Revit to MS Excel, assigning unique IDs to BIM elements, and linking BIM elements with project schedules.

15. Tracking construction progress using BIM-linked schedules, preparing progress reports, and developing Power BI dashboards for project visualisation.

A minimum of ten experiments shall be conducted as part of the laboratory course.

Course Outcomes:

After completing this course, students will be able to:

CO1: Prepare project planning documents, cost estimates and resource plans using spreadsheet tools **(L2–L4)**.

CO2: Develop project structures, WBS and schedules using Primavera P6 **(L3–L4)**.

CO3: Apply resource allocation, cost control and project tracking techniques using Primavera P6 **(L3–L5)**.

CO4: Perform project monitoring, reporting and EVA for construction projects **(L3–L5)**.

CO5: Apply digital tools for dashboards, multi-project scheduling and project data integration in construction management applications **(L3–L5)**.

Text Books:

1. Kenneth C. Laudon and Jane P. Laudon, *Management Information Systems: Organization and Technology*, Prentice Hall, 1996.
2. P. Vinayagam and A. Vimala, *Planning and Managing Projects with PRIMAVERA (P6) Project Planner*, New Delhi: I K International Publishing House Pvt. Ltd., 2017.

Reference Books:

1. Kathy Schwalbe, *Information Technology Project Management*, 6th Revised Edition, CENGAGE Learning Custom Publishing, 2010.

Mode of Evaluation: Continuous Internal Evaluation, Assignments, Mid Term Tests and End Semester Examination.

Discipline Electives

Discipline Elective Course - I

25MBCEMDC01 ADVANCED CONSTRUCTION ENGINEERING TECHNIQUES

L	T	P	C
3	0	0	3

Pre-Requisites: None

Course Description:

This course introduces advanced construction engineering techniques used in modern infrastructure and building projects. It covers advanced substructure systems, specialised construction methods, long-span structures, rehabilitation techniques and demolition practices. The course also emphasises construction safety, durability enhancement and contemporary engineering practices for complex construction projects.

Course Objectives:

1. To understand advanced substructure construction methods and ground improvement techniques used in challenging site conditions.
2. To explain modern building construction techniques, special formwork systems and precast construction methods.
3. To analyse construction methods adopted for special structures and long-span engineering systems.
4. To evaluate repair, rehabilitation and strengthening techniques for improving structural performance and durability.
5. To understand demolition methods, dismantling procedures and safety practices in construction operations.

UNIT I ADVANCED SUBSTRUCTURE CONSTRUCTION 9 hours

Dewatering methods – Well points, deep wells and electro-osmosis – Pile foundations and piling techniques – Diaphragm walls, sheet piles and cofferdams – Tunnelling, pipe jacking and box jacking – Grouting, soil stabilisation and ground improvement methods.

UNIT II ADVANCED BUILDING CONSTRUCTION TECHNIQUES 9 hours

Advanced formwork systems – Slip form, jump form, tunnel form and modular formwork – Continuous concreting and vacuum dewatered flooring – Construction techniques for tall buildings – Precast construction, erection methods, prestressing and post-tensioning applications.

UNIT III CONSTRUCTION OF SPECIAL AND LONG-SPAN STRUCTURES 9 hours

Construction techniques for bridges, domes, silos, chimneys and cooling towers – Cable-stayed, bowstring and long-span structures – Steel fabrication and erection methods – Launching, lifting and specialised transportation techniques.

UNIT IV REPAIR, REHABILITATION AND STRENGTHENING TECHNIQUES 9 hours

Repair materials and repair methods – Strengthening of beams, columns, slabs and masonry structures – Seismic retrofitting techniques – Underpinning, micropiles and grouting – Waterproofing and durability enhancement methods.

UNIT V DEMOLITION, DISMANTLING AND CONSTRUCTION SAFETY 9 hours

Demolition and dismantling methods – Mechanical, explosive and controlled demolition – Introduction to robotics in construction, robotic welding and robotic dismantling applications – Demolition planning and sequencing – Safety practices and waste management in demolition works.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain advanced substructure construction methods, dewatering systems and ground improvement techniques **(L1–L3)**.

CO2: Apply modern construction techniques, formwork systems and precast methods in building construction projects **(L2–L4)**.

CO3: Analyse construction methodologies for special structures, long-span systems and steel structure erection **(L3–L4)**.

CO4: Evaluate repair, rehabilitation and strengthening methods for enhancing structural safety and service life **(L3–L4)**.

CO5: Apply demolition planning, dismantling methods and construction safety practices in demolition works **(L3–L5)**.

Text Books:

1. Jerry Irvine, *Advanced Construction Techniques*, CA Rocket, 1984.
2. J. Patrick Powers, *Construction Dewatering: New Methods and Applications*, John Wiley & Sons, 2007.
3. Robert Wade Brown, *Practical Foundation Engineering Handbook*, New York: McGraw-Hill Publications, 2001.

Reference Books:

1. Roy Chudley and Roger Greeno, *Advanced Construction Technology*, Latest Edition.
2. S. K. Sarkar and S. Saraswati, *Construction Technology*, New Delhi: Oxford University Press, 2008.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

Discipline Elective Course - I

25MBCEMDC02 CONTRACTS MANAGEMENT AND REGULATIONS

L	T	P	C
3	0	0	3

Pre-Requisites: None

Course Description:

This course introduces the principles, procedures and legal aspects of contract management in construction projects. It covers contracts, tendering, procurement, dispute resolution, construction laws, labour regulations and ethical practices essential for effective management and legal compliance in the construction industry.

Course Objectives:

1. To understand the principles, types and administration of construction contracts and contract documents.
2. To study tendering procedures, procurement systems and bid evaluation methods in construction projects.
3. To understand claims, disputes, arbitration and dispute resolution mechanisms in construction contracts.
4. To study construction laws, regulations, insurance and statutory requirements affecting construction projects.
5. To understand labour laws, safety regulations, professional ethics and legal compliance in construction management.

UNIT I CONSTRUCTION CONTRACT MANAGEMENT 9 hours

Introduction to construction contracts – Indian Contracts Act – Elements and principles of contracts – Types of engineering contracts and their suitability – Contract administration and contract management process – Contract documents, specifications and conditions of contract – International contract forms and FIDIC contracts.

UNIT II TENDERING AND PROCUREMENT MANAGEMENT 9 hours

Tendering procedures and procurement systems – Prequalification and bidding process – Tender documents and notice inviting tenders – Technical, financial and commercial bid evaluation – Contract award, contract formation and interpretation – Transparency in tendering – World Bank procurement guidelines and case studies.

UNIT III CLAIMS, DISPUTES AND ARBITRATION 9 hours

Contractual claims and disputes in construction projects – Arbitration concepts and procedures – Appointment, powers and duties of arbitrators – Arbitration agreements and rules of evidence – Dispute resolution methods, adjudication and mediation – Enforcement of awards – Cost and legal aspects of arbitration.

UNIT IV CONSTRUCTION LAWS AND REGULATORY FRAMEWORK 9 hours

Insurance, bonding and risk allocation in construction contracts – Property law, agency law and law of torts – Land laws, planning approvals and statutory regulations – Taxation and legal requirements affecting construction projects – Local government regulations and compliance requirements.

UNIT V LABOUR LAWS, SAFETY AND ETHICAL PRACTICES 9 hours

Labour regulations in the construction industry – Social security and welfare legislations – Laws related to wages, compensation and industrial disputes – Factory Acts, child labour and labour administration – Insurance and safety regulations – Professional ethics, contractual responsibilities and legal compliance in construction projects.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain construction contract principles, contract documents and management practices used in engineering projects **(L1–L3)**.

CO2: Apply tendering, procurement and bid evaluation procedures for construction contract administration **(L2–L4)**.

CO3: Analyse contractual claims, disputes, arbitration procedures and dispute resolution methods in construction projects **(L3–L4)**.

CO4: Evaluate legal, regulatory, insurance and statutory requirements related to construction contracts **(L3–L4)**.

CO5: Apply labour regulations, ethical practices and legal compliance principles in construction project management **(L2–L5)**.

Text Books:

1. G. T. Gajaria, *Laws Relating to Building and Engineering Contracts in India*, 2000.

2. Jimmie Hinze, *Construction Contracts*, 3rd Edition, New York: McGraw-Hill, 2013.

3. B. S. Patil, *Civil Engineering Contracts and Estimates*, 5th Edition, Universities Press (India) Pvt. Ltd., 2019.

Reference Books:

1. Dharmendra Rautray, *Principles of Law of Arbitration in India*, Wolters Kluwer, 2018.

2. John G. Betty, *Engineering Contracts*, New York: McGraw-Hill, 2003.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

Discipline Elective Course – II

25MBCEMDC03 ORGANIZATIONAL BEHAVIOUR

L	T	P	C
3	0	0	3

Pre-Requisites: None

Course Description:

This course introduces the principles of organizational behavior and their application in engineering and construction organizations. It covers individual and group behavior, leadership, motivation, organizational culture, communication and change management for improving employee performance and organizational effectiveness.

Course Objectives:

1. To apply organizational behaviour concepts for improving project team performance, leadership effectiveness, and change management in construction and infrastructure projects/organizations.
2. To study individual behaviour, personality, learning, motivation and workplace attitudes.
3. To understand group behaviour, teamwork, communication and conflict management in organisations.
4. To study leadership, power, organizational structure and managerial roles.
5. To understand organizational culture, change management, stress management and organizational development.

UNIT I INTRODUCTION TO ORGANIZATIONAL BEHAVIOUR 9 hours

Concept, need and importance of organizational behavior – Nature and scope – Models and frameworks of organizational behavior – Individual, group and organizational dimensions – Applications of organizational behavior in engineering and construction firms. Challenges in construction organizations (temporary project teams, multi-stakeholder environment, safety culture, contractual relationships) - OB applications in EPC projects, PMC organizations, and government infrastructure departments.

UNIT II INDIVIDUAL BEHAVIOUR AND MOTIVATION 9 hours

Personality and its determinants – Personality traits suitable for construction professionals (Site Engineers, Project Managers) -Learning theories and learning process – Attitudes, values and perception – Emotional intelligence and workplace behavior – Motivation concepts, theories and impact on employee performance - Motivation challenges in construction (harsh site conditions, long working hours, safety risks).

UNIT III GROUP BEHAVIOUR AND COMMUNICATION 9 hours

Group formation and group dynamics – Team building and teamwork – Team dynamics in construction projects (multi-disciplinary teams: civil, mechanical, electrical, safety) - Interpersonal relations – Communication process and barriers – Communication barriers in construction sites (language, hierarchy, safety communication) - Group decision making, conflict management and organizational control - Conflict management in client-contractor-consultant relationships.

UNIT IV LEADERSHIP, POWER AND ORGANIZATIONAL STRUCTURE 9 hours

Leadership concepts and leadership theories – Leadership styles – Leadership styles in construction projects (Transactional vs Transformational, Situational Leadership) - Leaders and managers – Sources of power and organizational politics – Power and politics in project environments and client

interactions - Organizational structure, authority, responsibility and coordination - Matrix organizational structure commonly used in construction firms.

UNIT V ORGANIZATIONAL CULTURE, CHANGE AND DEVELOPMENT **9 hours**

Organizational culture and organizational climate – Safety culture and zero-harm initiatives in construction organizations - Job satisfaction and employee behavior – Organizational change and resistance to change – Stress management and work–life balance – Stress management for site engineers and project teams. Organizational development and case studies in construction and project organizations (e.g., Delhi Metro, Mumbai Trans Harbour Link, National Highways projects).

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain the concepts, models and organizational dimensions of organizational behaviour in construction and project environments **(L1–L3)**.

CO2: Analyse personality, motivation, learning and workplace behaviour influencing employee performance **(L2–L4)**.

CO3: Apply principles of group behaviour, teamwork, communication and conflict management in project-based construction organisations **(L2–L4)**.

CO4: Evaluate leadership styles, power structures and organizational frameworks in managerial settings **(L3–L4)**.

CO5: Analyse organizational culture, change processes, stress management and development practices in construction organisations **(L3–L5)**.

Text Books:

1. Stephen P. Robbins, *Organizational Behavior*, 18th Edition, Pearson Education, 2020.
2. Fred Luthans, *Organizational Behavior*, 12th Edition, New York: McGraw-Hill, 2005.
3. Schermerhorn, Hunt and Osborn, *Organizational Behavior*, 12th Edition, John Wiley, 2011.

Reference Books:

1. Udai Pareek, *Understanding Organizational Behaviour*, 3rd Edition, Oxford Higher Education, 2011.
2. McShane and Von Glinow, *Organizational Behaviour*, 6th Edition, Tata McGraw-Hill, 2012.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

Discipline Elective Course - II

25MBCEMDC04 BUILDING REHABILITATION AND FORENSIC ENGINEERING

L	T	P	C
3	0	0	3

Pre-Requisites: None

Course Description:

This course introduces concepts of building deterioration, forensic investigation, repair, rehabilitation and structural health monitoring of distressed structures. It covers condition assessment techniques, repair materials, retrofitting methods, protection systems and emerging technologies such as AI, digital twins and smart monitoring systems for sustainable infrastructure maintenance.

Course Objectives:

1. To understand structural deterioration mechanisms, failure causes and forensic engineering concepts in buildings and infrastructure.
2. To explain condition assessment, inspection methods and forensic investigation techniques for damaged structures.
3. To analyse repair materials, retrofitting methods and strengthening techniques for structural rehabilitation.
4. To understand protection methods, maintenance strategies and structural health monitoring systems.
5. To evaluate advanced forensic engineering tools, AI applications and smart rehabilitation technologies for infrastructure management.

UNIT I DETERIORATION AND FAILURE OF STRUCTURES 9 hours

Concepts of maintenance, repair, rehabilitation and forensic engineering – Causes of structural distress and failure – Design errors, construction defects and material deficiencies – Deterioration mechanisms in concrete structures – Permeability, corrosion of steel, chemical attack, fire damage and overloading effects.

UNIT II CONDITION ASSESSMENT AND FORENSIC INVESTIGATION OF STRUCTURES 9 hours

Condition survey and inspection techniques – Non-destructive and semi-destructive testing methods – Concrete strength assessment and durability evaluation – Crack identification, corrosion potential and fire damage assessment – Structural integrity assessment, forensic investigation procedures and case studies on damaged buildings.

UNIT III REPAIR, RETROFITTING AND STRENGTHENING TECHNIQUES 9 hours

Repair materials and selection criteria – Polymer modified mortars, epoxy systems, grouts, bonding agents and protective coatings – Crack repair techniques: Grouting, stitching, sealing and overlays – Strengthening methods: Jacketing, FRP wrapping, prestressing and retrofitting of slabs, beams, columns and beam-column joints – Repair provisions as per relevant codes.

UNIT IV PROTECTION METHODS AND STRUCTURAL HEALTH MONITORING 9 hours

Concrete and reinforcement protection methods – Corrosion mitigation techniques, cathodic protection, corrosion inhibitors and protective coatings – Maintenance strategies: Routine, preventive and special maintenance – Structural health monitoring concepts, components and sensor-based monitoring systems – Applications of SHM in proactive maintenance of buildings.

UNIT V ADVANCED FORENSIC ENGINEERING AND SMART REHABILITATION SYSTEMS **9 hours**

Vision-based structural damage detection – AI applications in forensic engineering and structural health monitoring – Digital twins, IoT, wireless sensors and edge computing for infrastructure monitoring – AR/VR applications in condition assessment and maintenance – Engineered demolition and forensic case studies on rehabilitation of distressed structures.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain deterioration mechanisms, structural failures and forensic engineering concepts related to buildings and infrastructure **(L1–L3)**.

CO2: Apply condition assessment, inspection and forensic investigation techniques for evaluation of distressed structures **(L2–L4)**.

CO3: Analyse repair, retrofitting and strengthening methods for rehabilitation of structural elements **(L3–L4)**.

CO4: Evaluate protection methods, maintenance strategies and structural health monitoring systems for proactive infrastructure management **(L3–L5)**.

CO5: Apply AI tools, digital twins and smart rehabilitation technologies in forensic engineering and infrastructure monitoring **(L3–L5)**.

Text Books:

1. Dodge Woodson, *Concrete Structures: Protection, Repair and Rehabilitation*, New Delhi: Butterworth-Heinemann, Elsevier, 2012.
2. Dov Kaminetzky, *Design and Construction Failures*, New Delhi: Galgotia Publications Pvt. Ltd., 2001.
3. K. Ravishankar and T. S. Krishnamoorthy, *Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures*, Allied Publishers, 2004
4. Robert T. Ratay, *Forensic Structural Engineering Handbook*, New York: McGraw-Hill, 2009.

Reference Books:

1. *Handbook on Repair and Rehabilitation of RCC Buildings*, New Delhi: CPWD, 2002.
2. *Handbook on Seismic Retrofit of Buildings*, New Delhi: CPWD and Indian Buildings Congress, Narosa Publishers, 2008.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

Discipline Elective Course - III

25MBCEMDC05 CONSTRUCTION QUALITY AND SAFETY MANAGEMENT

L	T	P	C
3	0	0	3

Pre-Requisites:

Course Description:

This course provides an understanding of quality and safety management principles and practices in construction projects. It covers quality assurance and control, material testing and documentation, safety management, legislation, contractual and cost aspects, and digital technologies for improving construction quality, worker safety and project performance.

Course Objectives:

1. To understand the concepts, standards and practices of construction quality and safety management.
2. To apply quality control, inspection, testing and documentation practices in construction projects.
3. To understand construction safety management, accident prevention and occupational health practices.
4. To study legal, contractual and economic aspects related to construction quality and safety management.
5. To explore integrated quality–safety practices and modern digital technologies for construction monitoring and performance improvement.

UNIT I FUNDAMENTALS OF CONSTRUCTION QUALITY MANAGEMENT **9 hours**

Concepts of quality in construction – Quality assurance (QA) and quality control (QC) – Construction specifications, standards and acceptance criteria – Quality requirements in construction projects – Construction materials quality and testing practices – Review, interpretation and maintenance of material testing data sheets – Quality records and documentation.

UNIT II QUALITY CONTROL AND PERFORMANCE IMPROVEMENT IN CONSTRUCTION **9 hours**

Inspection and testing of construction works – Workmanship and process quality control – Sampling, compliance and non-compliance – Defects, rework and corrective actions – ISO concepts and quality certification – Cost of quality and quality improvement practices in construction.

UNIT III CONSTRUCTION SAFETY MANAGEMENT AND ACCIDENT PREVENTION **9 hours**

Concepts of hazard, risk, accident, unsafe act and unsafe condition – Causes of construction accidents – Occupational health and construction safety – Site safety assessment and risk control – Personal Protective Equipment (PPE) – Safety training, signages and awareness programmes – Accident reporting, investigation and safety records.

UNIT IV SAFETY REGULATIONS, LEGISLATION AND SAFETY ECONOMICS **9 hours**

Construction safety regulations and labour laws – OSHA concepts – Safety legislation and practices in India and selected international contexts – Insurance, ESIC and EPF – Safety provisions in contracts – Direct and indirect costs of safety – Cost of accidents, non-compliance and productivity loss.

UNIT V INTEGRATED QUALITY AND SAFETY MANAGEMENT PRACTICES **9 hours**

Integration of quality and safety management in construction projects – Safety culture and workforce participation – Quality and safety audits and performance evaluation – Digital tools for quality and safety management – AI, IoT and smart monitoring applications – Case studies on quality failures, safety incidents and best construction practices.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain the fundamentals, standards and practices of construction quality and safety management **(L1–L3)**.

CO2: Apply quality management principles for inspection, testing, documentation, compliance and quality improvement in construction projects **(L2–L4)**.

CO3: Analyse construction safety practices, accident prevention methods, occupational health and safety legislation requirements **(L2–L4)**.

CO4: Evaluate legal, contractual and economic implications associated with construction quality and safety management **(L3–L4)**.

CO5: Apply integrated quality–safety practices, digital tools, AI and smart monitoring approaches in construction management **(L3–L5)**.

Text Books:

1. Patrick X. W. Zou and Riza Yosia Sunindijo, *Strategic Safety Management in Construction and Engineering*, John Wiley & Sons Ltd., 2015.
2. Jimmy W. Hinze, *Construction Safety*, Prentice Hall Inc., 1997.

Reference Books:

1. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, *Construction Safety and Health Management*, Prentice Hall Inc., 2001.
2. S. K. Bhattacharjee, *Safety Management in Construction: Principles and Practice*, New Delhi: Khanna Publishers, 2011.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

Discipline Elective Course - III

25MBCEMDC06 LEAN CONSTRUCTION CONCEPTS, TOOLS AND PRACTICES

L	T	P	C
3	0	0	3

Pre-Requisites:

Course Description:

This course introduces lean philosophy, concepts, tools and implementation strategies for improving productivity and reducing waste in construction projects. It covers lean project delivery, workflow management, lean tools, digital integration and sustainable lean practices in the construction industry.

Course Objectives:

1. To understand the concepts, principles and need for lean construction in project management.
2. To study lean project delivery systems, value generation and waste reduction practices.
3. To apply lean tools and techniques for workflow improvement and production control.
4. To understand lean implementation strategies and organisational practices in construction projects.
5. To explore digital technologies, BIM integration and advanced lean practices for sustainable construction.

UNIT I INTRODUCTION TO LEAN CONSTRUCTION 9 hours

Overview of construction project management and productivity – Construction project phases and production systems – Need for lean construction – Evolution of lean thinking and Toyota production principles – Waste, productivity measurement and performance improvement in construction.

UNIT II LEAN PRINCIPLES AND PROJECT DELIVERY 9 hours

Lean concepts and principles – Value generation in construction – Types of waste and waste elimination – Variability and workflow reliability – Lean project delivery system – Target value design and production control concepts – Practical applications in construction projects.

UNIT III LEAN TOOLS AND TECHNIQUES 9 hours

Value Stream Mapping – Work sampling – Crew balance chart – Flow and pull-based production – Last Planner System – Look-ahead planning, constraint analysis, weekly planning and daily huddles – Root cause analysis and continuous improvement – Practical examples and case studies.

UNIT IV LEAN IMPLEMENTATION IN CONSTRUCTION 9 hours

Implementation strategies for lean construction – Lean in design and supply chain management – Lean organisational culture and people management – Lean rules, training and implementation frameworks – Case studies on lean applications in construction projects.

UNIT V DIGITAL AND ADVANCED LEAN PRACTICES 9 hours

Lean and information technology applications – BIM and lean integration – Integrated Project Delivery (IPD) – Location Based Management System (LBMS) – Six Sigma and Lean Six Sigma concepts – Sustainability and productivity enhancement through lean construction practices.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain lean construction concepts, production systems and productivity improvement approaches in construction projects **(L1–L3)**.

CO2: Apply lean principles, value generation and waste elimination techniques in project delivery systems **(L2–L4)**.

CO3: Use lean tools and techniques for planning, workflow management and continuous improvement in construction **(L3–L5)**.

CO4: Analyse lean implementation strategies, organisational practices and case studies in construction projects **(L3–L4)**.

CO5: Evaluate BIM, IPD and advanced digital lean practices for improving sustainability and construction performance **(L3–L5)**.

Text Books:

1. Shang Gao and Sui Pheng Low, *Lean Construction Management: The Toyota Way*, Springer, 2014.
2. Corfe, C. and Clip, B., *Implementing Lean in Construction: Lean and the Sustainability Agenda*, CIRIA, 2013.
3. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., *Site Implementation and Assessment of Lean Construction Techniques*, *Lean Construction Journal*, 2005.

Reference Books:

1. Dave, B., Koskela, L., Kiviniemi, A., Owen, R. and Tzortzopoulos, P., *Implementing Lean in Construction: Lean Construction and BIM*, CIRIA, 2013.
2. Ballard, G., Tommelein, I., Koskela, L. and Howell, G., *Lean Construction Tools and Techniques*, 2002.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

Discipline Elective Course - IV

25MBCEMDC07 ENVIRONMENTAL IMPACT ASSESSMENT FOR CONSTRUCTION ENGINEERING

L	T	P	C
3	0	0	3

Pre-Requisites:

Course Description:

This course introduces the principles, methods and applications of Environmental Impact Assessment (EIA) for construction and infrastructure projects. It covers environmental, social, health and economic impact evaluation, environmental management planning, regulatory frameworks and advanced sustainability assessment approaches in construction engineering.

Course Objectives:

1. To understand the concepts, objectives and regulatory framework of Environmental Impact Assessment in construction projects.
2. To study methods for identification, prediction and management of environmental impacts.
3. To understand the health, social and economic impact assessment in sustainable construction planning.
4. To apply EIA concepts to buildings, infrastructure and construction engineering projects.
5. To explore advanced tools and approaches for integrated environmental assessment and sustainable infrastructure development.

UNIT I INTRODUCTION TO EIA AND SUSTAINABLE CONSTRUCTION 9 hours

Sustainable development and environmental challenges in construction – Need, objectives and principles of Environmental Impact Assessment (EIA) – Historical development and stages of EIA – Types and components of EIA – Legal, regulatory and institutional framework for environmental clearance in India – Introduction to international EIA practices and comparative perspectives with selected global frameworks.

UNIT II IMPACT IDENTIFICATION, PREDICTION AND ENVIRONMENTAL MANAGEMENT 9 hours

Identification, prediction and evaluation of environmental impacts – Assessment of impacts on air, water, soil, noise and ecology – Biodiversity impact assessment and mitigation measures – Environmental Management Plan (EMP) – Preparation of EIA reports, mitigation and rehabilitation strategies.

UNIT III HEALTH, SOCIAL AND ECONOMIC IMPACT ASSESSMENT 9 hours

Health impact assessment in construction projects – Environmental health risks and assessment tools – Social Impact Assessment (SIA), stakeholder participation and community concerns – Land acquisition, resettlement and rehabilitation – Economic evaluation methods, cost–benefit analysis and sustainable project planning.

UNIT IV EIA FOR CONSTRUCTION AND INFRASTRUCTURE PROJECTS 9 hours

EIA for buildings, highways, bridges, tunnels, dams and urban infrastructure projects – Assessment of impacts during planning, construction and operation phases – Environmental services and resource management in construction – Case studies on construction and infrastructure projects.

UNIT V ADVANCED APPROACHES AND APPLICATIONS IN EIA 9 hours

Integrated environmental, social and health impact assessment – Strategic Environmental Assessment (SEA) – Life Cycle Assessment (LCA) in construction – GIS, remote sensing and digital tools in environmental assessment – Climate resilience, green construction and emerging trends in sustainable infrastructure assessment.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain the principles, stages and legal framework of Environmental Impact Assessment for construction projects **(L1–L3)**.

CO2: Analyse environmental impacts and develop mitigation measures and environmental management plans **(L2–L4)**.

CO3: Evaluate health, social and economic impacts associated with construction and infrastructure projects **(L3–L4)**.

CO4: Apply EIA methods for assessing environmental issues in buildings and infrastructure developments **(L3–L5)**.

CO5: Assess advanced environmental evaluation approaches and digital tools for sustainable construction and infrastructure planning **(L3–L5)**.

Text Books:

1. Canter, L. W., *Environmental Impact Assessment*, New York: McGraw-Hill, 1996.
2. Yerramilli Anjaneyulu and Valli Manickam, *Environmental Impact Assessment Methodologies*, Hyderabad: BS Publications, 2022.
3. Lawrence, D. P., *Environmental Impact Assessment: Practical Solutions to Recurrent Problems*, Wiley-Interscience, New Jersey, 2003.

Reference Books:

1. Petts, J., *Handbook of Environmental Impact Assessment*, Volumes I & II, Blackwell Science, London, 1999.
2. *World Bank Source Book on Environmental Impact Assessment*, World Bank, 2010.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.

Discipline Elective Course - IV

25MBCEMDC08 CONSTRUCTION EQUIPMENT, AUTOMATION AND ROBOTICS

L	T	P	C
3	0	0	3

Pre-Requisites: **None**

Course Description:

This course introduces construction equipment, automation and robotic technologies used in modern construction projects. It covers equipment selection, management, heavy construction equipment, automated building systems, robotics, digital technologies and smart construction applications for improving productivity, safety and operational efficiency.

Course Objectives:

1. To understand the selection, management, costing and maintenance of construction equipment in projects.
2. To study earthwork, heavy construction and material handling equipment used in construction operations.
3. To understand the equipment used in concrete production, asphalt works and material transportation systems.
4. To study automation concepts in construction equipment and intelligent building systems.
5. To explore robotics, digital technologies and smart construction applications in modern construction practices.

UNIT I CONSTRUCTION EQUIPMENT MANAGEMENT **9 hours**

Identification, planning and selection of construction equipment – Equipment management in construction projects – Equipment productivity, operating cost and cost control – Maintenance management, depreciation and replacement analysis – Safety management in equipment operations.

UNIT II EARTHWORK AND HEAVY CONSTRUCTION EQUIPMENT **9 hours**

Earthwork operations and equipment selection – Excavators, dozers, loaders, scrapers, graders and hauling equipment – Compacting and finishing equipment – Equipment for drilling, blasting, piling, trenching, tunnelling, and demolition – Case studies on heavy construction equipment applications.

UNIT III CONCRETE, ASPHALT AND MATERIAL HANDLING EQUIPMENT **9 hours**

Aggregate production, crushers, feeders and screening equipment – Concrete batching, mixing, pumping and ready-mix concrete equipment – Asphalt plants, pavers and compaction equipment – Cranes, forklifts, conveyors, industrial trucks and aerial material handling equipment.

UNIT IV AUTOMATION IN CONSTRUCTION EQUIPMENT AND BUILDING SYSTEMS **9 hours**

Introduction to automation in construction industry – Automated and computerized construction equipment – Building automation systems for HVAC, lighting, fire safety, security and water systems – Intelligent Building Management Systems (IBMS), centralized monitoring and energy-efficient building control systems.

UNIT V ROBOTICS, DIGITAL TECHNOLOGIES AND SMART CONSTRUCTION **9 hours**

Applications of robotics in construction, precast and prefabrication industries – Automation in steel, masonry and concrete construction – Autonomous construction equipment and robotic machinery – 3D concrete printing, drones and digital monitoring in construction – Case studies on AI, smart construction and emerging automation technologies.

Course Outcomes:

After completing this course, students will be able to:

CO1: Explain the principles of construction equipment selection, management, maintenance and cost analysis **(L1–L3)**.

CO2: Identify and analyse earthwork, heavy construction and specialised equipment for different construction operations **(L2–L4)**.

CO3: Apply concepts related to concrete, asphalt and material handling equipment in construction projects **(L2–L4)**.

CO4: Evaluate automation systems in construction equipment and intelligent building management applications **(L3–L4)**.

CO5: Analyse robotic systems, digital technologies and smart construction practices in modern construction engineering **(L3–L5)**.

Text Books:

1. Peurifoy, R. L., Schexnayder, C., Schmitt, R. L. and Aviad Shapira, *Construction Planning, Equipment and Methods*, 9th Edition, Singapore: McGraw-Hill, 2018.
2. S. V. Deodhar, *Construction Equipment and Job Planning*, 4th Edition, New Delhi: Khanna Publishers, 2020.
3. Javad Majrouhi Sardroud, *Automation in Construction Management*, Scholars' Press, 2014.

Reference Books:

1. Granberg, G. and Popescu, M., *Construction Equipment and Management for Engineers, Estimators and Owners*, Taylor & Francis Publishers, New York, 2006.
2. Sharma, S. C., *Construction Equipment and Management*, New Delhi: Khanna Publishers, 2008.

Mode of Evaluation: Assignments, Mid-Term Tests and End Semester Examination.