

NATIONAL INSTITUTE OF TECHNOLOGY WARANGAL



SCHEME OF INSTRUCTION AND SYLLABI FOR M.TECH. PROGRAM IN CONSTRUCTION TECHNOLOGY AND MANAGEMENT

(Effective from 2021-22)

DEPARTMENT OF CIVIL ENGINEERING



Vision and Mission of the Institute

National Institute of Technology Warangal

VISION

Towards a Global Knowledge Hub, striving continuously in pursuit of excellence in Education, Research, Entrepreneurship and Technological services to the society

MISSION

- Imparting total quality education to develop innovative, entrepreneurial and ethical future professionals fit for globally competitive environment.
- Allowing stakeholders to share our reservoir of experience in education and knowledge for mutual enrichment in the field of technical education.
- Fostering product-oriented research for establishing a self-sustaining and wealth creating centre to serve the societal needs.

Vision and Mission of the Department

Department of Civil Engineering

VISION

To be a knowledge nerve centre in civil engineering education, research, entrepreneurship and industry outreach services for creating sustainable infrastructure and enhancing quality of life.

MISSION

- Generate a specialized cadre of civil engineers by imparting quality education and training
- Attain international standards in teaching, research and consultancy with global linkages

Department of Civil Engineering:

Brief about the Department:

The Department of Civil Engineering was established in 1959, along with the setting up of the institute, that is, REC Warangal. The Department offers undergraduate and eight postgraduate programs in addition to Ph.D. The Department has highly committed faculty who are well qualified and are members of several national and international policy making and advisory bodies, including the BIS. The Department is a recognized QIP center since 1978 to offer Ph.D. programs to faculty of other institutes. The Department is known for its cutting-edge research and believes in disseminating the knowledge through publishing in highly reputed journals and patenting the research work.

The Department maintains excellent industry-institute linkages. Most of the students are placed in reputed companies, Government organizations, and Higher Educational Institutes in India and abroad. The alumni who are important stakeholders of the Department actively guide and provide valuable inputs. They constantly peer review the syllabus and curriculum to make students industry-ready.

The Civil Engineering Department, apart from Teaching and R&D, also does an enormous amount of consultancy, which adds up to the institutional internal revenue generation and involves faculty and students in challenging field problems. There are six centers of excellence in the Department, and most laboratories have state-of-the-art equipment.

The faculty of the Department are actively involved in sponsored projects and have prestigious projects like SPARC, BRICS, IMPRINT, DST, SERB, DBT, ARDB, to name a few. The Department takes pride in having conducted the highest number of GIAN and SPARC programs.

The Civil Engineering Department has MoUs with highly reputed organizations like NAAC, NCCBM, WALAMTARI, SCCL, INVENTA, PSI, among others, and has collaborations with several foreign universities and companies such as – Texas A&M, NCAR-Colorado, PTV Group Germany, etc.

List of Programs offered by the Department:

Program	Title of the Program
B.Tech.	Civil Engineering
M.Tech.	Engineering Structures
	Water Resource Engineering
	Geotechnical Engineering
	Transportation Engineering
	Remote Sensing and Geographical Information Systems
	Environmental Engineering
	Construction Technology and Management
	Waste Management
Ph.D.	Civil Engineering

Note: Refer to the following weblink for Rules and Regulations of M.Tech. program:

<https://www.nitw.ac.in/main/MTechProgram/rulesandregulations/>



M.TECH IN CONSTRUCTION TECHNOLOGY AND MANAGEMENT

Program Educational Objectives

PEO-1	Apply systems, methods, procedures, modern tools and techniques in construction projects.
PEO-2	Identify and apply sustainable, alternative and cost effective construction materials and practices.
PEO-3	Work in team environment and apply tools to optimize resources for achieving project objectives.
PEO-4	Communicate effectively, demonstrate leadership qualities and exhibit professional ethics.
PEO-5	Engage in lifelong learning for career enhancement and adapt to changing societal needs.

Program Articulation Matrix

Mission Statement	PEO1	PEO2	PEO3	PEO4	PEO5
MS1	2	3	3	3	3
MS2	2	2	3	3	3

1-Slightly; 2-Moderately; 3-Substantially



PROGRAM OUTCOMES: At the end of the program, the student will be able to:

PO1	Engage in critical thinking and pursue research/ investigations and development to solve practical problems.
PO2	Communicate effectively on complex engineering activities with the engineering community and with society, write and present substantial technical reports.
PO3	Demonstrate higher level of professional skills to tackle multidisciplinary and complex problems related to construction technology & management.
PO 4	Acquire necessary skills to plan, organize, staff, lead and exercise control in the directing and coordinating of resources to achieve construction project objectives.
PO 5	Apply knowledge, techniques, skills, and tools in construction management.
PO 6	Ability to function effectively as members or leaders on construction management/multifunctional teams.

Mapping of program outcomes with program educational objectives

	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	3	3	3	3	3
PO2	3	3	3	2	2
PO3	3	3	3	2	
PO4	3	3	2	2	2
PO5	3		3	2	2
PO6	3		2	3	2

1: Slightly 2: Moderately 3: Substantially

**SCHEME OF INSTRUCTION****M.Tech. Construction Technology and Management – Course Structure****M. Tech. I – Year I – Semester**

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	CE5101	Construction Techniques	3	0	0	3	PCC
2	CE5102	Construction Planning and Management	3	0	0	3	PCC
3	SM5011	Construction Economics and Finance	3	0	0	3	PCC
4		Elective – I	3	0	0	3	PEC
5		Elective – II	3	0	0	3	PEC
6		Elective – III	3	0	0	3	PEC
7	CE5103	Construction Project Management Software Laboratory	0	1	2	2	PCC
8	CE5104	Building Information Modelling Laboratory	0	1	2	2	PCC
9	CE5148	Seminar – I	0	0	2	1	SEM
		TOTAL	18	2	6	23	

PCC- 13, PEC- 9, SEM-1**M. Tech. I – Year II – Semester**

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	CE5151	Contract Management and Arbitration	3	0	0	3	PCC
2	CE5152	Quantitative Methods in Construction Management	3	0	0	3	PCC
3	CE5153	Construction Methods and Equipment	3	0	0	3	PCC
4		Elective – IV	3	0	0	3	PEC
5		Elective – V	3	0	0	3	PEC
6		Elective – VI	3	0	0	3	PEC
7	CE5154	Construction Project Studio	0	1	2	2	PCC
8	CE5155	Building Science Laboratory	0	1	2	2	PCC
9	CE5198	Seminar – II	0	0	2	1	SEM
		TOTAL	18	2	6	23	

PCC- 13, PEC- 9, SEM-1

**SCHEME OF INSTRUCTION****M.Tech. Construction Technology and Management – Course Structure****M. Tech. II – Year I – Semester**

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1		Industrial Training (8-10 weeks; Optional)					
2	CE6147	Comprehensive Viva voce				2	CVV
3	CE6149	Dissertation Part – A				12	DW
TOTAL						14	

PCC- 2, DW- 12**M. Tech. II – Year II – Semester**

S.No.	Course Code	Course Title	L	T	P	Credits	Cat. Code
1	CE6199	Dissertation Part – B				20	PCC
TOTAL						20	

DW- 20**TOTAL SUMMARY OF CREDITS (Semester Wise)**

Category	I	II	III	IV	Total
PCC	13	13	0	0	26
PEC	9	9	0	0	18
SEM	1	1	0	0	02
CVV	0	0	2	0	02
DW	0	0	12	20	32
Total	23	23	14	20	80

Nomenclature:

- Program Core Courses (PCC)
- Program Elective Courses (PEC)
- Seminar(SEM)
- Comprehensive Viva-Voce(CVV)
- Dissertation Work(DW)

**List of Electives**

Course No.	Subject	L	T	P	Credits
	For Electives I, II and III (Basket 1)				
CE5111	Building Information Modelling (BIM) in Sustainable Design and Construction	3	0	0	3
CE5112	Lean Construction	3	0	0	3
CE5113	Building Services	3	0	0	3
SM5012	Human Resource Development for Construction	3	0	0	3
	For Electives IV, V and VI (Basket 2)				
CE5161	Energy Efficient Buildings	3	0	0	3
CE5162	Formwork Design & Practice	3	0	0	3
CE5163	Quality and Safety Management	3	0	0	3
SM5061	Strategic Management in Construction	3	0	0	3

Note: Students can choose relevant electives from other divisions of Civil Engineering Department



Department of Civil Engineering

DETAILED SYLLABUS

M.Tech. – Construction Technology and Management



Course Code: CE 5101	CONSTRUCTION TECHNIQUES	Credits 3-0-0: 3
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Pre-requisites: None

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Identify various construction techniques and their limitations.
CO2	Analyze productivity and economics in construction techniques.
CO3	Comprehend modular construction practices.
CO4	Implement advanced construction techniques for Civil Engineering projects.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	2	3	1
CO2	3	1	2	2	3	1
CO3	3	1	2	2	3	2
CO4	3	1	3	2	3	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus

Prefabricated Structures: Introduction to Prefabricated structures, Planning for pre-casting, Selection of equipment for fabrication, Transport and erection of prefabricated components, Quality measures, Design considerations of precast elements, Safety measure during erection

Modular Construction Practices: Introduction to Modular Construction, Modular coordination, Modular Standardization, Modular System Building, Limitation and Advantages of Modular Construction

Formwork: Requirements of Formwork, Loads carried by Formwork, Types of Formwork: Timber, Steel, Modular shuttering, Slip forms, Scaffolding, Deep Excavation Methods.

High Rise Buildings: New Design Trends in Geometrical Forms, Construction Techniques of High Rise Buildings, High Rise Construction Techniques, Brick work, Selected High-Tech High-Rise Buildings.

Bridge construction techniques: Introduction, Embankments and Foundations, Conventional Bridge Construction Techniques, Accelerated Bridge Construction, Prefabricated Bridge Construction.

Learning Resources:

Text Books:

1. Construction Planning, Equipment, and Methods, Robert L. Peurifoy, Clifford J. Schexnayder, Robert Schmitt and AviadShapira, McGraw-Hill Education, 2018, Ninth Edition.



2. Construction Equipment and Management, S. C. Sharma, Khanna Publishing, 2019, First Edition.
3. Fundamentals of Building Construction: Materials and Methods, Edward Allen and Joseph Iano, Wiley, 2019, Seventh Edition.

Reference Books:

1. Principles and Practices of Commercial Construction, Cameron Andres, Ronald Smith and W. Woods, Pearson, 2018, Tenth Edition.
2. Construction Materials and Techniques, D. S. Vijayan, S. Arvindan and A. Paulmakesh, Notion Press, 2021, First Edition.

Online Resources:

1. <http://www.sasurieengg.com/e-course-material/CIVIL/III-Year%20Sem%205/CE%206506%20Construction%20Techniques,%20Equipment%20and%20Practice.pdf>
2. <https://www.nbmcw.com/product-technology/precast/prefabrication-building-construction-an-indian-perspective.html>
3. <https://www.sciencedirect.com/topics/engineering/prestressed-concrete>



CE 5102	CONSTRUCTION PLANNING AND MANAGEMENT	Credits 3-0-0: 3
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Pre-Requisites: None

Course Outcomes:

At the end of the course, the student will be able to

CO1	Plan and develop project organization for executing construction projects.
CO2	Prepare work break down plan and estimate resources requirements.
CO3	Learn the techniques used for planning, scheduling and control of construction projects.
CO4	Apply the techniques for a real-world project and demonstrate the learning.

Course Articulation Matrix:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	3	2	3
CO2	2	1	3	3	3	2
CO3	2	1	2	3	3	3
CO4	3	2	2	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction: Phase of project, project management and its relevance, stakeholders of a project, structure of project organization, management levels, and traits of a project manager.

Construction Planning: Introduction, activities involved types of project plan, work breakdown structure. Planning terminologies, Critical path method, forward and backward pass, AOA, AON, Precedence Diagramming Method (PDM), PERT, Line of balance,

Project scheduling and resource levelling: Introduction, Resource allocation and levelling for unlimited resources, Resource allocation for limited resources, Multi resource allocation, Optimal scheduling.

Project Monitoring and Control: Introduction, Project updating, Time Cost Trade off Analysis and Earned Value Analysis. IT tools for project data updating.

Project Risk Management: Risk register, identification, evaluation, allocation, avoidance and sharing of risk. Delay Analysis and Case Studies.

Text Books:

1. Construction project scheduling and control. Mubarak, Saleh A, John Wiley & Sons, 2015, 3rd Edition.



2. Construction project management: Theory and practice. Jha, Kumar Neeraj, Pearson Education India, 2011, First Edition.
3. Project management: strategic design and implementation, Cleland, David I. McGraw-Hill Education, 2007, 5th Edition.

Reference Books:

1. Construction project scheduling. Callahan, Michael T., Daniel G. Quackenbush, and James E. Rowings. McGraw-Hill 1992, 1st Edition.
2. Construction project management. Clough, Richard H., Glenn A. Sears, and S. Keoki Sears. John Wiley & Sons, 2000, 4th Edition.
3. Project management for engineering and construction. Oberlender, Garold D. McGraw-Hill Education, 2014, First Edition.
4. Precedence and arrow networking techniques for construction. Harris, Robert Blynn. University of Michigan, 1973, First Edition.
5. Critical chain: A business novel. Goldratt, E. M., Routledge, 2017.
6. Project management body of knowledge (pmbok® guide), Guide, A., In Project Management Institute, 2021, Seventh Edition.
7. Construction Project Management - Guidelines: Part 1 General, IS 15883 (Part 1), Bureau of Indian Standards, 2009.
8. Construction Project Management - Guidelines: Part 2 Time Management, IS 15883 (Part 2), Bureau of Indian Standards, 2013.

Online Resources:

1. <https://nptel.ac.in/courses/105/103/105103093/>
2. https://onlinecourses.nptel.ac.in/noc19_ce30/preview
3. <https://www.pmi.org.in>
4. <https://www.pma-india.org>



SM 5011	CONSTRUCTION ECONOMICS AND FINANCE	Credits: 3-0-0:3
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Pre-requisites: None

Course Outcomes: At the end of the course, the student will be able to:

CO1	Prepare income, profit and loss statements and implement construction accounting.
CO2	Evaluate construction project economics, cost-benefit analysis and Breakeven Analysis.
CO3	Analyze and evaluate construction risks and uncertainties.
CO4	Manage working capital and employ budgeting and control.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	2	3	1
CO2	3	2	1	2	3	1
CO3	3	1	1	2	3	1
CO4	2	2	1	2	3	1

Syllabus

Chapter 1 - Construction Accounting: Income statement, Depreciation and amortization, Engineering economics, Time Value of Money, Break even analysis.

Chapter 2 - Benefit-cost analysis, Replacement analysis

Chapter 3 - Capital Budgeting & Methods, Discounted Cash flow, Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index (PI), Annual Rate of Return (ARR), Risks and uncertainties and management

Chapter 4 - Taxation and inflation, Cost Elements, bidding and award revision due to unforeseen causes, escalation. Financial plan, multiple sources of finance, Working capital Management. Budgeting and budgetary control, Project Appraisal and Project yield, Performance – appraisal and project yield.

Learning Resources:

Text Books:

1. Danny Myers, Construction Economics: A New Approach, Taylor and Francis Publisher, 2016.
2. Vazirani and chandola, Construction Accounting and Finance, Dhanpat Rai Publications,2011

Reference Books:

1. Ofori, G, The Construction Industry Aspects of its Economics and Management, Singapore University Press, 1990.
2. Coombs W.E and W.J Palmer , Construction and Finance Management , Mc-Graw-Hill New



York,1994.

3. Halpin, D.W. ,Financial and Cost concepts for construction Management, John Wiley & sons, New York,1985.

Online Resources:

1. <https://www.financialexpress.com>
2. <https://economictimes.indiatimes.com>
3. <https://www.coursera.org › learn › construction-finance>



CE 5103	CONSTRUCTION PROJECT MANAGEMENT SOFTWARE LABORATORY	Credits 0-1-2: 2
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Pre-requisites: None

Course Outcomes:

At the end of the course, the student will be able to

CO1	Prepare work break down structure of project and estimate resources required in a construction project.
CO2	Develop precedence diagram and network diagrams.
CO3	Implement resource allocation and levelling using MSP and Primavera P6.
CO4	Perform simulation of construction projects using CM tool and demonstrate learnings

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	3	3	3
CO2	1	3	2	3	3	3
CO3	1	3	2	3	3	3
CO4	1	3	2	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction to MS Project (MSP) software and development of work breakdown structure of a project in MSP software.

Project planning, Scheduling and resource allocation using MSP software

Introduction to Primavera P6 software

Development of work breakdown structure of a project in Primavera P6 software

Project planning, Scheduling and resource allocation using Primavera P6 software

Comparative analysis between MSP and Primavera P6.

Case studies to implement the MSP and Primavera P6 software.

Demonstration on BIM360 and Stroboscope Software



Text Books:

1. Manual for MS Project 2019 Step by Step, Lewis, C., Chatfield, C., & Johnson, T., Microsoft Press, 2019, First Edition.
2. The Project Managers Guide to Microsoft Project 2019, Cicala, G., Apress, Berkeley, CA 2020.
3. Project Planning and Control Using Primavera P6, Harris, P.E., Eastwood Harris Pty Ltd, 2010.

Reference Books:

1. Project management body of knowledge (pmbok® guide), Guide, A., In Project Management Institute, USA, 2008, 4th Edition.

Online Resources:

1. <https://www.youtube.com/watch?v=2zynTGvNZ2w>



Course Code: CE5104	BUILDING INFORMATION MODELING LABORATORY	Credits 0-1-2: 2
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Pre-requisites: None

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Apply the fundamental concepts of Building Information Modeling (BIM)
CO2	Integrate construction processes through Building Information Modelling (BIM)
CO3	Analyze project delivery methods using BIM and related digital technologies
CO4	Model a structure with building information modeling (BIM) software.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1					3	3
CO2			2			
CO3	2	2	2	1	3	2
CO4					2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

- Level of Detail (LOD) BIM Concepts
- Detailed Architectural BIM Modeling
- Basic Introduction to Structural / MEP BIM Concepts
- 3D Spatial Interference Analysis
- Generating Good for Construction (GFC) Documentation
- Material Take-Off(MTO)
- Bill of Quantity (BOQ) Generation
- Project Scheduling with BIM
- 4D Simulation
- Project work

Learning Resources:

Text Books:

1. BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, Chuck Eastman, Paul Teicholz, Rafael Sacks and Kathleen Liston, John Wiley & Sons, 2008.
2. BIM and Construction Management: Proven Tools, Methods, and Workflows, Brad Hardin, Sybex, 2009.
3. Building Information Modeling: BIM in Current and Future Practice, Karen Kensek and Douglas Noble, Wiley, 2014, First Edition.

Reference Books:

1. BIM Handbook: A Guide to Building Information Modeling for Owners, Designers, M Tech (CTM) Scheme and Syllabi w.e.f. 2021-22



Engineers, Contractors, and Facility Managers, Rafael Sacks, Chuck Eastman, Ghang Lee and Paul Teicholz, Wiley, 2018, Third Edition.

2. Building Information Modeling (Pocket Architecture), Karen M. Kensek, Routledge, 2014, First Edition.

Online Resources:

1. <https://youtube.com/playlist?list=PLbJykfQm9O8cArlgixHjUnHI4QLbTZpV3>
2. <https://youtu.be/fiUr9B2yKil>



CE 5148	Seminar-I	MDC	0 – 0 – 2	1 Credit
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Pre-requisites:None

Course Outcomes:At the end of the course, the student will be able to:

CO1	Identify and chose appropriate topic of relevance.
CO2	Assimilate literature on technical articles of specified topic and develop comprehension.
CO3	Prepare technical report.
CO4	Design, develop and deliver presentation on specified technical topic.

Program Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	1	3	1
CO2	3	2	1	1	3	1
CO3	2	3	1	1	3	1
CO4	1	3	3	1	3	1

Detailed syllabus

Student can choose any topic, of his choice, pertaining to Construction Technology and Management. Topic should be a relevant and currently researched one. Students are advised to refer articles published in current journals in the area of Construction Technology and Management for choosing their seminar topics. Student should review minimum of 10 research papers relevant to the topic chosen, in addition to standard textbooks, handbooks, etc. Students are required to prepare a seminar report, in the standard format and give presentation to the Seminar Assessment Committee (SAC) in the presence of their classmates. It is mandatory for all the students to attend the presentations of their classmates.

Learning Resources:

1. Construction Technology and Management Journals
2. Research Articles / Reports available on Internet
3. Construction Technology and Management Textbooks and Handbooks



CE 5111	BUILDING INFORMATION MODELLING (BIM) IN SUSTAINABLE DESIGN AND CONSTRUCTION	Credits 3-0-0: 3
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Pre-Requisites: None

Course Outcomes:

At the end of the course, the student will be able to

CO1	Study the role of BIM in sustainable building design and construction
CO2	Apply BIM approach in construction Planning, Control and Operation
CO3	Demonstrate the use of BIM as a communication tool for decision making among stakeholders
CO4	Apply BIM in sustainable building design and construction practices through case studies

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	3	2	2
CO2	3	2	2	3	2	3
CO3	3	3	2	2	3	2
CO4	3	2	2	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

BIM in Sustainable Building Design: Low/Zero-Impact Buildings - Assesses the role of BIM in designing and operating Sustainable (Comfortable) buildings that significantly reduce or eliminate energy use. Evaluation of low or zero-carbon and renewable technologies, application of BIM to evaluate buildings' environmental performance and explore the impact of IGBC, BREEAM, LEED and EPC ratings.

BIM in Construction Operation - BIM approaches and applications for construction planning and operations, including simulating construction schedules and logistics, buildability forecasting and clash detection.

BIM in Design Co-ordination - Develop an advanced understanding of BIM approaches for retrieving, analyzing and integrating information to aid decision-making, and using appropriate BIM tools.

BIM in Operation and Maintenance - Examine the role of BIM for building and asset operation and maintenance, and the challenges of BIM-Facilities Management (FM) integration.

BIM in Construction Organization and Practice - BIM approaches and protocols using case studies. BIM organizational strategic and implementation plan to ensure it's aligned with the business strategy.

Text Books:

1. Building Information Modelling (BIM) in Design, Construction and Operations De Wilde, P., Mahdjoubi, L., & Garrigós, A. G., WIT Press, 2019, Volume 192.
2. BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors. Eastman, C. M., Eastman, C., Teicholz, P., Sacks, R., & Liston, K. John Wiley & Sons, 2011, 2nd Edition.



3. Building information modeling: BIM in current and future practice, Kensek, K., & Noble, D., John Wiley & Sons, 2014, 1st Edition.

Reference Books and Standard code books:

1. Integrated Practice in Architecture: Mastering Design-Build, Fast-Track, And Building Information Modelling, Elvin, G., John Wiley & Sons, 2007, First Edition.
2. Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling: Concepts and principles, BS EN ISO 19650-1, The British Standards Institution, 2018.
3. Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling: Delivery phase of the assets, BS EN ISO 19650-2, The British Standards Institution, 2018.
4. Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling. Operational phase of the assets, BS EN ISO 19650-3:2020, The British Standards Institution, 2020.
5. Organization and digitization of information about buildings and civil engineering works, including building information modelling (BIM). Information management using building information modelling. Security-minded approach to information management, BS EN ISO 19650-5:2020, The British Standards Institution, 2020.

Online Resources:

1. <https://youtu.be/iRMA2TayvM>
2. https://youtu.be/mVsy_ycUD1Q



CE5112	LEAN CONSTRUCTION	Credits 3-0-0:3
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Pre-requisites: Project Planning and Management

Course Outcomes: At the end of the course, the student will be able to:

CO1	Comprehend the principles and concepts in Lean Construction
CO2	Apply lean techniques in construction projects
CO3	Demonstrate lean integration aspects
CO4	Comprehend the application of lean through Information Technology

Course Articulation Matrix:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1				3		
CO2					3	
CO3	2	2				
CO4			2			2

Detailed Syllabus

Lean Thinking: Introduction to lean concepts and core concepts in lean thinking, Productivity measurements.

Lean Tools in Construction: Work Sampling, process charts, foreman delay survey, Last Planner System, Value stream mapping, 5S, case studies.

Lean Integration: Lean Construction and safety, Lean Construction and sustainable development, Lean and Green, Issues in lean implementation in the construction industry, case studies.

Enabling Lean through Information Technology: Building Information Modelling, Integrated project delivery, case studies.

Value Engineering Techniques in Construction Management: General and Specific Techniques.

Learning Resources:

Text Books:

1. Modern Construction-Lean project delivery and integrated practices. Forbes, L., Ahmed, S, CRC Press, New York, 2011.



2. Lean Construction: Core concepts and New Frontiers, Patricia Tzortzopoulos, Mike Kagioglou and Lauri Koskela, Routledge, Taylor and Francis Group, 2020

Reference Books:

1. Lean Construction Management: The Toyota Way, Shang Gao and Sui Pheng Low, Springer, 2014
2. Lean Project Delivery and Integrated Practices in Modern Construction, Lincoln H. Forbes and Syed M. Ahmed, Routledge, Taylor and Francis Group, 2020

Online Resources:

1. <http://www.leanconstruction.org/readings.htm>
2. International Labour Organization (work sampling and Process charts)



CE 5113	BUILDING SERVICES	Credits 3-0-0:3
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Pre-requisites: None

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Design residential buildings from the point of view of grouping and circulation, lighting and ventilation and fire protection.
CO2	Design vertical transportation in buildings.
CO3	Prepare a detailed report on the building performance in terms of its serviceability.
CO4	Plan and design building services.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	---	3	1	3	1
CO2	2	---	3	1	3	1
CO3	2	3	3	1	3	1
CO4	2	3	3	2	3	1

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Orientation and Planning: Selection of site, Orientation of building, Design of residential buildings with particular reference to grouping and circulation.

General building requirements: Open spaces in and around buildings for lighting and ventilation, Minimum sizes and height of roofs, Rat and Termite proofing of buildings, Lightning protection of buildings.

Fire protection of buildings: Important considerations in fire protection, Fire resisting, Properties of common building materials, Fire safety and exit requirements.

Vertical transportation in buildings: Essential requirements and details of construction of stairs, lifts, escalators and ramps.

Building services: Lighting and Ventilation, Electrical installation, Air-conditioning and heating, Acoustics and Sound insulation, Plumbing services, Building Security and Access control, Smart Buildings Integrated with Internet of Things (IOT), Design of car parking systems and Laundry planning and design.



Learning Resources:

Text Books:

1. Hand Book of Designing and Installation of Services in High Rise Building Complexes, Jain, V. K. Jain, Khanna Publishers, 2000, Third Edition.
2. Building Services Engineering, David V. Chadderton, Routledge, 2012, Sixth Edition.
3. Building Services Handbook, Fred Hall and Roger Greeno, Routledge, 2017, Ninth Edition.

Reference Books:

1. Manual of Tropical Housing and Building: Climate Design, O. H. Koenigsberger, T. G. Ingersoll, A. Mayhew and S. V. Szokolay, Universities Press (India) Private Limited, 2020, First Edition.
2. Energy Simulation in Building Design, Joseph Clarke, Routledge, 2007, Second Edition.
3. Environmental and Architectural Acoustics, Maekawa, Taylor & Francis, 2010, Second Edition.
4. Naturally Ventilated Buildings: Building for the senses, the economy and society, D Clements-Croome and Derek Clements-Croome, Routledge, 2002, First Edition.

Online Resources:

1. Handbook on Functional Requirements of Industrial Buildings (Lighting and Ventilation), SP 32, Bureau of Indian Standards, 1986.
<https://law.resource.org/pub/in/bis/S03/is.sp.41.1987.pdf>
2. Handbook of Functional Requirements of Buildings (Other than Industrial Buildings), SP 41, Bureau of Indian Standards, 1987.
<https://law.resource.org/pub/in/bis/S03/is.sp.41.1987.pdf>
3. National Building Code of India, Bureau of Indian Standards, 2016, Volume – 1 & 2.
 - a. <ps://archive.org/dhttdetails/nationalbuilding01>
 - b. <https://archive.org/details/nationalbuilding02>
4. Selection, Installation and Maintenance of Control and Indicating Equipments for Fire Detection and Alarm System - Code of Practice, IS 15908, Bureau of Indian Standards, 2011.
<https://law.resource.org/pub/in/bis/S03/is.15908.2011.pdf>
5. Code of Practice for Fire Safety of Building (General): General Principles of Fire Grading and Classification, IS 1641, Bureau of Indian Standards, 2002.
<https://law.resource.org/pub/in/bis/S03/is.1641.1988.html>
6. Code of practice for fire safety of buildings (general): Details of construction, IS 1642, Bureau of Indian Standards, 1989.
<https://law.resource.org/pub/in/bis/S03/is.1642.1989.pdf>



SM 5012	HUMAN RESOURCE MANAGEMENT FOR CONSTRUCTION	Credits: 3-0-0:3
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Pre-requisites: None

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Plan and manage key human resource functions within organizations.
CO2	Analyse current issues, trends, practices, and challenges in HRM.
CO3	Manage employee performance and contribute to organizational effectiveness.
CO4	Develop employability skills.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	---	2	2	3	1	3
CO2	2	3	2	3	1	3
CO3	---	2	2	3	1	3
CO4	---	1	2	3	1	3

Syllabus

Chapter 1- Introduction: HRM and its functions, Organization and management theory, Contemporary management Theory, Production efficiency: the Classical Approach, Human Behavior theory, Challenges of HRM -Challenges of managing people in construction, Manager's attitude towards people in construction, Expectations of the employment relationship.

Chapter 2 -Strategic HRM approaches and operational HRM approaches: Models of HRM, Employee resourcing, Recruitment & Selection, Employee orientation, Training & Development, Appraisal Systems, Reward management, Mentoring, Career in Construction Management (Case studies Discussion).

Chapter 3 -Employee relations and empowerment: Employees relations, The changing role of trade unions, The effect of unions, Collective bargaining, The evolution of empowerment within HRM.

Chapter 4- Diversity, work/life balance & Employment legislations: Workforce Diversity, Equal Opportunities in construction, Work- life Balance (Case study Discussion). Employee welfare and Employment legislations: Workplace health and safety hazards, employment legislations.

Chapter 5 -Strategic human resource development: Relationship between HRM and Business Performance, Measuring the Performance of HRM – HRM audit, HR scorecard, HR analytics, Digital HRM, Current industry issues and the role of HRM, Future improvements in construction HRM (Case Study Discussion)



Learning Resources:

Text Books:

1. Martin Loosemore, Andrew Dainty, Helen Lingard, Human Resource Management in Construction Projects: Strategic and Operational Approaches, Taylor and Francis, 2014
2. Dessler, G., & Varkkey, B. Human Resource Management, India: Pearson Education, 2020.

Reference Books:

1. David Langford, R.F. Fellows , M. R. Hancock. Human Resource Management in Construction, Routledge, 2014.
2. David A. Decenzo and Stephens P. Robbins, Human Resource Management, John Wiley & Sons, 2015.

Online Resources:

1. www.shrm.com
2. www.hrkatha.com
3. www.nationalhrd.com
4. www.nipm.com
5. www.istdindia.org



CE5151	CONTRACT MANAGEMENT AND ARBITRATION	Credits 3-0-0: 3
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Pre-requisites: Project Planning and Management, Construction Techniques

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Prepare contract schedules, notice inviting tender and contract documents.
CO2	Identify and implement contract formats
CO3	Implement dispute resolution.
CO4	Prepare contract management plan as per standards.

Course Articulation Matrix

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	1	2	---
CO2	2	3	1	---	2	---
CO3	2	2	3	2	2	3
CO4	2	2	1	---	2	---

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Contract Formats: FIDIC, CPWD, Special Conditions of Contract (SCC)

Construction contracts: Types of Contracts, Contract specification, types of contract documents used for construction, Contract Procedure, RED Flag Clauses.

Claims and Disputes during Execution Construction Contracts: Claims, Claim Management, Disputes, arbitration and litigation procedure-preparation, settlement, evidence.

Contract Execution: Roles & Responsibilities, Contractor's Liabilities

Contracts – Change Management: Change Management Process & Procedures, Contract Communication & Documentation

Professional Ethics in Construction Industry: Significance of Ethical Practice in an Organization, Professionals and Professional Ethics in Construction Industry, Social Values in Construction, Impact of Professional Ethics on Construction Quality, Code of Ethics, Causes of Unethical Conduct and Ways to Minimize Unethical Conduct.



Learning Resources:

Text Books:

1. Contracts and Their Management, B.S. Ramaswamy, Lexis Nexis, 2016, First Edition.
2. Contracts Management A Life Cycle, Rashid Hussain, 3C Corporate Consulting Contracting, 2020, First Edition.
3. Introduction to Construction Contract Management, Brian Greenhalgh, Routledge, 2016, First Edition.
4. Construction Contracts Preparation and Management: From concept to completion, Geoff Powell, Palgrave Macmillan, 2016, First Edition.

Reference Books:

1. Content of Construction Contracts, Arvind Gavade, SunitDhere, 2018, First Edition.
2. Evaluating Contract Claims, John Mullen and Peter Davison, Wiley-Blackwell, 2019, Third Edition.
3. 200 Contractual Problems and their Solutions, J. Roger Knowles, Wiley-Blackwell, 2012, Third Edition.
4. Construction Claims and Responses: Effective Writing and Presentation, Andy Hewitt, Wiley-Blackwell, 2016, Second Edition.

Online Resources:

1. Acts and Contract Documents: The Indian Contract Act, 1872.
<https://legislative.gov.in/sites/default/files/A1872-09.pdf>
2. The Arbitration and Conciliation Act, 1996 as amended on Dec 2015.
<https://lawmin.gov.in/sites/default/files/ArbitrationandConciliation.pdf>
3. General Conditions of Contract for Central P.W.D. Works, 2014.
<http://cewacor.nic.in/Docs/TendersArchive/ArchiveTender2018/CWVASHITEND ER 241218.pdf>
4. FIDIC Conditions of contract – Red Book – 1999
[https://lauwtjunnji.weebly.com/uploads/1/0/1/7/10171621/fidic - conditions of contract for construction for building and engineering works designed by the employer \(1999\).pdf](https://lauwtjunnji.weebly.com/uploads/1/0/1/7/10171621/fidic_-_conditions_of_contract_for_construction_for_building_and_engineering_works_designed_by_the_employer_(1999).pdf)



CE 5152	QUANTITATIVE METHODS IN CONSTRUCTION MANAGEMENT	Credits 3-0-0: 3
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Pre-Requisites: None

Course Outcomes:

At the end of the course, the student will be able to

CO1	Formulate and solve the deterministic optimization problems.
CO2	Model risk and uncertainty in construction projects.
CO3	Apply stochastic optimization techniques for decision making under uncertainty.
CO4	Apply simulation techniques in construction projects

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	3	3	3
CO2	1	3	2	3	3	3
CO3	2	3	2	3	3	3
CO4	1	3	3	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Introduction and concepts of probability and statistics: Probability: Conditional probability, Probability distributions (Normal, Bayesian, Poisson, Exponential), Probability density functions.

Linear programming: Formulation of LP problems: Basic variables, constrains, corner points, augmented form, maximization and minimization problems. Solution methods: Graphical method, Algebraic method, Simplex method (Tabular and Matrix form). Integer linear programming.

Transportation problems: Transportation problem: Basic feasible solutions using N-W Corner rule, Minimum cost method, Vogel's approximation method. Optimal solutions using Stepping Stone Method, Modified distribution method. Assignment problems: Hungarian algorithm.

Decision theory: Decision in certainty: Analytical hierarchy approach, Comparison Matrix, Consistency test, Oil exploration problem, Manpower planning problem. Probabilistic decision making: Expected value approach, sensitivity analysis on payoffs, Optimal decision strategy.

Forecasting: Quantitative methods-Time series (average method, moving average method, exponential smoothing, mean square error), Regression analysis. Qualitative methods.

Games theory simulations applied to construction: n x m person zero sum games with finite strategies, Maximin & Minimax strategies, Saddle points, Rule of dominance.

Simulation: Monte-Carlo Simulation, Sensitivity Analysis and Analytical Hierarchy Process (AHP).



Text Books:

1. Quantitative Analysis for Management, Render, B., & Stair Jr, R. M., Pearson Education India, 2017, 12th Edition.
2. Operations research: an introduction, Taha, H. A., Pearson Education India, 2013, 9th Edition.
3. Probability and Statistics for Engineers, Freund, J.E. and Miller, I.R., Prentice - Hall of India, New Delhi, 1994. 5th Edition.

Reference Books:

4. Introduction to Optimization, J. C. Pant, Jain Brothers, New Delhi, 2012, 7th Edition.
5. Operations Research, Goel B.S. and Mittal, S.K., PragatiPrakashan, Meerut, 2000.

Online Resources:

2. <https://nptel.ac.in/courses/112/106/112106134/>
3. <https://nptel.ac.in/courses/112/106/112106131/>



CE 5153	CONSTRUCTION METHODS AND EQUIPMENT	Credits 3-0-0: 3
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Pre-Requisites: None

Course Outcomes:

At the end of the course, the student will be able to

CO1	Select construction equipment appropriate to tasks.
CO2	Evaluate equipment ownership and operating costs.
CO3	Estimate and schedule activities using equipment productivity and cost data.
CO4	Apply contemporary techniques pertaining to construction methods, equipment usage and management.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	2	3	3	3
CO2	1	3	2	3	3	3
CO3	2	3	2	3	3	3
CO4	1	3	3	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Equipment Economics: Equipment records, Cost of Capital, Elements of ownership Cost, Operating Cost, Replacement Decisions, Rent and Lease Considerations.

Planning for Earthwork Construction: Planning, Graphical Presentation of Earthwork, Earthwork Quantities, Mass Diagram, Pricing Earthwork Operations.

Compaction and Stabilization Equipment: Compaction of Soil and rock, Types of Compacting Equipment, Dynamic Compaction, Stabilizing soils with Lime, Cement Soil Stabilization.

Mobile Equipment Power Requirements: Required Power, Available power, Usable power, Performance Charts.

Dozers, Scrapers, Excavators: Introduction, Performance Characteristics of Dozers, Pushing Material, Land Clearing, Scraper types, operation, Performance Charts, Production cycle, Hydraulic Excavators, Shovels, Hoes.

Trucks and Hauling Equipment, Finishing Equipment: Trucks, productivity, Performance Calculations, Graders, Trimmers.

Introduction to Modern Construction Methods in Construction Projects: Choice of choosing MCM, Segmental, Insitu construction of Bridges, Elaborate (Case studies) (Mechanical Fabrication, Typical Method statements), and Introduction to IT tools in construction. Stochastic Methods for Estimating Productivity.



Text Books:

1. Construction equipment management for engineers, estimators, and owners, Gransberg, D. D., & Rueda-Benavides, J. A., CRC Press, 2020, 2nd Edition.
2. Construction planning, equipment, and methods, Peurifoy, R. L., Schexnayder, C. J., Schmitt, R. L., McGraw-Hill Education, 2018, 9th Edition.

Reference Books:

1. Construction Equipment and Management, Sharma S.C. Khanna Publishers New Delhi, 2019, 1st Edition.
2. Construction equipment management, Schaufelberger, J.E. and Migliaccio, Routledge, 2019, 1st Edition.

Online Resources:

1. <https://nptel.ac.in/courses/105/103/105103206/>



Course Code: CE 5154	CONSTRUCTION PROJECT STUDIO	Credits 0-1-2: 2
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Pre-requisites: Construction Project Management Software lab and BIM Lab

Course Outcomes:

At the end of the course, the student will be able to

CO1	Prepare contract drawings and estimates for civil engineering works.
CO2	Develop detailed item wise specification of the project.
CO3	Identify and estimate resources for the items of the project and prepare detailed project schedule.
CO4	Conduct a case study on overall project management of constructions using construction management tools.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1	3	2	3	3	3
CO2	1	3	2	3	3	3
CO3	1	3	2	3	3	3
CO4	1	3	2	3	3	3

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Selection of real time project development of 2D and 3D model of Project using Auto CAD and Autodesk Revit Tool.

Development of Work breakdown structure, planning, scheduling and resource allocation using MSP and Primavera P6 tool.

Estimation and Quantity Take off from Autodesk Revit tool.

Integrate of 3D model and project planning, scheduling of project in Navisworks tool.

Simulation of project model for 4D (time) and 5D (cost) in Navisworks tool.

Application of BIM approach to adopt 6D to 10D in the real time project through case studies.

Demonstration on IT tools used in construction projects

Text Books:

1. BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors. Eastman, C. M., Eastman, C., Teicholz, P., Sacks, R., & Liston, K. John Wiley & Sons, 2011, 2nd Edition.
2. BIM and Construction Management: Proven Tools, Methods, and Workflows, Brad Hardin, John Wiley & Sons, 2015, 2nd Edition.



Reference Books:

1. Interaction Networks within Student Teams Learning Building Information Modeling (BIM), Herrera, R. F., Muñoz-La Rivera, F., & Vielma, J. C., Journal of Civil Engineering Education, ASCE, 2021.
2. Deployment of Building Information Modelling (BIM) for Energy Efficiency in the UK. Oloke, David. Collaboration and Integration in Construction, Engineering, Management and Technology. Springer, Cham, 2021.

Online Resources:

1. <https://www.coursera.org/courses?query=bim>



Course Code: CE5155	BUILDING SCIENCE LABORATORY	Credits 0 – 1 – 2: 2
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Pre-requisites: None

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Comprehend the requirements of Indoor Built Environment.
CO2	Evaluate and verify the Indoor Built Environment is complying with the specifications provided in the Indian Standards.
CO3	Integrate Indoor built Environment facilities into software and optimize the facilities provided in a building.
CO4	Prepare a detailed report on the building performance in terms of its serviceability.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1		3	3
CO2	2		2			
CO3	2	2	2		3	2
CO4	2	2	1	2	2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Occupant comfort, Energy, Acoustics, Illumination, Time/Motion studies/Ergonomics, Moisture, Construction chemicals/Additives, Non-Destructive Testing.

Experiments:

1. Determination of coefficient of thermal conductivity of a given material using Lee's Disc Apparatus.
2. Non - Destructive Testing: Determination of a compressive strength of a concrete sample using Rebound Hammer.
3. Non - Destructive Testing: Determination of a compressive strength and crack depth in a given concrete sample using Ultra Pulse Velocity Meter.
4. Building Inspection - Building envelope inspection for detection of heat gain/loss using Thermal Imaging Camera.
5. Determination of relative humidity of a given room using a Hygrometer.
6. Measurement of illuminance in a building using Lux Meter.
7. Measurement of the sound pressure levels (in dB) created by different types of sound sources.
8. Testing a given building material behaviour under controlled environmental conditions using Climate chamber.
9. Part A - Energy analysis of a building using software - Revit Architecture.



10. Part B - Optimization of building design for achieving lower energy consumption in buildings.
11. Green Building Rating Systems - Assimilation of complete procedure for green building certification through Indian green building rating tool (GRIHA-Green Rating for Integrated Habitat Assessment).

Learning Resources:

Text Books:

1. Hand Book of Designing and Installation of Services in High Rise Building Complexes, Jain, V. K. Jain, Khanna Publishers, 2010, Third Edition.
2. Building Services Engineering, David V. Chadderton, Routledge, 2012, Sixth Edition.
3. Building Services Handbook, Fred Hall and Roger Greeno, Routledge, 2017, Ninth Edition.

Reference Books:

1. Manual of Tropical Housing and Building: Climate Design, O. H. Koenigsberger, T. G. Ingersoll, A. Mayhew and S. V. Szokolay, Universities Press (India) Private Limited, 2020.
2. Energy Simulation in Building Design, Joseph Clarke, Routledge, 2007, Second Edition.
3. Environmental and Architectural Acoustics, Maekawa, Taylor & Francis, 2010, Second Edition.

Online Resources:

1. Handbook on Functional Requirements of Industrial Buildings (Lighting and Ventilation), SP 32, Bureau of Indian Standards, 1986.
<https://law.resource.org/pub/in/bis/S03/is.sp.41.1987.pdf>
2. Handbook of Functional Requirements of Buildings (Other than Industrial Buildings), SP 41, Bureau of Indian Standards, 1987.
<https://law.resource.org/pub/in/bis/S03/is.sp.41.1987.pdf>
3. Code of practice for acoustical design of auditoriums and conference halls, IS 2526, Bureau of Indian Standards, 1963.
<https://www.cracindia.in/admin/uploads/IS-2526.pdf>



CE 5198	Seminar-II	MDC	0 – 0 – 2	1 Credit
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Pre-requisites: None

Course Outcomes: At the end of the course, the student will be able to:

CO1	Identify and chose appropriate topic of relevance.
CO2	Assimilate literature on technical articles of specified topic and develop comprehension.
CO3	Prepare technical report.
CO4	Design, develop and deliver presentation on specified technical topic.

Course Articulation matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	2	1	3	1
CO2	3	2	1	1	3	1
CO3	2	3	1	1	3	1
CO4	1	3	3	1	3	1

Detailed syllabus

Student can choose any topic, of his choice, pertaining to Construction Technology and Management. Topic should be a relevant and currently researched one. Students are advised to refer articles published in current journals in the area of Construction Technology and Management for choosing their seminar topics. Student should review minimum of 10 research papers relevant to the topic chosen, in addition to standard textbooks, handbooks, etc. Students are required to prepare a seminar report, in the standard format and give presentation to the Seminar Assessment Committee (SAC) in the presence of their classmates. It is mandatory for all the students to attend the presentations of their classmates.

Reading:

1. Construction Technology and Management Journals
2. Research Articles / Reports available on Internet
3. Construction Technology and Management Textbooks and Handbooks



Course Code: CE5161	ENERGY EFFICIENT BUILDINGS	Credits 3-0-0: 3
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Pre-requisites: None

Course Outcomes:

At the end of the course, the student will be able to:

CO1	Comprehend the overview of building design, building physics, ventilation technology, indoor climate and requirements of low energy building design.
CO2	Apply technologies that will contribute to both energy efficient and healthy buildings.
CO3	Design energy saving measures in new buildings as well as existing buildings in regard to building services (HVAC) and building technology.
CO4	Simulate the energy efficiency measures into software and optimize the facilities provided in a building.

Course Articulation matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1		3	2
CO2	2		2			
CO3	3	2	2		3	1
CO4	2	2	1		2	2

1 - Slightly; 2 - Moderately; 3 – Substantially

Syllabus:

Overview of Energy Efficiency in Buildings - Energy consumption pattern in buildings and role of energy efficiency in buildings.

Energy Efficient Building Design - Planning & Orientation, Insulation, Ventilation, Equipment, Renewable energy

Audits for Healthy Building - Estimation and reduction of environmental impact (embodied energy, carbon footprint etc.) associated with buildings.

Energy Efficient Facility Management- Proactively manage energy-using equipment, Effective use of lighting and HVAC controls, Retrofit existing building systems, Repair and Maintenance of Facility Management.

Software Simulation - Integration of energy efficiency measures and optimize the facilities provided in a building.



Learning Resources:

Text Books:

1. Energy Efficient Buildings In India, MiliMajumdar, The Energy Research Institute (TERI), 2009.
2. Solar Energy and thermal processes, John A. Duffie and William A. Beckman, Wiley, 2013, Fourth Edition.
3. Energy-Efficient Building Systems: Green Strategies for Operation and Maintenance, Lal Jayamaha, McGraw-Hill Education, 2007.

Reference Books:

1. Building Integrated Renewable Energy: Technical and Aesthetic Performance of Renewable Energy Systems on Buildings, Tim Sharpe, Springer, 2020, First Edition.
2. Sustainable Construction: Green Building Design and Delivery, Charles Kibert, John Wiley & Sons, 2005.

Online Resources:

1. Handbook of Functional Requirements of Buildings (Other than Industrial Buildings), SP 41, Bureau of Indian Standards, 1987.
<https://law.resource.org/pub/in/bis/S03/is.sp.41.1987.pdf>
2. Energy Conservation Building Code, Bureau of Energy Efficiency, 2017.
https://beeindia.gov.in/sites/default/files/BEE_ECBC%202017.pdf



CE 5162	Formwork Design and Practice	Credits 3-0-0: 3
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Pre-requisites: None

Course Outcomes: At the end of the course, the student will be able to:

CO1	Design formwork in Civil Engineering projects.
CO2	Plan the sequence of construction of civil engineering structures.
CO3	Plan the safety steps involved in the design of formwork and false work.
CO4	Select a right material for manufacturing false work and formwork suiting specific requirements.

Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	1	--	3	---
CO2	1	3	2	1	3	1
CO3	1	3	1	1	3	1
CO4	2	3	3	1	3	--

Detailed syllabus

Introduction to Formwork and false work, Temporary work systems, Requirements, Construction planning and site constraints, Selection, and Classification (Types) of Formwork

Formwork Materials, Shoring Towers, and Scaffolds

Conventional and Proprietary (timber and steel) Formwork Design: Foundation, Wall, Column, Slab and Beam formworks. Design of Decks and False works. Effects of various loads. Loading and moment of formwork, IS Code provisions.

Formwork for Special Structures such as Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, and Lift Shaft.

Formwork for Bridge Structures, Cases in Failure of Temporary Support Structures of Bridges

Flying Formworks such as Table Forms, Tunnel Formwork System, Column Mounted Shoring System, Gang Forms, Slipform, Formwork for Precast Concrete,



Formwork Failure, Construction Sequence and Safety in use of Formwork: Sequence of construction, Safety use of formwork and false work.

Pre-Award and Post –award Formwork Management Issues, Formwork Issues in Multi-Story Building Construction

Learning Resources:

Text Books:

1. Formwork for Concrete Structures, Jha, K.N., McGraw Hill, 2012, First Edition,.
2. Formwork for Concrete Structures, Robert L. Peurifoy and Garold D. Oberiender, McGraw-Hill, 2010

Reference Books:

1. Slip Form Techniques, Tudor Dinescu and Constantin Radulescu Abacus Press, Turn Bridge Wells, Kent, 2004
2. Formwork for concrete, Austin, C.K., Cleaver - Hume Press Ltd., London, 2010

Online Resources:

1. <https://www.youtube.com/watch?v=p5lzixbac6k>
2. https://www.youtube.com/watch?v=xSCYsb_d3Ao



CE5163	QUALITY AND SAFETY MANAGEMENT	Credits 3-0-0: 3
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Pre-requisites: None

Course Outcomes: At the end of the course, the student will be able to:

CO1	Distinguish different aspects of quality and apply related tools.
CO2	Apply techniques of total quality assurance and quality control programme
CO3	Plan various aspects of safety during construction activity.
CO4	Apply principles of environmental safety to construction projects.

Course Articulation Matrix:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	3			
CO2	3	1	2			
CO3	3	1			1	
CO4	3	1		2		

Detailed syllabus

Quality Management: Quality Gurus, Quality policy in construction industry-Consumer satisfaction-Ergonomics, Quality tools, Quality Function Deployment, Cost of Quality, Statistical Tolerance-Taguchi's concept of quality- Inspection procedures.

Quality Assurance and Control: Total QA/QC Program and cost implication. Statistical Quality Control, Different aspects of quality-Appraisals, failure mode analysis, Stability methods and tools, Influence of drawings, detailing, and specification.

Safety Programmes and organization: Introduction to safety, challenges in the construction sector, accident statistics, accident causation theories, Cost of Safety, Safety acts and Regulations, Safety audit, accident investigation and prevention Techniques, Environmental safety, Social and environmental factors, Application of digital technology in construction safety.



Learning Resources:

Text Books:

1. Introduction to Health and Safety in construction, Phil Hughes and Ed Ferrett, Routledge publications, Fifth Edition, 2016
2. Construction Inspection Handbook: Quality Assurance/Quality Control, James, J.O Brian, Third Edition, 2012

Reference Books:

1. Construction Safety Management, Prof Jha, Patel and Singh, 2021 (In Press)
2. Quality planning and Analysis, Juran Frank, J.M. and Gryna, F.M ,Tata McGraw Hill, 2000
3. Quality Management in Construction Projects, Abdul RazzakRumane, CRC Press, 2018, Second Edition,
4. ISO 9000:2015, Quality management systems — Fundamentals and vocabulary
5. ISO 9001:2015, Quality management systems — Requirements
6. ISO 9004:2018, Quality management — Quality of an organization — Guidance to achieve sustained success
7. OHSAS 18001:2007 Occupation Health and Safety Management Systems
8. National Building Code of India 2016, Bureau of Indian standards, IS SP 7 : 2016

Online Resources:

1. <https://nptel.ac.in/courses/105/102/105102206/> Website reference links



SM 5012	STRATEGIC MANAGEMENT IN CONSTRUCTION	Credits: 3-0-0:3
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Course Outcomes:

At the end of the course, the student will be able to:

CO1	Analyze the importance of Strategic Management in a business organization.
CO2	Identify environmental factors that influence business firm.
CO3	Analyze the effect of competition on the business environment.
CO4	Implement different models and strategies used by organizations.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	3	1	1	3	--
CO2	2	2	1	1	3	--
CO3	3	3	1	1	3	--
CO4	3	3	1	1	3	--

Syllabus

Chapter 1- Introduction to Strategic Management Concepts: Introduction to strategy, Purpose, Objectives, goals, Policies and programs, 7-S frame work, Board of Directors-Roles, Responsibilities, Structure and composition Role of top management.

Chapter 2 -External and Internal Environment Analysis: Strategic Management process, SWOT Analysis Macro and Micro environmental factors. Importance of value chain.

Chapter 3 - Decision and Analytical Tools: Competitive Environment-five forces model, Factors driving industry change. Key factors for success in organization, overall cost Leadership, focus and differentiation strategies.

Chapter 4 - Financial Strategies: Growth strategy, stabilization strategy and retrenchment strategy. Portfolio strategies G.E, B.C.G & Arthur D.Little's model.

Chapter 5 -Corporate Strategic Events: Corporate parenting strategy, Ansoffs product market Grid-Product Development, Market Development and Market penetration and diversification strategies.

Chapter 6 - Strategic Management Evaluation and control: Strategy implementation and evaluation control of strategic performance-performance gap, ROI, Budget and Financial Ratios, Strategy Audit, Case studies of Construction Companies.



Learning Resources:

Text Books:

1. Strategic Management in Construction, David Langford, Steven Male, John-Wiley and Sons, 2008 and 2nd Edition,
2. Construction Management in Practice, Richard Fellows, Blackwell Science, 2001 and 2nd Edition.

Reference Books:

3. Crafting & Executing Strategy: Concepts and Cases, Arthur Thompson and Margaret Peteraf and John Gamble and A. Strickland, Mc Graw Hill, 2020, 22nd Edition
4. Strategy Safari: A Guided Tour Through The Wilds of Strategic Management, Henry Mintzberg; Bruce W Ahlstrand; Joseph Lampel , New York : Free Press, 2005

Online Resources:

6. <https://strategicmanagementinsight.com/>
7. <https://www.strategy-business.com/>
8. <https://www.fastcompany.com/>



CE6147	COMPREHENSIVE VIVA VOCE	PCC	0 – 0 – 0	2 Credits
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Pre-requisites: Both I & II Semester course work of I Year should be completed.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Assimilate knowledge of different courses studied.
CO2	Develop overall comprehension about Construction Technology and Management.
CO3	Analyse real life engineering problems with theoretical knowledge learned.
CO4	Interpret and articulate solutions to real life structural engineering problems.

Mapping of course outcomes with program outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	3	3	2	3	---
CO2	3	3	3	2	3	---
CO3	3	3	3	2	3	---
CO4	3	3	3	2	3	---

Detailed syllabus

All the subjects studied in I year I semester and II semesters.

Learning Resources:

1. Reading Material of all the courses
2. Case Studies / Consultancy Reports



CE6149	DISSERTATION PART- A	PCC	0 – 0 – 0	6 Credits
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Pre-requisites: Both I & II Semester course work of I Year should be completed.

Course Outcomes: At the end of the course, the student will be able to:

CO1	Define Research Problem Statement.
CO2	Critically evaluate literature in chosen area of research & establish scope of work.
CO3	Develop study / experimental methodology.
CO4	Carryout pilot theoretical study/experiment.

Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	3	---
CO2	3	2	2	1	3	---
CO3	3	2	2	1	3	---
CO4	3	2	2	1	3	---

Detailed syllabus

Students are required to search, collect and review various research articles published in chosen area of research. A student has to select a topic for his dissertation, based on his/her interest and the available facilities at the commencement of dissertation work. A student shall be required to submit a dissertation report on the research work carried out by him/her.

Learning Resources:

1. Journal Publications
2. Conference / Seminar Proceedings
3. Handbooks / Research Digests

CE6199	DISSERTATION PART- B	PCC	0 – 0 – 0	12 Credits
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Pre-requisites:

1. Both I & II Semester course work of I Year should be completed.
2. CE6149: Dissertation Part A

Course Outcomes: At the end of the course, the student will be able to:

CO1	Expand on the defined research problem
CO2	Critically evaluate literature in the well-defined research & clearly establish scope of work.
CO3	Conduct Laboratory studies.
CO4	Analyze data, develop models and offer solutions.

Course Articulation

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	2	1	3	---
CO2	3	2	2	1	3	---
CO3	3	2	2	1	3	---
CO4	3	2	2	1	3	---

Detailed syllabus

Students are required to search, collect and review various research articles published in chosen area of research. A student has to select a topic for his dissertation, based on his/her interest and the available facilities at the commencement of dissertation work. A student shall be required to submit a dissertation report on the research work carried out by him/her.

Learning Resources:

1. Journal Publications
2. Conference / Seminar Proceedings
3. Handbooks / Research Digests

NOTE: Refer to the following link for the guidelines to prepare dissertation report:
<https://www.nitw.ac.in/main/PGForms/NITW/>