# NATIONAL INSTITUTE OF TECHNOLOGY WARANGAL

## Honors in

## CONSTRUCTION TECHNOLOGY AND MANAGEMENT

## SCHEME OF INSTRUCTION AND SYLLABI

(for students of B.Tech., Civil Engineering)

**(Effective from 2021-22)**

## DEPARTMENT OF CIVIL ENGINEERING

## SCHEME OF INSTRUCTION

## Honours Program – Construction Technology and Management

| S. No. | Course Code | Name of the Course | L | T | P | Credits | Sem. |
|---|---|---|---|---|---|---|---|
| 1 | CE5101 | Construction Techniques | 3 | 0 | 0 | 3 | V |
| 2 | CE5151 | Contract Management and Arbitration | 3 | 0 | 0 | 3 | VI |
| 3 | CE5153 | Construction Methods and Equipment | 3 | 0 | 0 | 3 | VI |
| 4 | SM5011 | Construction Economics and Finance | 3 | 0 | 0 | 3 | VII |
| 5 | CE5112 | Lean Construction | 3 | 0 | 0 | 3 | VII |
| 6 | CE5163 | Quality and Safety Management | 3 | 0 | 0 | 3 | VIII |
| | | **Total** | | | | **18** | |

# DETAILED SYLLABUS

## Honors

## Construction Technology and Management

| Course Code: CE5101 | CONSTRUCTION TECHNIQUES | Credits 3-0-0: 3 |
|---|---|---|

Pre-requisites: None

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

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| **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. |

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 Aviad Shapira, 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

| Course Code: CE5151 | CONTRACT MANAGEMENT AND ARBITRATION | Credits 3-0-0: 3 |
|---|---|---|

Pre-requisites: Project Planning and Management, Construction Techniques

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

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|---|---|
| **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. |

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, Sunit Dhere, 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/TendersArchieve/ArchieveTender2018/CWVASHITENDER_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_b_y_the_employer_(1999).pdf

| Course Code: CE5153 | CONSTRUCTION METHODS AND EQUIPMENT | Credits 3-0-0: 3 |
|---|---|---|

Pre-requisites: None

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

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| **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. |

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.

**Stochastic Methods for Estimating Productivity:** Developing Mathematical models, Monte Carlo Simulation Theory, Expected Production and Validation of Simulation.

Learning Resources:

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: SM5011 | CONSTRUCTION ECONOMICS AND FINANCE | Credits 3-0-0: 3 |
|---|---|---|

Pre-requisites: None

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

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| **CO1** | Prepare income, profit and loss statements and implement construction |
| **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. |

Syllabus:

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

**Benefit-cost analysis**, Replacement analysis

**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

**Project Finance:** 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. Construction Economics: A New Approach, Danny Myers, Taylor and Francis Publisher, 2016.
2. Construction Accounting and Finance, Va**zi**rani and chandola, Dhanpat Rai Publications,2011


Reference Books:


1. The Construction Industry Aspects of its Economics and Management, Ofori, G, Singapore University Press, 1990.
2. Construction and Finance Management , Coombs W.E and W.J Palmer , Mc-Graw-Hill New York,1994.
3. Financial and Cost concepts for construction Management, Halpin, D.W., 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

| Course Code: 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:

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| **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 |

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, Routlege, 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, Routlege, Taylor and Francis Group, 2020

Online Resources:

1. http://www.leanconstruction.org/readings.htm

| Course Code: CE5163 | QUALITY AND SAFETY MANAGEMENT | Credits 3-0-0: 3 |
|---|---|---|

Pre-requisites: None

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

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| **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. |

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. Quality planning and Analysis, Juran Frank, J.M. and Gryna, F.M ,Tata McGraw Hill, 2000
2. Quality Management in Construction Projects, Abdul Razzak Rumane, CRC Press, 2018, Second Edition

Online Resources:

1. https://nptel.ac.in/courses/105/102/105102206/