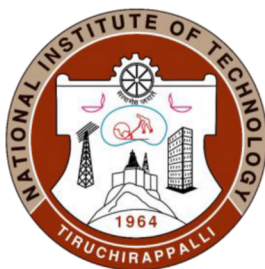


**M.TECH. DEGREE
CONSTRUCTION TECHNOLOGY AND MANAGEMENT**

**SYLLABUS
FOR
CREDIT BASED CURRICULUM
(With effect from 2022)**



**DEPARTMENT OF CIVIL ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI – 620015 INDIA**



Vision of the Institute

- To be a university globally trusted for technical excellence where learning and research integrate to sustain society and industry

Mission of the Institute

- To offer undergraduate, postgraduate, doctoral and modular programmes in multi-disciplinary / inter-disciplinary and emerging areas.
- To create a converging learning environment to serve a dynamically evolving society.
- To promote innovation for sustainable solutions by forging global collaborations with academia and industry in cutting-edge research.
- To be an intellectual ecosystem where human capabilities can develop holistically

Vision of the Department

- Shaping infrastructure development with societal focus

Mission of the Department

Achieve International Recognition by:

- Developing Professional Civil Engineers
- Offering Continuing Education
- Interacting with Industry with emphasis on R&D



M. Tech. (Construction Technology and Management)

The total minimum credits required for completing the M. Tech. (Construction Technology and Management) course is 64.

SEMESTER I

| Code | Course of Study | Credit |
|-------------|---|---------------|
| CE751 | Construction Planning & Control | 3 |
| CE753 | Construction Economics & Finance | 3 |
| CE755 | Contracts & Specifications | 3 |
| CE757 | Construction Personnel Management | 3 |
| | Elective – I | 3 |
| | Elective – II | 3 |
| CE759 | Construction Management Software Laboratory | 2 |
| | | 20 |

SEMESTER II

| Code | Course of Study | Credit |
|-------------|---|---------------|
| CE752 | Construction Methods & Equipment | 3 |
| CE754 | Construction Quality & Safety Management | 3 |
| CE756 | Organizational Behaviour | 3 |
| | Elective – III | 3 |
| | Elective – IV | 3 |
| | Elective – V | 3 |
| CE760 | Construction Engineering and Information Laboratory | 2 |
| | | 20 |

SUMMER

| Code | Course of Study | Credit |
|-------------|-------------------------------|---------------|
| | Summer Training/ Mini Project | - |

SEMESTER III

| Code | Course of Study | Credit |
|-------------|------------------------|---------------|
| CE797 | Project Work – Phase I | 12 |

SEMESTER IV

| Code | Course of Study | Credit |
|-------------|-------------------------|---------------|
| CE798 | Project Work – Phase II | 12 |



PROGRAMME ELECTIVES

| Sl. No | Code | Course of Study | Credit |
|---------------|-------------|--|---------------|
| 1. | CE761 | Modern Construction Materials | 3 |
| 2. | CE762 | Functional Efficiency of Buildings | 3 |
| 3. | CE763 | Advanced Concrete Technology | 3 |
| 4. | CE764 | Disaster Mitigation and Management | 3 |
| 5. | CE765 | Construction Supply Chain Management | 3 |
| 6. | CE766 | Forensic Engineering and Rehabilitation Techniques | 3 |
| 7. | CE767 | Project Risk Analysis and Mitigation Techniques | 3 |
| 8. | CE768 | Planning of Prefabricated Structures | 3 |
| 9. | CE769 | Safety in Material Handling at Construction | 3 |
| 10 | CE770 | Non Destructive Evaluation | 3 |
| 11 | CE771 | Value Engineering | 3 |
| 12 | CE772 | Strategic Management in Construction | 3 |
| 13 | CE773 | Lean Construction Concepts, Tools and Practices | 3 |
| 14 | CE774 | Quantitative Methods in Construction Management | 3 |
| 15 | CE775 | Formwork Design | 3 |

** Electives chosen from other PG specializations of Department of Civil Engineering and Electrical and Electronics Engineering shall follow the respective course codes.



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|----------------------|--|
| Course Code: | CE751 |
| Course Title: | Construction Planning & Control |
| Credit: | 3 |
| Type: | Core |

Course Content

Project Management: Basic forms of organization with emphasis on Project and matrix structures; project life cycle, planning for achieving time, cost, quality, project feasibility reports based on socio-techno-economic-environmental impact analysis, project clearance procedures and necessary documentation for major works like dams, multistoried structures, ports, tunnels, Qualities, role and responsibilities of project Manager, Role of Project Management Consultants, Web based project management.

Project Scheduling – Non-Networking Techniques: Gantt-Chart, Networking Techniques: Formulation and Applications of Critical Path Method (CPM) and Program Evaluation & Review Technique (PERT), Precedence Diagram Method (PDM), RPM (Repetitive Project Modeling) techniques. Linear Scheduling, LOB technique, Mass haul diagrams.

Project Control - Man-Material-Machinery-money optimization, scheduling, monitoring, updating. Resource Planning - Resource Constrained Scheduling, Resource Levelling. Time-cost tradeoffs – Network crashing

Performance Measurement, Earned Value, Multiple Construction Projects, Real time Applications

References

1. Project Management for Engineering and Construction, GD. Oberlender, McGraw-Hill, 3rd Edition, 2014.
2. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley & Sons, 6th Edition, 2016.
3. Construction Project Scheduling, Callaghan, MT., Quackenbush, DG. and Rowings, JE., McGraw-Hill, 1992.
4. A Guide to the Project Management Body of Knowledge (PMBOK Guide) - Sixth Edition, An American National Standard, 2018.
5. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019.
6. Jerome D. Wiest and Ferdinand K. Levy, “A Management Guide to PERT/CPM”, Prentice Hall of India Publishers Ltd., New Delhi, 2012.

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|----------------------|---|
| Course Code: | CE752 |
| Course Title: | Construction Methods & Equipment |
| Credit: | 3 |
| Type: | Core |

Course Content

Construction Methods - High rise Buildings, Highways, Bridges, Erection of Girders, Underground Utilities, Offshore platforms, Slip form for Chimneys and Cooling Towers, Steel construction-fabrication and erection.



Underground Construction – Tunnel boring machineries, Tunnel-Shaft sinking, Micro Tunneling, Tunnel driving in hard and soft strata, bedding of conduits.

Under water construction - Problems encountered. Underwater drilling, blasting, Grouting methods in soft and hard soil including Jet grouting and Chemical grouting, Dewatering in shallow and deep excavations using different methods, Vacuum Dewatering and Well point system.

Pile Construction- Piling – Single pile and a group piles (Bored and Driven); driven and cast-in-situ piles, Piles in land and marine structures. Precast piles, pre stressed piles, steel piles and friction piles. Methods of pile driving by Vibration and Construction of micro piles, Diaphragm Walls.

Coffer Dams - Types, construction of single, double wall. Cofferdam. Sheet pile cofferdams, concrete wall movable cofferdam, land cofferdams, soldier construction method. Cofferdam wall by ICOS method. Caissons - Types, box, pneumatic and open caissons, Well foundation

Construction engineering fundamentals- Concrete construction batching, mixing, transport, placement, finishing, formwork, scaffolding.

Construction Equipment Management - Costing, Optimum utilization and Equipment selection - Technical and economical, depreciation, interest on capital, Manpower, Spare parts, Documentation, Log-Books, History Books, Periodical MIS Report.

Construction equipment and machinery- Earthwork, Hoisting and lifting, Material handling, Concreting, Pile driving, dewatering equipment. Characteristics and performances analysis of production outputs and costs

References

1. Peurifoy, R.L., Schexnayder, J.C., and Shapira, A, Construction Planning, Equipment and Methods, Tata McGraw Hill, New Delhi, Ninth Edition, 2018.
2. F. Harris, Modern Construction and Ground Engineering Equipment and Method, Prentice Hall 2nd Edition, 1994.
3. Stephens W. Nunnally, Managing Construction Equipment: Pearson 8th Edition, 2011.
4. K.N. Jha, Construction Project Management: Theory and Practice, Pearson Education India, 2nd Edition, 2015.
5. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 2016.

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|----------------------|---|
| Course Code: | CE753 |
| Course Title: | Construction Economics & Finance |
| Credit: | 3 |
| Type: | Core |



Course Content

Construction economics - Overview of construction economics- time value of money - cash flow diagram- single payment now compared to a single payment in future (F/P) - Future payment compared to a uniform series of payments (F/A,) - one present payment compared to a uniform series of payments (A/P) - arithmetic Gradient G, Geometric gradient.

Financial Returns analysis - Comparing Alternatives - Present Worth Method-Annual payments method- Future worth methods, Rate of Return (ROR), Incremental Rate of Return (IROR), Break even analysis , Marginal costing , Cost Benefit analysis.

Accounting methods - Depreciation accounting, income tax accounting, inflation, replacement analysis.

Construction costing - Methods of construction costing- percentage completion method – Fixed contract Pricing- cost plus pricing- Escalation clause- Sources of Finance, Infrastructure financing; Life-cycle costing, Construction cost control, Personnel costs; Equipment costs, Job in directs and markup.

Financial Statement Analysis - Balance sheet and Profit and Loss accounts – ratios analysis, Fund flow statement, Cash flow statement, Working Capital Management, Financial Control - Management accounting, Case studies on financial analysis

References

1. Blank, L.T., and Tarquin, A. J, Engineering Economy, 7th Edition, Mc-Graw Hill Book Co, 2016.
2. Collier, C and GlaGola, C, Engineering Economics & Cost Analysis, 3rd Edition, Addison Wesley Education Publishers, 1998.
3. Patel, B M, Project management- strategic Financial Planning, Evaluation and Control, Vikas Publishing House Pvt. Ltd. New Delhi, 2nd edition, 2011.
4. Steiner, H.M, Engineering Economic principles, 2nd Edition, Mc-Graw Hill Book Co, 1992
5. Maheshwari S.N, Management Accounting and Financial Control, 16th edition, Sultan Chand & sons, New Delhi, 2015.

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|----------------------|---|
| Course Code: | CE754 |
| Course Title: | Construction Quality & Safety Management |
| Credit: | 3 |
| Type: | Core |

Course Content

Construction Quality Management - Introduction to quality. Planning and control of quality during design of structures. Quality assurance during construction. Material Quality Assurance; Specifications and Tolerances - Inspection of materials and machinery. Preparation of quality manuals, checklist and inspection report. Establishing quality assurance system. Quality standards/codes in design and construction. Total quality management concepts; ISO 9000 family of standards; QA/QC systems and organizations, Quality Audits; Problem solving techniques; Statistical Quality Control; Quality Function Deployment.



Construction Safety Management – Concept of safety. Factors affecting safety: Physiological, Psychological and Technological. Roles, duties and responsibilities of workers, Supervisors, Managers and Owners, safety program components - safety committee, safety training, incentives and monitoring. ISO 45001 standard for health and safety at work - Safety Procedures for various construction operations, preparation of safety manuals, safety checklists and inspection reports, safety audits; Safety laws, Labor laws, legal requirement and cost aspects of accidents on site, Incentive for safety practices, Case studies on various construction projects

References

1. Jimmy W. Hinze, Construction Safety, Pearson College Division, 2nd Edition, 2013
2. Richard J Coble, Jimmy W. Hinze & Theo C Haupt, Construction Safety and Health Management, Pearson, 2000.
3. John L Ashford, The Management of Quality in Construction, Routledge, 1st edition, 2002.
4. Juran Frank, J.M. and Gryna F.M. Quality Planning and Analysis: From Product Development Through Use (Mcgraw-Hill Series in Industrial Engineering and Management Science) 3rd Edition, 1993.
5. Grant E.L., and Leavens worth, “Statistical Quality Control”, Mc Graw Hill, 1996.

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|----------------------|--|
| Course Code: | CE755 |
| Course Title: | Construction Contracts & Specifications |
| Credit: | 3 |
| Type: | Core |

Course Content

Project cost estimation, rate analysis, overhead charges, bidding models and bidding strategies. Qualification of bidders, Owner's and contractor's estimate. Construction specifications – standard specifications, development, interpretation, GST calculations.

Comprehensive study of different types of Tenders, Applications to various works

Type of contracts, International Contracts, FIDIC, Indian Contract Act 1872, Problems in the operation of contracts Claims, compensation and disputes, Dispute resolution Techniques, Delay analysis

Arbitration and Conciliation Act 1996, Arbitration case studies

Professional practices, ethics, duties and responsibilities, Management Information systems, Case studies

References

1. B.J. Vasavada, “Engineering Contracts and Arbitration”, Jubilee Publications, 1996.
2. Dr. Vandana Bhatt & Pinky Vyas :- Laws for Engineers (Contract, Arbitration, Evidence, Limitation), 2015.
3. Gajria, G. T., Law Relating to Building and Engineering Contracts in India, 4th Edition, N. M. Tripathi Pvt. Ltd., Mumbai, 2000.
4. Hinze, J., Construction Contracts. Third Edition, McGraw Hill, 2013.



5. Sweet J., and Schneier, M.C., Legal Aspects of Architecture, Engineering and the Construction Process, 9th Edition, Thomson, Toronto, Canada, 2012.
6. FIDIC Contract Documents including: Conditions of Contract for Construction – Red Book 2nd Edition, 2013; Short Form of Contract; Conditions of Contract for EPC Turnkey Projects.

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|----------------------|---------------------------------|
| Course Code: | CE756 |
| Course Title: | Organizational Behaviour |
| Credit: | 3 |
| Type: | Core |

Course Content

Leadership in Organizations. Characteristics of Organizations: Organization Structure and Design, Organizational Behavior, Organizational Culture and climate

Individuals in Organizations - individual decision-making; Group Dynamics: Group behavior, Inter-group relation and conflict; Communication;

Motivation and behavior, Motivation at work, designing motivating jobs

Functional and Dysfunctional conflict – conflict management strategies - Principles and Tactics of Negotiation- Factors affecting Intergroup Relations and Managing Intergroup Relations

Organizational change and Development - Managing Innovation and Technology in changing environments -case studies of OD interventions in mega-construction projects.

References

1. Gregory Moorhead and Ricky W. Griffin, Organizational Behaviour: Managing People and Organizations, 11th Edition, Houghton Mifflin Company, Boston, 2013.
2. Stephen, P Robbins, Organizational Behaviour, 18th Edition, Pearson Education Asia, New Delhi, 2020.
3. Wendell L French and Cecil H. Bell, Jr., Organization Development: Behavioral Science Interventions for Organization Improvement, 6th edition, Pearson Education Asia, New Delhi, 1999.
4. Jit. S.. Chander, Organizational Behaviour, 3rd edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2014.
5. Robbins, S., Judge T.A. & Vohra N. Organizational Behavior, Pearson Education 18th Edition, 2018.

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|----------------------|--|
| Course Code: | CE757 |
| Course Title: | Construction Personnel Management |
| Credit: | 3 |
| Type: | Core |

Course Content

Elements of Personnel Management – Organization - Requirement of Organization, Organization structure, Organization Hierarchical charts, Staffing Plan, Development and



Operation of human resources, Managerial Staffing, Recruitment, Selection strategies, Placement and Training.

Manpower Planning process - Organising, Staffing, directing, and controlling, Estimation of manpower requirement, Factors influencing supply and demand of human resources, Role of HR manager, Personnel Principles, Welfare measurements

Leadership – Functions, types of Leadership and its importance, Productivity - Assessment tools, Productivity Improvement, Competency Development. Motivation – Types and Theories, Performance planning and Assessment, Rewards. Team Behavior – Stages and Characteristics of Team work. Communications – Methods and Channels of communication and its function, Crisis Management – Features and Case studies

References

1. Carleton Counter II and Jill Justice Coutler, The Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc, 1989.
2. Dwivedi R.S, Human Relations and Organisational Behaviour, Macmillian India Ltd., 2005.
3. Josy.J. Familaro, Handbook of Human Resources Administration, McGraw-Hill International Edition, 1989.
4. Memoria, C.B., Personnel Management, Himalaya Publishing Co., (Text and Cases), 13th Edition, 2019.

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|----------------------|--|
| Course Code: | CE759 |
| Course Title: | Construction Software Management Laboratory |
| Credit: | 2 |
| Type: | Core |

Course content

Computer aided Cost Estimation, Spreadsheet, Database applications, Project management software - Network preparation and computations, Scheduling and allocation, Simulation and Optimization Software etc., application of L.P. in construction problem - Construction applications

References

1. Kenneth C Laudon and Jane Price Laudon, Management Information Systems Organization and Technology, Prentice Hall, 1996.
2. Vinayagam P, Vimala A, Planning and Managing Projects with PRIMAVERA (P6) Project Planner, I K International Publishing House Pvt. Ltd, 2017.
3. Kathy Schwalbe, Information Technology Project Management, CENGAGE Learning Custom Publishing; 6th Revised ed. Edition, 2010.
4. Paul E, Harris, Planning and Control Using Microsoft Project 2013, 2016 & 2019, Eastwood Harris Pty Ltd, 2019.



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| Course Code: | CE760 |
| Course Title: | Construction Engineering and Information Laboratory |
| Credit: | 2 |
| Type: | Core |

Course Content

Deterministic and Probabilistic Inventory Models - Software applications.

Building Information Modelling (BIM) - Introduction to BIM, Model-based Cost Estimating, Construction Scheduling and 4D Simulation, Design Coordination, BIM to the Field

References

1. Eastman, C.; Teicholz, P.; Sacks, R.; Liston, K., BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors. New York: Wiley, 2011.
2. Dana K. Smith and Michael Tardif, Building Information Modeling: A Strategic Implementation Guide for Architects, Engineers, Constructors, and Real Estate Asset Managers, John Wiley & sons, Inc., 2009.
3. Willem Kymmell, Building Information Modeling: Planning and Managing Construction Projects with 4D CAD and Simulations. McGraw Hill Construction Series, 2008.

PROGRAMME ELECTIVES

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|----------------------|--------------------------------------|
| Course Code: | CE761 |
| Course Title: | Modern Construction Materials |
| Credit: | 3 |
| Type: | Elective |

Course Content

Aggregates: Introduction, Historical back ground of Light weight aggregate concrete, Artificial aggregates, Physical properties of aggregates, Light weight aggregate concrete, Applications of light weight aggregate concrete, Properties of green light weight aggregate concrete, Effect of size aggregate on the strength properties of LWAC made with palm oil shells, Recycled aggregate, Pre placed aggregate concrete.

Fibers in Concrete: Types of Fibers - Glass fiber reinforced concrete, Natural fiber reinforced concrete, Polymer Fiber Reinforced Concrete, Steel Fiber reinforced Concrete. Behavior - Workability, Mechanical and Physical properties of Fiber in reinforced concrete.

Special Concretes: High strength concrete, Effect of RHA on the properties of HSC, High performance concrete –applications, Self-Compacting Concrete, Concrete made with waste rubber, Special Concretes, Sulfur Concrete, Ferro cement, Geo synthetics, Nano Concrete, Changes in concrete with respect to time.



Steel construction, Types of steel used for construction, Methods of utilizing steel in construction, Advantages and Applications of steel in construction

Advanced Materials: Adhesives in construction industry-Acrylics, Bridge bearings, Industrial waste materials in concrete Rapid wall panels, Moisture Barriers, Polymer foams and polymers in Building Physics. Polymer concrete composites.

Reference

1. Adam M Neville, Properties of Concrete, 5th Edition, Longman Sc and Tech Publishers, 2012.
2. Kumar Mehta. P and Paulo J M Monteiro, Concrete Microstructure, Properties and Materials, McGraw Hill, 4th Edition, 2013.

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|----------------------|--|
| Course Code: | CE762 |
| Course Title: | Functional Efficiency of Building |
| Credit: | 3 |
| Type: | Elective |

Course Content

Environmental factors: Solar Control and shading devices, Louvre design; ventilation; introduction to lighting; units of light, color, lamps, luminaries, Day light design of general lighting schemes; Energy management and lighting - codal requirements. GRIHA rating to evaluate the environmental performance of a building.

Climatic design - Climatic factors, classification of tropical climates, site climate, microclimate of human settlements, ventilation requirements for health, mechanisms and estimation of natural ventilation, airflow patterns in building.

Thermal performances of buildings - Thermal comfort factors, comfort indices, thermal quantities, heat exchange in buildings, periodic heat flow. Mechanical and structural means of thermal control. Moisture control in buildings.

Propagation of sound, sound insulation absorption and transmission, reverberation, Design of floor, roofing and walling system for sound absorption and insulation. Design of auditoria Noise control in buildings.

References

1. Brown, G.Z. and DeKay, M., "Sun, Wind and Light - Architectural Design Strategies", John Wiley and Sons Inc., 3rd Edition, 2014.
2. Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2017.
3. Handbook on Functional Requirements of Buildings Part 1 to 4 SP: 41 (S and T) 1995



4. Majumdar, M (Ed), "Energy - Efficient Buildings" in India, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009.
5. Moore, F., Environmental Control Systems: Heating, Cooling, Lighting Paperback – International Edition, McGraw Hill Inc., 1993.
6. Tyagi, A.K. (Ed). "Handbook on Energy Audits and Management Tata Energy Research Institute", 2000.
7. “GRIHA Manual”, Ministry of New and Renewable Energy, Government of India, and The Energy and Resources Institute, TERI Press, New Delhi 2010.

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|----------------------|-------------------------------------|
| Course Code: | CE763 |
| Course Title: | Advanced Concrete Technology |
| Credit: | 3 |
| Type: | Elective |

Course Content

Introduction to concrete – Mineral and chemical admixtures – Structure of hydrated cement paste – Calcium Aluminate Cement – Cement Production quality control - Transition zone in concrete – measurement of workability by quantitative empirical methods – concrete properties: setting and hardening. Concrete Design mix for higher grades. Strength-Porosity relationship – Failure modes in concrete – plastic and thermal cracking – maturity concept to estimate curing duration - Elastic behavior in concrete- Creep, shrinkage and thermal properties of concrete.

Classification of causes of concrete deterioration – Permeability of concrete – durability concept: pore structure and transport process - Alkali-aggregate reactivity. Non-Destructive testing methods - Semi-destructive testing methods. Concreting under special circumstances – Special materials in construction – Concreting machinery and equipment – Sustainability in concrete - Future trends in concrete technology.

Reference

1. P. Kumar Metha and Paulo J. M. Monteiro., Concrete: Microstructure, Properties and Materials, Mc Graw Hill, Fourth Edition, 2013.
2. John Newman and Ban Seng Choo, Advanced Concrete Technology Part 1 to 4, Butterworth-Heinemann, First Edition, 2003.
3. Adam. M. Neville., Properties of Concrete, Wiley Publications, Fourth and Final Edition, 1996.
4. A. R. Santhakumar, Concrete Technology” Oxford University Press, 2018.
5. P. C. Aitcin, High Performance Concrete, E & FN SPON, 1998.



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|----------------------|---|
| Course Code: | CE764 |
| Course Title: | Disaster Mitigation And Management |
| Credit: | 3 |
| Type: | Elective |

Course Content

Meaning and types of hazards, disasters and catastrophes – Disaster Management; Earthquakes: causes and effects – measurements - earthquake zones India – vulnerability and microzonation; - volcanic hazards;

Landslides: Causes and effects – landslide prone zones in India –Cyclone: Origin and types - effects on land and sea – damage assessment; Flooding: Tsunami –Soil Erosion-Drought: Characteristics- Occurrence – Preventive measures

Emerging approaches in Disaster Management- Pre- disaster stage (preparedness) - Preparing hazard zonation maps, Predictability/forecasting& warning- Preparing disaster preparedness plan- Land use zoning- Disaster resistant house construction- Population reduction in vulnerable areas- Awareness

Emergency Stage - Rescue training for search & operation at national & regional level- Immediate relief- Assessment surveys - Post Disaster stage-Rehabilitation- Political Administrative Aspect- Social Aspect-

Economic Aspect- Environmental Aspect

Mitigation - Role of Media - Monitoring Management- Preventive Measures- A regional survey of Land Subsidence, Coastal Disaster, Cyclonic Disaster& Disaster in Hills with particular reference to India -Ecological planning for sustainability & sustainable development in India-Sustainable rural development

Soft Solutions for Disaster Management - Case studies - Earthquake, volcano and landslide - Flood prone area analysis and management – risk assessment – cyclones and floods - Drought and desertification

References

1. National Disaster Management Division (2004) Disaster Management in India - A Status Report, Ministry of Home Affairs, Government of India, New Delhi.
2. UNDRO (1995) Guidelines for Hazard Evaluation Procedures, United Nations Disasters Relief Organization, Vienna.
3. Nagarajan, R., (2004) Landslide Disaster Assessment and Monitoring, Anmol Publications, New Delhi.
4. Ramkumar, Mu, (2009) Geological Hazards: Causes, Consequences and Methods of Containment, New India Publishing Agency, New Delhi.

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|----------------------|---|
| Course Code: | CE765 |
| Course Title: | Construction Supply Chain Management |
| Credit: | 3 |
| Type: | Elective |



Course Content

Introduction to Construction supply chain management - Supply Chain Performance: Achieving Strategic Fit and Scope - Supply Chain Drivers and Metrics - Managing cross-functional drivers in supply chain - Sourcing Decisions in a Supply Chain - Pricing and Revenue Management in Supply Chain – Supply Chain Risks – Framework agreements- Information Technology in Supply Chain - Coordination in Supply Chain

Logistics Solution in Construction projects - Planning and control mechanisms of construction logistics and supply chain - Demand Forecasting in a Supply Chain - Aggregate Planning in a Supply Chain – Inventories in supply chain – Distribution networks – Transportation networks - Network Design in an Uncertain Environment – Global Sourcing – Procurement and Centralized Decision Making – Bulk Material Handling – Improvement Strategies for Effective Supply Chain Management

Contemporary opportunities and challenges for construction logistics and supply chain management in the context of sustainable development - Construction Supply chain case studies

References

1. William J. O' Brain, Carlos T. Formoso, Ruben Vrijhoef, Kerry A. London, Construction Supply Chain Management Handbook, CRC Press, Taylor & Francis group, 2008.
2. Stephen Pryke, Construction Supply Chain Management, Wiley BlackWell, 2009
3. Greger Lundesjo, Supply Chain Management and Logistics in Construction, Kogan Page, London Philadelphia, New Delhi, 2015
4. Sunil Chopra and Peter Meindl, "Supply Chain Management, strategy, planning, and operation" 6/e – PHI, 7th Edition, 2019
5. V.V. Sople, "Supply Chain Management, text and cases", Pearson Education South Asia, 2012

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|----------------------|---|
| Course Code: | CE766 |
| Course Title: | Forensic Engineering and Rehabilitation Techniques |
| Credit: | 3 |
| Type: | Elective |

Course Content

Failure of Structures: Review of the construction theory – performance problems – responsibility and accountability – case studies – learning from failures – causes of distress in structural members – design and material deficiencies – over loading.

Diagnosis and Assessment of Distress: Visual inspection – non-destructive tests – ultrasonic pulse velocity method – rebound hammer technique – ASTM classifications – pullout tests –



Bremor test – Windsor probe test – crack detection techniques – case studies – single and multistorey buildings – Fibre optic method for prediction of structural weakness. Environmental Problems and Natural Hazards: Effect of corrosive, chemical and marine environment – pollution and carbonation problems – durability of RCC structures – damage due to earthquakes and flood - strengthening of buildings – provisions of BIS 1893 and 4326.

Modern Techniques of Retrofitting: Structural first aid after a disaster – guniting - jacketing – use of chemicals in repair – application of polymers – ferrocement and fiber concretes as rehabilitation materials – rust eliminators and polymer coating for rebars - foamed concrete - mortar repair for cracks - shoring and underpinning - strengthening by pre-stressing. Case studies – buildings - heritage buildings - high rise buildings - water tanks – bridges and other structures.

References

1. Raikar, R. N., Learning from Failures – Deficiencies in Design, Construction and Service R&D Centre (SDCPL), Raikar Bhavan, 1987.
2. Dovkaminetzky, Design and Construction Failures, Galgotia Publication, New Delhi, 1991.
3. Shen-En Chen, R. Janardhanam, C. Natarajan, Ryan Schmidt, Ino-U.S. Forensic Practices - Investigation Techniques and Technology, ASCE, U.S.A, 2010.
4. C. Natarajan, R. Janardhanam, Shen-En Chen, Ryan Schmidt, Ino-U.S. Forensic Practices - Investigation Techniques and Technology, NIT, Tiruchirappalli, 2010.
5. Gary L. Lewis, Guidelines for Forensic Engineering Practice, ASCE, U.S.A., 2003.

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|----------------------|--|
| Course Code: | CE767 |
| Course Title: | Project Risk Analysis and Mitigation Techniques |
| Credit: | 3 |
| Type: | Elective |

Course Content

Risk analysis General – Importance of Risk, types of risks, quantifiable and un-quantified risks. Micro, market, project level risk analysis approach. Risk analysis and Management for projects (RAMP) – Identifying risk events. Probability distribution. Stages in Investment, life-cycle; determination of NPV and its standard deviation for perfectly co-related, moderately co-related and un-correlated cash flows. Dealing with uncertainties Sensitivity analysis, scenario analysis simulation, decision tree analysis, risk profile method, certainly equivalent method; risk adjusted discount rate method, certainty index method, 3 point estimated method, Projects - Delay analysis

Use of risk prompts, use of Risk Assessment tables, details of RAMP process, utility of Grading of construction entities for reliable risk assessment. Risk Mitigation – by elimination, reducing, transferring, avoiding, absorbing or pooling. Residual risk, mitigation



of un-quantified risk. Coverage of risk through CIDC's MOU with the Actuarial Society of India through risk premium such as (BIP) – Bidding Indemnity Policy (DIMO) – Delay in meeting obligation by client policy, (SOC) – Settlement of claims policy (LOP)- Loss of profit policy (TI). Transit Insurance policy (LOPCE) Loss of performance of construction equipment policy.

Reference

1. John Bartlet, Project Risk Analysis and Management Guide, APM Publishing Limited, 2004
2. Dr. Surendra Kumar Satya Prakashan, Industrial Engineering and Management of Manufacturing Systems.
3. RAMP Handbook by Institution of Civil Engineers and the Faculty and Institute of Actuaries Thomas Telford Publishing, London, 2014.
4. K. K. Chitkara, Construction Project Management, Tata Mcgraw Hill Publication, 3rd Edition, 2014.
5. Dr. V. K. Raina, Construction Management Practice, Shroff Publication, 2nd Edition, 2010.

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|----------------------|---|
| Course Code: | CE768 |
| Course Title: | Planning of Prefabricated Structures |
| Credit: | 3 |
| Type: | Elective |

Course Content

Types of prefabrication, prefabrication systems and structural schemes- Disuniting of structures- Structural behaviour of precast structures.

Prefabricated Structure Production – Yard planning, Equipment requirement, Shuttering and mould design, Stacking, Transportation & Erection. Dimensional tolerances- Erection of R.C. Structures, Total prefabricated buildings – Case Studies.

Prefabricated Structure Planning and Erection Methodologies - 1) Industrial Structures 2) Multistorey Buildings, 3) Bridges, 4) Underground Metros and Tunnels 5) Offshore structures – Case Studies.

Reference

1. Gerostiza C.Z., Hendrikson C. and Rehat D.R., “Knowledge based process planning for construction and manufacturing”, Academic Press Inc., 2012.
2. Kim S. Elliott, Precast Concrete Structures, CRC Press, 2nd edition, 2019.
3. Jack S. Goulding, Farzad Pour Rahimian, Offsite Production and Manufacturing for Innovative Construction: People, Process and Technology, Routledge, Taylor & Francis Group, 2019.



4. Hubert Bachmann, Alfred Steinle, Precast Concrete Structures, Wilhelm Ernst & Sohn., 2nd Edition, 2019.

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| Course Code: | CE769 |
| Course Title: | Safety in Material Handling at Construction |
| Credit: | 3 |
| Type: | Elective |

Course Content

Manual Material Handling

Preventing common injuries, lifting by hand, team lifting and carrying, handling specific shape machines and other heavy objects – accessories for manual handling, hand tools, jacks, hand trucks, dollies and wheel barrows – storage of specific materials - problems with hazardous materials, liquids, solids – storage and handling of cryogenic liquids - shipping and receiving, stock picking, dock boards, machine and tools, steel strapping and sacking, glass and nails, pitch and glue, boxes and cartons and car loading – personal protection – ergonomic considerations.

Lifting Tackles and Mechanical Material Handling

Fiber rope, types, strength and working load inspection, rope in use, rope in storage - wire rope, construction, design factors, deterioration causes, sheaves and drums, lubrication, overloading, rope fitting, inspection and replacement – slings, types, method of attachment, rated capacities, alloy chain slings, hooks and attachment, inspection, safe slinging practices – Testing procedures for wire rope slings, chain slings and lifting tackles like Shackles, eye bolts – Inspection and maintenance of lifting tackles, chain pulley block and slings.

Hoisting apparatus, types - cranes, types, design and construction, guards and limit devices, signals, operating rules, maintenance safety rules, inspection and inspection checklist – conveyors, precautions, types, applications. Powered industrial trucks, requirements, operating principles, operators selection and training and performance test, inspection and maintenance, electric trucks, gasoline operated trucks, LPG trucks – power elevators, types of drives, hoist way and machine room emergency procedure, requirements for the handicapped, types- Escalator, safety devices and brakes, moving walks – man lifts, construction, brakes, Inspection and examination of lift and hoist

Reference

1. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 2nd Edition, 2013.
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.

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| Course Code: | CE770 |
| Course Title: | Non Destructive Evaluation |
| Credit: | 3 |
| Type: | Elective |



Course Content

Surface Methods -Visual Inspection - Liquid Penetrant Testing - Magnetic Particle Inspection, Cover meter testing.

Volumetric Methods - Electro-Magnetic Methods - Acoustical Methods - Radiographic Methods - Thermal Methods - Optical Methods.

Applications In Construction Industry - Analysis of quality and durability of materials on building threats, break - downs and catastrophes. Testing of concrete in building structures. Testing of reinforcement in reinforced concrete structures (Radiographic testing and electromagnetic testing), Testing of walls, steel, wood and plastic of civil structures. Pipelines- Lifetime and quality assessments.

References

1. Non Destructive Testing Handbook, 4th Edition, 2019.

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| Course Code: | CE771 |
| Course Title: | Value Engineering |
| Credit: | 3 |
| Type: | Elective |

Course Content

Value Analysis - Value - Meaning of value, basic and secondary functions, factor contributing to value such as aesthetic, ergonomic, technical, and economic.10 Commandments of value analysis; value analysis team; principles of value analysis, elements of a job plan viz. orientation, Information, presentation. Implementation, follow up action, benefits of value analysis, various applications; assessing effectiveness of value analysis.

Factors governing project selection – Types of Projects-Life Cycle Costing (LCC) for Managing the Total Value

Life cycle costing - Forecasting of Capital as well as operating & maintenance costs, time value, present worth analysis, DCF methods, ROR analysis, sensitivity analysis. Different methods of performing value engineering.

Phases of Value Engineering:

Creative thinking and creative judgment- positive or constructive discontent. Tangible and Intangible costs of implementation - False material-labour and overhead saving, Relationship between savings and probability of success-Reliability estimation, System reliability-Reliability elements in series and parallel. General Phase, Information Phase, Function Phase – Type of costs, Evaluation of Functional Relationships. Checks for consistency-Function – cost-weight-matrix-VIP Index – High cost and Poor value areas. Creativity/Speculation Phase



– Rules of creativity-Brainstorming- Idea activators- Result accelerators. Evaluation Phase – Estimation of costs of ideas- Evaluation by comparison.

References

1. Value Engineering: Analysis And Methodology By Del Younke, 2003
2. Industrial Engg. & Mgt., O.P.Khanna, Dhanpat Rai Publ., 2008
3. Industrial Organization & Engg. Economics, T.R.Banga, S.C.Sharma, Khanna Publ., 2006
4. Arthur E Mudge, “Value Engineering”, McGraw Hill Book Company, 1989.
5. Richard J Park, “Value Engineering – A Plan for Inventions”, St.Lucie Press, London, 2017.
6. S S Iyer,” Value Engineering – A How to Manual”, 3rd edition, New Age Publishers, Chennai, 2009.

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| Course Code: | CE772 |
| Course Title: | Strategic Management in Construction |
| Credit: | 3 |
| Type: | Elective |

Course Content

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.

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

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.

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

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

Strategic Management Evaluation and control: Strategy implementation and evaluation control of strategic performance-performance gap, ROI, Budget and Financial Ratios, Strategy Audit.



References

1. David Langford, Steven Male, Strategic Management in Construction, 2nd Edition, John-Wiley and Sons, 2001.
2. Richard Fellows, Construction Management in Practice, 2nd Edition, Blackwell Science, 2002.

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| Course Code: | CE773 |
| Course Title: | Lean Construction Concepts, Tools and Practices |
| Credit: | 3 |
| Type: | Elective |

Course Content

Introduction – Lean concepts - Lean Principles – Types of Wastes - overview and review of project management and productivity, productivity measurement and forecasting

Lean Tools in Construction – Work sampling, Value Stream Mapping, Crew Balance chart, Last Planner System – Secondary Lean Tools – Lean rules- Training and Implementation for Lean systems - Six Sigma, Lean Six Sigma- Conceptual Models

Lean in Design, Supply Chain Management, Organizational Culture - Managing People, Integrated project delivery strategy, Information Technology applications, and Case studies.

References

1. Patricia Tzortzopoulos, Mike Kagioglou, Lauri Koskela, Lean Construction Core concepts and New Frontiers, CRC Press, 2020.
2. Larry Rubrich, An Introduction to Lean Construction: Applying Lean to Construction Organizations and Processes, WCM Associates LLC, 2012.
3. Lincoln H. Forbes and Syed M. Ahmed, Modern Construction: Lean Project Delivery and Integrated Practices, CRC Press, 2020.

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| Course Code: | CE774 |
| Course Title: | Quantitative Methods in Construction Management |
| Credit: | 3 |
| Type: | Elective |

Course Content

Introduction - Use of Operations Research in Civil Engineering and Managerial Decision making process. Introduction to Optimization Techniques and their application in Engineering Planning, Design and Construction. Various models; Objective function and constraints, convex and concave functions, regions and sets and concepts of probability and statistics.



Linear programming – Formulation of Linear optimization models, Civil engineering applications. Simplex method, special cases in simplex method, Method of Big M, Two phase method, duality, sensitivity analysis.

Transportation problems – Approximation method, Assignment problems – Hungarian Methods of Solution.

Dynamic programming – Bellman's principle of optimality. Other Techniques - Decision theory, Queuing theory and Games theory – Monte Carlo Simulation.

References

1. Hamdy A.Taha, Operations Research, Pearson Education India, 10th Edition, 2016.
2. Ravindran, Engineering Optimization - Methods and Applications, John Wiley & Sons, Inc., 9th Edition, 2011.
3. Vohra, N. D., Quantitative Techniques in Management, McGraw Hill Education, 5th Edition, 2017.
4. Wangner, H.M., Principles of Operations Management by, Prentice Hall India Learning Private Limited, 1980.
5. Hira and Gupta, S.Chand, Operation Research, S. Chand Publisher, 2007.

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| Course Code: | CE775 |
| Course Title: | Formwork Designs |
| Credit: | 3 |
| Type: | Elective |

Course Content

Introduction: Formwork and false work, Temporary work systems, Construction planning and site constraints, Materials and construction of the common formwork and false work systems, Special and proprietary forms, Slip form techniques.

Formwork – Design: Concrete pressure on forms, Design of timber and steel forms, Loading and moment of formwork.

Design of Decks and False works: Types of beam, decking and column formwork, Design of decking, false work design, Effects of wind load, Foundation and soil on false work design.

Special Forms: The use and applications of special forms.

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

Reference

1. Austin, C.K., Formwork for concrete, Cleaver - Hume Press Ltd., London, 3rd Edition, 1978.
2. Michael P. Hurst, Construction Press, London and New York, 2003.



3. Robert L. Peurifoy and Garold D. Oberiender, Formwork for Concrete Structures, McGraw-Hill, 4th Edition, 2010.
4. Tudor Dinescu and Constantin Radulescu, Slip Form Techniques, Abacus Press, Turn Bridge Wells, Kent, 2004
5. L&T Formwork Manual.