

**SCHOOL OF ENGINEERING**

**SYLLABUS AND COURSE STRUCTURE**

**M. TECH (CONSTRUCTION ENGINEERING AND MANAGEMENT)**

**ACADEMIC YEAR 2020-21**

**M.Tech. (Construction Engineering and Management)**

**Code & Subject Scheme**

**Semester I**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| MCI096A | Construction Project Management | 4 | 0 | 0 | 4 | C |
| MCI097A | Quantitative Methods in Construction Management | 4 | 0 | 0 | 4 | C |
| MCI098A | Advanced Concrete Technology | 4 | 0 | 0 | 4 | C |
| MCI099A | Construction Quality and Safety in Construction | 4 | 0 | 0 | 4 | C |
| MCI100A | Construction Management Lab | 0 | 0 | 4 | 4 | C |
| MCI007A | Seminar | 0 | 0 | 2 | 2 | C |
|  | **Total** | **16** | **0** | **6** | **22** |  |
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**Semester II**

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| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| MCI101A | Construction Economics and Finance | 4 | 0 | 0 | 4 | F |
| MCI102A | Construction Practices and Equipment | 4 | 0 | 0 | 4 | C |
| MCI103A | Construction Contract and Specifications | 4 | 0 | 0 | 4 | C |
| MCI104A | Durability and Repair of Concrete Structures | 4 | 0 | 0 | 4 | C |
| MCI105A | Construction Technology Lab | 0 | 0 | 4 | 4 | C |
| MCI013A | Seminar | 0 | 0 | 2 | 2 | C |
|  | **Total** | **15** | **0** | **7** | **22** |  |

**Semester III**

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| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| MCI106A | Infrastructure Development and Management | 4 | 0 | 0 | 4 | C |
| MCI107A | Sustainable Materials and Green Buildings | 4 | 0 | 0 | 4 | C |
|  | Elective-I | 4 | 0 | 0 | 4 | S |
|  | Elective-II | 4 | 0 | 0 | 4 | S |
| MCI016A | Dissertation Part – I | 0 | 0 | 12 | 12 | C |
|  | **Total** | **16** | **0** | **12** | **28** |  |

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| **Elective Subjects** | | | |
| MCI108A | Building Services and Maintenance Management | MCI112A | Formwork for Concrete Structures |
| MCI109A | Construction Data Modelling | MCI113A | Fire Engineering and Design |
| MCI110A | Heating, Ventilation, Air Conditioning (HVAC) Systems andtheir Applications | MCI114A | Construction Planning |
| MCI111A | Functional Efficiency of Buildings | MCI115A | Procurement Management |

**Semester IV**

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| **Code** | **Subject** | **Contact Hours/week** | | | **Total Credits** | **Type** |
| **L** | **T** | **P** |
| MCI023A | Dissertation Part – II | 0 | 0 | 28 | 28 | C |
|  | **Total** | **0** | **0** | **28** | **28** |  |

**SEMESTER-I**

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| **L-T-P** | **MCI096A-Construction Project Management** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* Students should be able to understand basics of construction project management.
* To understand the management regarding time, cost and materials.
* To understand the productivity in CPM & Measuring project progress & performance and Identification of risks and impact.

**Unit 1:**

Introduction to construction project management - CPM, PERT, PDM, LOB. Scope management, WBS, PDRI.

**Unit 2:**

Time and cost management, material related management - purchase & inventory control, time-cost-resource optimization, quality, safety - planning & control.

**Unit 3:**

Labor productivity variations, productivity improvement - work study.

**Unit 4:**

Measuring project progress & performance - EVA & ES.

**Unit 5:**

Identification of risks and impact. Management Information systems.

***Text Book:***

1. Prasanna Chandra, ***Projects Planning, Analysis, Selection, Implementation, and Review.* Bangalore: Tata McGraw Hill Publications,** 2019.

2. Sengupta B., Guha H. *Construction Management and Planning*. New Delhi: Tata McGraw Hill Publication.

***Reference book:***

1. Alan Twort C., Gordon Rees J. *Civil Engineering Project Management.* New York: Elsevier Publications.
2. Pilcher Roy. *Principles of Construction Management.* McGraw-Hill.

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| **L-T-P** | **MCI097A-Quantitative Methods in Construction Management** | **Credits: 4** |
| **4-0-0** |

**OBJECTIVES**

* Students should be able to understand concepts of probability & statistics, concepts of Linear programming and Dynamic programming.
* To understand the various theories for decision making and CPM/PERT techniques.

**Unit 1:**

Introduction and concepts of probability and statistics.

**Unit 2:**

Introduction and concepts of Linear programming, Transportation and assignment problems.

**Unit 3:**

Dynamic programming and Queuing theory.

**Unit 4:**

Decision theory and Games theory.

**Unit 5:**

Simulations applied to construction, Modifications and improvement on CPM/PERT techniques.

***Text Book***

1. [James J. Adrian](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22James+J.+Adrian%22&source=gbs_metadata_r&cad=8). *Quantitative Methods in Construction Management.* University of Michigan: American Elsevier Publishing Company, 2007.

***Reference Book***

1. J. F Woodward. *Quantitative Methods in Construction Management.* Macmillan, 1975.

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| **L-T-P** | **MCI098A-Advanced Concrete Technology** | **Credits: 4** |
| **4-0-0** |

**Objectives**

* Students should be able to relate their understanding regarding advance concrete technologies with the view of various properties of concrete.
* Finding out the techniques of concrete characterization.

**Unit 1:**

Hydration of cements and microstructure development.

**Unit 2:**

Mineral additives, Chemical admixtures and Rheology of concrete.

**Unit 3:**

Creep and relaxation, Shrinkage, cracking and volume stability and deterioration processes of concrete

**Unit 4:**

Special concretes and Advanced characterization techniques.

**Unit 5:**

Sustainability issues in concreting and Modeling properties of concrete.

***Text Book:***

# 1. [Zongjin Li](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Zongjin+Li&search-alias=stripbooks). *Advanced Concrete Technology*. Wiley Publication, 2011.

***References:***

1. Newman, J.B., Choo, B.S. *Advanced Concrete Technology, Constiturent Materials*. Butterworth-Heinemann, 2003.

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| **L-T-P** | **MCI099A-Construction Quality and Safety in Construction** | **Credits: 4** |
| **4-0-0** |

**Objective:**

Students should be able to relate their understanding regarding safety, injuries, assessment of quality in construction.

**Unit 1:**

Introduction to safety. Types of injuries, Factors affecting safety, Strategic Planning for safety provisions.

**Unit 2:**

Personal & Structural safety - Safety consideration during construction, demolition and during use of equipment.Recording injuries and accident indices. Method statement, SOPs, PPE, Inspections, Investigations.

**Unit 3**

Site safety programmes - JSA, JHA, Root cause analysis, meetings, safety policy, manuals, training & orientation. Safety legislation regard to violation.

**Unit 4:**

Introduction to quality, assurance, control and audit. Regulatory agent - owner, designer, contractor. Strategic Planning and control of quality during design and construction, Quality tools in construction projects, Customer satisfaction and QFD, Quantitative techniques in quality control, Quality assurance during construction, Inspection of materials and machinery.

**Unit 5:**

Assessing quality. Teachings/findings of Gurus - Concept and philosophy of TQM, 6Sigma, ISO Certification.

IS codes and standards regard to quality & safety.

***Text Book:***

# 1. [Brian Thorpe](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Brian+Thorpe%22&source=gbs_metadata_r&cad=8), [Peter Sumner](https://www.google.co.in/search?tbo=p&tbm=bks&q=inauthor:%22Peter+Sumner%22&source=gbs_metadata_r&cad=8).*Quality Management in Construction.* Gower Publishing, Ltd., 2004.

***Reference Book*:**

1. Bhattacharjee S. K. *Safety Management in Construction.* Khanna Publishers.

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| **L-T-P** | **MCI100A-Construction ManagementLab** | **Credits: 4** |
| **0-0-4** |

**List of Experiments:**

1.Analytical solution of construction project models.

2. Numerical solution of construction project models.

3. Application software for project planning, scheduling & control.

4. Programming exercises for estimation, network planning and control, LP in construction.

5. MATLAB Programming in linear and non-linear programming.

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| **L-T-P** | **MCI007A- Seminar** | **Credits: 2** |
| **0-0-2** |

**SEMESTER-II**

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| **L-T-P** | **MCI101A-Construction Economics and Finance** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

* Students should be able to relate their understanding regarding economics, taxation, risk, capital budgeting of various construction projects.
* To overcome the economics &finance related problems in construction.

**Unit 1:**

Engineering economics, Time value of money, discounted cash flow, NPV, ROR, PI.

**Unit 2:**

Basis of comparison, Incremental rate of return, Benefit-cost analysis, Replacement analysis, Break even analysis. Depreciation and amortization.

**Unit 3:**

Taxation and inflation, Evaluation of profit before and after tax. Risks and uncertainties and management decision in capital budgeting.

**Unit 4:**

Working capital management, financial plan and multiplesource of finance. Budgeting and budgetary control, Performance budgeting.

**Unit 5:**

Profit & Loss, Balance Sheet, Income statement, Ratio analysis, Appraisal through financial statements, International finance, forward, futures and swap.Practical problems and case studies.

***Text Books:***

1. [Steven J. Peterson](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Steven+J.+Peterson+MBA++PE&search-alias=stripbooks).*Construction Economics and Finance.*USA: Pearson, 2011.

***Reference Books:***

# 1. Danny Myers. *Construction Economics: A New Approach.* New Delhi: Routledge, 2008.

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| **L-T-P** | **MCI102A-Construction Practices and Equipment** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* Students should be able to relate their understanding of pre-stressing, prefabrication, special construction methods.
* Finding out the Characteristics and performances of equipment for major civil engineering activities.

**Unit 1:**

Form work design and scaffolding, slip form and other moving forms, Shoring, Reshoring, and Back shoring in multistoried Building construction.

**Unit 2:**

Prestressing, Steel and composites construction methods: Fabrication and erection of structures including heavy structures, Prefab construction, Industrialized construction, Modular coordination.

**Unit 3:**

Special construction methods: High rise construction, Bridge construction including segmental construction, incremental construction and push launching techniques.

**Unit 4:**

Factors affecting selection of equipment - technical and economic, Analysis of production outputs and costs

**Unit 5:**

Characteristics and performances of equipment for major civil engineering activities such as Earth moving, erection, material transport, pile driving, Dewatering, and Concreting.

***Textbooks:***

1. Mahlingam, B. *Construction Techniques, Equipment and Practices.* ARS Publications.

***References:***

1. Sharma S.C. “*Construction Equipment and Management*”, Khanna Publishers New Delhi,1988.

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| **L-T-P** | **MCI103A-Construction Contract and Specifications** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* Students should be able to relate their understanding of theProfessional Ethics, Duties and Responsibilities.
* To understand procedures of tendering, contracts & its administration and various acts along with case studies.

**Unit 1:**

Professional Ethics, Duties and Responsibilities of Parties. Owner’s and contractor’s estimate, Bidding Models and Bidding Strategies, Qualification of Bidders.

**Unit 2:**

Tendering and Contractual procedures and Indian Contract Act 1872.

**Unit 3:**

Definition of Contract and its Applicability, Types of Contracts, Clauses in Domestic and International Contracts - CPWD, MES, FIDIC, AIA, NEC, JCT, etc.

**Unit 4:**

Contract Administration, Delay Protocol, Change Orders Analysis, Claim Management and Compensation, Disputes and Resolution Techniques.

**Unit 5:**

Arbitration and Conciliation Act 1996 and Arbitration Case Studies.

***Text/Reference Books:***

# 1. Brian Greenhalgh. *Introduction to Construction Contract Management.* Routledge.2016.

# 2. Jimmie Hinze. Construction Contracts*.* McGraw Hill Education, 2013.

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| **L-T-P** | **MCI104A-Durability and Repair of Concrete Structures** | **Credits: 4** |
| **4-0-0** |

**Objective:**

* Students should be able to relate their understanding regarding various properties of concrete & pre-stressing.
* To understand Non-destructive testing, repairs, protection and retrofitting, durability based design of structures.

**Unit 1:**

Chemical composition of concrete, permeability and transport processes.

**Unit 2:**

Corrosion of reinforcement and pre-stressing steel in concrete.

**Unit 3:**

Carbonation, chloride attack, alkali-silica reaction, freeze-thaw attack, sulphate attack, acid attack.

**Unit 4:**

Effect of fire and high temperatures and seawater attack, cracking, weathering, biological processes.

**Unit 5:**

Non-destructive testing, repairs, protection and retrofitting, durability based design of structures.

***Text Book:***

1. Varghese P.C. *Maintenance, Repair & Rehabilitation and Minor Works of Buildings.* PHI Learning Pvt. Ltd., 2014.

***References Book***

# 1. Mays G.C.*Durability of Concrete Structures: Investigation, repair, protection*. CRC Press, 1991.

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| **L-T-P** | **MCI105A-Construction Technology Lab** | **Credits: 4** |
| **0-0-4** |

**List of Experiments:**

1. Tests related to quality control at site.

2. Tests related to quality control in-situ

3. Damage and deterioration assessment test.

4. Performance monitoring test of structures.

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| **L-T-P** | **MCI013A-Seminar** | **Credits: 2** |
| **0-0-2** |

**Semester III**

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| **L-T-P** | **MCI106A-Infrastructure Development and Management** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

To understand the Indian infrastructure practices, Govt. initiatives, infrastructure procurement, Selection procedure of concessionaires, Issues in financial closure, Stakeholder management, Financial Models, Risk management and Environmental Impact Assessment.

**Unit 1:**

Introduction to Indian Infrastructure. Govt. initiatives through various five year plans.

**Unit 2:**

Overview of various sectors of infrastructure and SEZ.

**Unit 3:**

Infrastructure procurement through Public-Private-Partnership.Sector-wise differences in policies, Concession agreement.

**Unit 4:**

Selection procedure of concessionaires, Issues in financial closure, Stakeholder management.

**Unit 5:**

Financial Models, Risk management, Environmental Impact Assessment, Case studies.

***Text book:***

# 1. Chowdhury [Amrita, Sarkar Debjani, Sister Maria Rashmi A.C.](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Amrita+Chowdhury+Sister+Maria+Rashmi%2C+Debjani+Sarkar&search-alias=stripbooks) *Development and Management of Urban Infrastructure in India.*

***References:***

# 1. Mani N. *Infrastructure Development and Financing in India.* Ingram short title, 2012.

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| **L-T-P** | **MCI107A-Sustainable Materials and Green Buildings** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

Students should be able to relate their understanding regarding basics of sustainability, various practices & properties of green building and energy efficient practices in India.

**Unit 1:**

Introduction and definition of Sustainability. Carbon cycle and role of construction material such as concrete and steel, etc. CO2 contribution from cement and other construction materials.

**Unit 2:**

Construction materials and indoor air quality. No/Low cement concrete. Recycled and manufactured aggregate. Role of QC and durability. Life cycle and sustainability.

**Unit 3:**

Components of embodied energy, calculation of embodied energy for construction materials. Exergy concept and primary energy. Embodied energy via-a-vis operational energy in conditioned building. Life Cycle energy use.

**Unit 4:**

Control of energy use in building, ECBC code, codes in neighboring tropical countries, OTTV concepts and calculations, features of LEED and TERI Griha ratings.

**Unit 5:**

Role of insulation and thermal properties of construction materials, influence of moisture content and modeling. Performance ratings of green buildings. Zero energy building.

***Text book:***

# 1. Charles J. Kibert. *Sustainable Construction: Green Building Design and Delivery.* John Wiley & Sons, 2012.

***References:***

1.  Indian Building Congress, Practical Handbook on Energy Conservation in Buildings, 1 st ed. Nabhi Publication, 2008.

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| **L-T-P** | **MCI016A-Dissertation Part - I** | **Credits: 12** |
| **0-0-12** |

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| **Elective Subjects** | | | |
| MCI108A | Building Services and Maintenance Management | MCI112A | Formwork for Concrete Structures |
| MCI109A | Construction Data Modelling | MCI113A | Fire Engineering and Design |
| MCI110A | Heating, Ventilation, Air Conditioning (HVAC) Systems andtheir Applications | MCI114A | Construction Planning |
| MCI111A | Functional Efficiency of Buildings | MCI115A | Procurement Management |

**Elective Subjects**

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| **L-T-P** | **MCI108A-Building Services and Maintenance Management** | **Credits: 4** |
| **4-0-0** |

**Objective:**

Students should be able to relate their understanding regarding fire protection, designing of lift system, building service system, Waste water handling system, electrical services and building maintenance management.

**Unit 1:**

Concepts of functional design of building for fire protection, service.

**Unit 2:**

Design of lift systems for optimum

**Unit 3:**

Building service system design.

**Unit 4:**

Control and intelligent buildings, HVAC, hot and cold water services,

**Unit 5:**

Waste water handling system, electrical services, building maintenance management

***Text Book***

1. Gahlot P.S., Sharma Sanjay. *Building Repair and Maintenance Management.* CBS Publishers & Distributors.

***References***

1. Varghese P.C. *Maintenance, Repair & Rehabilitation and Minor Works of Buildings.*DelhiIndia: PHI Learning.

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| **L-T-P** | **MCI109A-Construction Data Modelling** | **Credits: 4** |
| **4-0-0** |

**Objective:**

Students should be able to relate their understanding regarding modelling, performance analysis, rendering, animation, and visualizationof building elements.

**Unit 1:**

Accurately model building elements (walls, doors, windows, roofs, circulation, infill, etc.)

**Unit 2:**

Parametric model elements and geometries

**Unit 3:**

Analysis of Models-based (structural, energy use, and construction planning)

**Unit 4:**

Analysis and design of Performance-based driven and Rendering, animation, and visualization

**Unit 5:**

Time-phased design and design options.

***Text Books:***

# 1. Woodbury Robert. *Elements of Parametric Design.* Routledge, 2010.

***Reference:***

1. Jonathan T. Ricketts, Frederick S. Merritt. *Building Design and Construction Handbook*. New York:McGraw Hill, 2000.

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| **L-T-P** | **MCI110A-Heating, Ventilation, Air Conditioning (HVAC) Systems and their Applications** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

Students should be able to relate their understanding of heating system, ventilation, indoor air quality, air conditioning in buildings.

**Unit 1:**

**Heating Systems -**Forced-air system components, Radiant heating systems, Heat pump equipment, Air source heat pumps, its efficiency, Geothermal heatpump, its efficiency ,

**Unit 2:**

Furnace equipment, measures of efficiency for furnaces, Electric Integrated Systems, Unvented Fuel-Fired Heaters.

**Unit 3:**

**Ventilation and Indoor Air Quality -** Supplying outside air from air leaks, Supplying outside air from inlet vents, Supplying outside air via ducted make-up air, Dehumidification-ventilation systems, Heat recovery ventilators – Radon – passiveand active radon resistant construction - testing for radon.

**Unit 4:**

**Air-conditioning -** Air-conditioners, Seer rating, Variable speed units, Installation of air-conditioners.

**Unit 5:**

**HVAC Systems –** Sizing, Temperature controls, Zoned HVAC systems, Coolingequipment selections.

***Text Book***

# 1. Nandan Shivendra, Trivedi Rishikesh, Kant Satyjeet. *Heating Ventilation, Air Conditioning And Refrigeration.*

***References***

# 1. Vedavarz A., Kumar S., Hussain M.*Heating, Ventilation and Air Conditioning Handbook.* US: Industrial Press Inc, 2006.

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| **L-T-P** | **MCI111A-Functional Efficiency of Buildings** | **Credits: 4** |
| **4-0-0** |

**Objective:**

Students should be able to relate their understanding of GIS through Data Representation, Storage, Quality and Standards, GIS Data Processing, Analysis and Modeling in construction management.

**Unit 1:**

**Introduction: Definitions of GIS** – Components of GIS – Geographic data presentation: maps –mapping process – coordinate systems – transformations – map projections – geo referencing -data acquisition.

**Unit 2:**

**Geographic Data Representation, Storage, Quality and Standards**: Storage –Digitalrepresentation of data – Data structures and database management systems – Raster datarepresentation – Vector data representation – Concepts and definitions of data quality –Components of data quality – Assessment of data quality – Managing data errors – Geographicdata standards.

**Unit 3:**

**GIS Data Processing, Analysis and Modeling**: Raster based GIS data processing – Vectorbased GIS data processing – Queries – Spatial analysis – Descriptive statistics – Spatialautocorrelation – Quadrant counts and nearest neighbor analysis – Network analysis – Surfacemodeling – DTM.

**Unit 4:**

**GIS Applications**: Applications of GIS in Environment monitoring – Natural hazardmanagement, Transport Planning, Analysis and monitoring. Use of softwares related to GISapplications in Transportation Engineering.

**Unit 5:**

**Case studies.**

***Text Books:***

1. Lo, C.P., Yeung A.K.W. *Concepts and Techniques of Geographic Information Systems.* Prentice Hall of India, New Delhi, 2006.

***Reference Books:***

1. Burrough, P.A. *Principles of Geographical Information Systems.* Oxford Publication, 1998.

2. Clarke, K. *Getting Started with Geographic Information Systems*, Prentice Hall, New Jersy, 2010.

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| **L-T-P** | **MCI112A-Formwork for Concrete Structures** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

Students should be able to relate their understanding regarding detailed practices of formwork carried out in construction.

**Unit 1:**

Requirements and selection for Formwork , Formwork Materials, such as Timber, Plywood, Steel, Aluminum Form, Plastic Forms, and Accessories, Horizontal and Vertical Formwork Supports;

**Unit 2:**

Formwork Design Concepts, Illustration of Formwork system for Foundations, walls, columns, slab and beams and their design.

**Unit 3:**

Formwork for Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower. Formwork for Bridge Structures, Flying Formwork such as Table form, Tunnel form.

**Unit 4:**

Slipform, Formwork for Precast Concrete, Formwork Management Issues pre award and post award.

**Unit 5:**

Formwork failures-causes and Case Studies in Formwork Failure, Formwork issues in multi-story building construction.

***Text/Reference books:***

# 1. Oberlender Garold, Peurifoy Robert. *Formwork for Concrete Structures*. Mc Graw Hill Education, 2010.

2. Kumar Neeraj Jha.*Formwork for Concrete Structures.* Mc Graw Hill Education, 2017

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| **L-T-P** | **MCI113A-Fire Engineering and Design** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

Students should be able to relate their understanding regarding fundamentals of fire engineering with view of fire protection techniques, passive fire protection practices, fire response of various building materials in construction.

**Unit 1:**

Fire engineering: fundamentals of fire science, fire dynamics, hazard mitigation, and safety; codes, standards, rules and fire safety regulations; thermodynamics, thermofluids, heat and mass transfer; human behavior in fire and urban planning; fire testing methods for materials; large-scale fire testing.

**Unit 2:**

Fire protection - current methods in fire safety engineering; mechanics of repair; mitigation of fire damage by due design, and construction; industrial fire safety.

**Unit 3:**

Passive fire protection: analyzing the thermal effects of fires on buildings and designing structural members. Introduction to active fire protection.

**Unit 4:**

Structural fire engineering: fire behavior and scenarios, heat transfer to the structure, structural response and stability under thermo-mechanical loads; fire safety design; mechanical properties of structural materials at elevated temperatures; fire response of steel, concrete, fiber reinforced polymers, high-performance materials etc.

**Unit 5:**

Computational procedures to predict structural behavior under fire conditions; structural fire resistance based on theoretical/ empirical relationships; performance-based fire engineering; strengthening/ repair of structures.

***Text Book:***

# 1. John A Purkiss. *Fire Safety Engineering Design of Structures*, Laxton's Publisher, 1996.

***References:***

# 1. Kevin J. LaMalva.*Structural Fire Engineering.* American Society of Civil Engineers, 2018.

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| **L-T-P** | **MCI114A-Construction Planning** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

Students should be able to relate their understanding regarding planning, scheduling, resources management, project cash flow and controlling of projects in construction management.

**Unit 1: Project Planning**

Introduction, Project Planning Steps, Work Breakdown Structure (WBS), Project Activities, Activities Relationships, Drawing Project Network, Estimating Activity Duration and Direct Cost

**Unit 2: Project Scheduling**

The Critical Path Method, Calculations for the Critical Path Method, Activity-On-Arrow, Networks Calculations, Precedence Diagram Method (PDM) , Time-Scaled Diagrams , Schedule Presentation , Criticisms to Network Techniques

STOCHASTIC SCHEDULING**:** Scheduling with Uncertain Durations, Program Evaluation and Review Technique , Criticism to Program Evaluation and Review Technique

**Unit 3: Resources Management**

Resource Definition, Resource Management, Resource Allocation, Resource Aggregation (Loading), Resource Leveling (Smoothing) , Method of Moments for Resource Smoothing, Heuristic Procedure for Resource Smoothing , Scheduling with Limited Resource, Case Study

PROJECT TIME-COST TRADE-OFF**:**  Time-Cost Trade-Off, Activity Time-Cost Relationship, Project Time-Cost Relationship, Shortening Project Duration

**Unit 4: Project Cash Flow**

Contract Cash Flow, Construction Project Costs , The S-Curve , Project Income (Cash-in) , Calculating Contract Cash Flow , Minimizing Contractor Negative Cash Flow, Cost of Borrowing (Return on Investment), Project Cash Flow , Project Profitability Indicators , Discounted Cash Flow , Present Value, Net Present Value (NPV), Internal Rate of Return (IRR)

**Unit 5: Project Control**

Problems that may arise During Construction, Schedule Updating, Earned Value Management

***Text Book:***

# 1. Shaw R., Kumar P.*Construction Planning & Management*, Techno World, 2018.

***References:***

# 1. Gahlot P.S., Dhir B.M. *Construction Planning and Management.* New Age International Publishers, 2018.

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| **L-T-P** | **MCI115A-Procurement Management** | **Credits: 4** |
| **4-0-0** |

**Objectives:**

This course will introduce students to purchasing and materials management by learning the planning production process, master scheduling, material requirements, and forecasting material demands and inventory levels. This course is designed to build on the student’s knowledge of how effective material management improves supply chain performance.

**Unit 1:Purchasing and Procurement Overview**

Introduction, Objective of Procurement ,Course Introduction, Purchasing and Procurement Introduction, Roles & Responsibilities, Contract Monitoring Introduction, Risk Management and Mitigation

**Unit 2: Procurement and Contract Management**

Contractual relation and contract management, various parties involved, contracts, types of contract, disputes and Arbitrations

**Unit 3: Key Procurement Issues**

Quality and procurement, quality management, inventory management, lead time and time compression, Price and total cost, negotiations

Procurement Process: Plan, conduct, administer the contract and close outs, delegation of authorities

**Unit 4: Procurement of Services**

Supplier selection and evaluation, supplier evaluation and methods

Methodologies, legal issues and forms and samples for: Procurement Management of Architectural and Engineering Services, professional and technical services, construction services

**Unit 5:Procurement and Contract Management**

Electronic procurement, Measuring procurement performance, bench marking in procurement and supply, Procurement of goods and services in Indian Context, Global procurement case study

***Text Book:***

# 1. Lysons Kenneth, Farrington Brian. *Procurement and Supply Chain Management*, Pearson, 2016.

***References:***

# 1. Baily Peter, Crocker Barry, Farmer David.*Procurement and Principles Management.* Pearson Education, 2018.

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| **L-T-P** | **MCI023A – Dissertation Part - II** | **Credits: 28** |
| **0-0-28** |