Veermata Jijabai Technological Institute, Mumbai.
Master of Technology

M.Tech
(Civil Engineering with specialization of Construction Management)

From 2009 to May 2014
M Tech (Semester I)
(Civil Engineering with specialization of Construction Management)

### Theory Courses

<table>
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<th>Hr/Week</th>
<th>Credits</th>
<th>Examination Scheme (Evaluation in % Weightage)</th>
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### Co-curricular Activities

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|-------------|-----------------|---------||
|             |                 | L       | T |
| CC4311      | Industry Interaction | -       | 2  |
| CC4312      | E-library       | -       | 2  |
| CC4313      | Internet        | -       | 2  |</p>
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M Tech (Semester II)
(Civil Engineering with specialization of Construction Management)

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(Civil Engineering with specialization of Construction Management)

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**Abbreviations:**

**Notes:**
TA for Theory and Laboratory courses shall carry 50 marks

IST: One mid semester test (40 marks, Two hour duration).

ESE(W) shall be of 100 marks and of 3 hours, ESE(P) and ESE(O) shall be decided as per course requirement. ESE(O) and ESE (P) shall together carry 50 marks.
CE 0411 Principles and practice of management

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**Course Outcomes:**

- C01 Able to apply fundamental principles of management and behavioural theories for managing employee’s behaviours.
- C02 Able to analyze what motivates employees and adopt appropriate motivation strategies.
- C03 Able to understand the strategic and policies of planning and make planning effectively.
- C04 Able to initiate, manage and implement changes in organization.

**Relevant Programme Outcomes:**

- PO6. An ability to lead multidisciplinary teams.
- PO7. An understanding of management principles with the consideration of social, Economical and financial aspects.

**Course Content:**

**Management**

Need, what is it, systems approach, and emergence of management thought, contributions of Fredrick Taylor, Henry Fayol, emergence of behavioral sciences, and that of the modern management thought.

**Construction Management**

Need, nature of construction industry, scope and functions of construction management

**Planning**

Planning process, objectives, strategies and policies, making planning effective

**Organizing**

Nature and purpose, types of organizations, organizational behavior, informal organizations, organizational climate, group decision making, making organizing effective

**Staffing**

Nature and purpose, selection, appraisal, organizational development

**Leading**

Managing and human factor, motivation, leadership, team development, communication, managing conflicts, qualities of project manager

**Controlling**

Process of controlling, direct and indirect control.
References:
- Koontz, O'Donnel & Weihrich, Management, McGraw Hill
- Dharwadkar P P, Management in Construction Industry, Oxford & IBH
- Luthans, Organization Behavior, McGraw Hill

CE 0412 Legal aspects of construction

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<th>Course Name</th>
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Course Outcomes
C01 Capable of handling the legal issues faced by the construction Industries and Government bodies.
C02 Analyze the trade union problems, workers problem based on legal provisions.
C03 Capable of preparing and analyzing the national and International level Contract documents and tenders.

Relevant Programme Outcomes:
PO4. An ability to use systems approach to formulate, analyse and seek solutions to relevant problems
PO7. An understanding of management principles with the consideration of social, economical and financial aspects

Course Content:

Construction through contracts
Types, critical comparison, bid cycle, tender and contract documents, contract conditions, study of contract documents of FIDIC, State PWD and CPW

Indian Contract Act
Need, provisions, scope for modifications / improvement

Contract administration
Deviations and extras, claims and their management, disputes and dispute resolution methods, Arbitration and Reconciliation Act

Laws applicable to construction activity
Need and broad provisions of:
Industrial Disputes Act, Workmen's Compensation Act, Employer's Liability Act, Payment of wages Act, Contract Labour Act, Minimum Wages Act, Inter-state Migrant workmen act and other acts introduced from time to time

References:
- Patil B S, Legal Aspects of Building & Engineering Contracts
Course Code | Course Name                      | Hr/Week | Credits | Examination Scheme (Evaluation in % Weightage) |
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             |                                 | L  T  P | TA      | IST   ESE Total ESE (W) (hrs)                  |
CE0413       | Advanced construction techniques | 3  -  - | 3       | 20    20  60  100 3                            |

Course Outcome:

C01 Develop skill of choosing the correct Construction techniques, materials for a concern construction projects.
C02 Capable to prepare Method statements for large and heavy construction projects.
C03 An ability to select correct construction techniques for site conditions and make use of suitable construction materials.

Relevant Programme Outcomes:

PO1. An ability to evaluate and gauge appropriateness of construction technologies
PO3. An ability to foresee & formulate problems and select and apply appropriate problem solving approach

Course Content:

**Method statement for large and heavy Engineering projects:**
Method statement for major activities like excavation, concreting, steel fabrication and erection for projects like earthen dams, tunnels, composite structure hydropower projects, nuclear power plant, refineries and other industrial projects like cooling tower, silos, and Chimney

**Concrete construction for heavy Engineering projects:**
Selection of equipments for batching, mixing, transporting, placing and compacting for various types of jobs, safety measures during concreting, special concretes and mortars, preplaced aggregate concrete, roller compacted concrete, concreting under water, concreting in different weather condition.

**Prefabricated Construction:**
Planning for pre-casting, selection of equipment for fabrication, transport and erection, quality measures, safety measure during erection.
Steel Construction:-
Planning for field operation, selection of equipment and erection tools and methods of welding, tools and methods of cutting and joining, safety measures during fabrication and erection.

Bridge Construction: - Launching of bridges by incremental launching, using false work, and balanced cantilever construction method.

Ground Improvement Techniques:-
Soil distribution in India, Reclaimed Soils, selection for field compaction procedures, compaction quality control, stone column, sand drain, diaphragm wall, soil reinforcement, thermal methods, improving rock stability and quality.

Formwork:-
Requirement of formwork, loads carried by formwork, types of formwork such as timber formwork, Steel formwork, patent formwork, modular shuttering, slip forms, steel scaffolding.

Intelligent Buildings:
Historical Context, High technology: - Energy efficiency, life safety systems, Telecommunications systems, workplace automation and typical services.

Case Studies for heavy Construction Projects

Reference Books:-
1. Thomas Baron, Erection of steel structures
2. Stubbs, handbook of heavy Construction
3. Mahesh Verma, Construction Equipment and its planning & applications
4. R.L. Purify & Ledbetter, Construction Equipment and planning, McGraw Hill
5. Wadell, Concrete Construction Handbook
6. Dr. P. Purushothamra Raj, Ground Improvement Techniques, Laxmi Publications
7. Punnoswami, Bridge Construction
8. Journals of Civil Engineering and Construction Engineering
HM 0311 COMMUNICATION SKILLS- I

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**Course Outcomes:**
- C01 Able to communicate well by speaking, listening and writing.
- C02 Able to write the research paper and deliver the presentation

**Relevant Programme outcome:**
- PO6. An ability to lead multidisciplinary teams.
- PO8. A skill for listening and communicating convincingly.

**Course Content:**
2. Listening Skill: Barriers to listening, Listening & Note making.

**Books Recommended:**
- Effective Technical Communication- M.Ashraf Rizvi (McGraw Hill)
## CE 1411 Project management laboratory I

**Scheme**

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**Course Outcome:**

C01 Student will be able to read, prepare the various types of drawings, Bar charts etc.
C02 Able to prepare the activity logic sequence and calculation of network duration and float analysis by using suitable software’s / manually.

**Relevant Programme Outcome:**

PO5. An ability to harness ICT tools including prediction and modelling

**Course Content:**

The laboratory includes an assignment of preparation of plans for construction of a facility using architectural drawings and also working drawings giving structural details. The plan shall include

- List of activities
- Quantity estimation for activities
- Method statement for complex activities
- Activity logic sequence table
- Estimates of duration (including computations)
- Preparation of activity on link and/or activity on node network
- Calculation of network duration and float analysis
### CE 1412 Computer laboratory

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**Course Outcomes:**

C01 An ability to develop spreadsheets and database management systems

**Programme Outcomes:**

PO5. An ability to harness ICT tools including prediction and modelling

**Course Content:**

Use of spreadsheet and data base application software for performing various functions of civil engineers as mentioned below is to be demonstrated

- Quantity Estimation
- Rate Analysis
- Bid preparation
- Material and supplier information
- Employee / equipment information etc.
CE 1413 Quantity surveying & estimating laboratory
Scheme

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Course Outcomes:
C01 An ability to perform cost estimates related to Civil Engineering Projects.
C02 An ability to plan and prepare design and construction documents, such as specification, contracts and construction schedules.

Relevant Programme Outcomes:
PO1. An ability to evaluate and gauge appropriateness of construction technologies
PO5. An ability to harness ICT tools including prediction and modelling

Course Content:
The laboratory includes detailed study of architectural and working RCC drawings of the structure, estimation of quantities, preparation of detailed estimates, and use of provisional sums, day works and contingencies in the estimate.
For estimation, structures such as high rise buildings, flyovers, bridges, commercial structures, industrial structures may be considered.
CE 2411 SEMINAR- I
Scheme

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Course Outcome:

C01 Able to understand the reading, understanding the research paper and able to develop skill to summarize it with optimum words.
C02 Able to give presentation on allotted research topic.

Programme outcome:

PO8. A skill for listening and communicating convincingly.
PO9. An ability to lifelong learning technological advances in construction technologies and management methodologies.

Course Content:
Students are required to select at least two research papers as a particular topic published in referred journal on the said topic. Students are expected to study and understand the contents and prepare a summary report about the contents of the papers and will present a seminar.
CE 0421 Construction resource management

Scheme

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Course outcome

- C01 Able to Prepare Inventory analysis and make purchase decisions.
- C02 Able to plan for Equipments and material requirements.
- C03 Able to monitor material, construction equipment movement and control.
- C04 Able to carry out the Human resource Management efficiently.

Programme Outcome:

- PO1. An ability to evaluate and gauge appropriateness of construction technologies
- PO7. An understanding of management principles with the consideration of social, economical and financial aspects

Course Content:

Human Resources Management
Staffing, recruiting, orientation and training, performance evaluating, merit rating
Labour Management: Strikes and lockouts, collective bargaining, grievances and grievance settling procedure, labour welfare

Equipment Management
Mechanization on construction projects, selection of major and minor equipment, production estimating, sizing and matching of equipment
Sources of construction equipment: purchase, rent and lease, old and new equipment
Economics of equipment, useful / economic life of equipment, equipment operation and service, maintenance, depreciation, obsolescence and replacement
Equipment management systems, organizations, record keeping, training to operators

Materials Management
Importance, Estimation of materials, Classification and codification, ABC analysis
Purchase function: legal aspects of purchase, inventory control, concept of EOQ
Stores management, minimizing wastage
Material management systems, Organizations, record keeping
References:
Varma Mahesh, Construction Equipment, its Planning & Application, Metropolitan & Co
- Gopalkrishnan, Materials Management
- Nunnally, Managing construction equipment, Prentice Hall

CE 0422 Project financing

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<th>Course Code</th>
<th>Course Name</th>
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Course Outcomes:
- C01 Able to understood the basic Accounting principles and prepare financial statements
- C02 Able to Estimate the Project Cash Flows.
- C03 Able to Perform financial Analysis using various tools.
- C04 Selecting appropriate sources of Project Financing.
- C05 Able to take Investment decisions.

Programme Outcomes:
- PO3. An ability to foresee & formulate problems and select and apply appropriate problem solving approach
- PO4. An ability to use systems approach to formulate, analyse and seek solutions to relevant problems
- PO7. An understanding of management principles with the consideration of social, economical and financial aspects

Course Content:

**Basic accounting mechanics**
Generally accepted accounting principles, books of original entry

**Preparation of financial statements**
Income statement, balance sheet

**Techniques of financial analysis**
Statement of changes in financial position (working capital / cash flow / total resources basis)
Ratio analysis

**Project financing**
means, norms, and policies of financial institutions

**Long term investment decisions**
cash flow estimates, evaluating techniques, alternative selection, basic concepts of analysis of risk & uncertainty, cost of capital, lease financing

**Management of current assets**
Planning, financing and control of working capital, management of cash, receivables management,
inventory management

References:
- Bhattacharya & Dearden, Accounting for management, Vani Educational Books
- Prasanna Chandra, Financial Management
CE 0423 Advanced project management

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<tr>
<th>Course Code</th>
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Course Outcomes:
- C01 Able to carry out the variance analysis and use appropriate measures for Cost control, Time control.
- C02 Able to perform resource scheduling, planning, and time cost trade off.
- C03 Develop analytical skills for planning and for interpretation of progress data to develop awareness skills regarding control measures
- C04 Able to use tools required for Risk management.

Programme outcome:
- PO3. An ability to foresee & formulate problems and select and apply appropriate problem solving approach
- PO4. An ability to use systems approach to formulate, analyse and seek solutions to relevant problems
- PO7. An understanding of management principles with the consideration of social, economical and financial aspects
- PO10. An understanding of professional and ethical responsibility.

Course Content:
Project management: scope and framework, agencies involved, their relationships and scope

Project Planning: Plan development process, precedence diagrams with overlapping relationships, network analysis, master network and sub-nets

Resource scheduling: resource aggregation, allocation, concept of leveling and smoothening, line of balance, float factor, issues involved in multi project multi resource scheduling, time-cost tradeoff: simple and complex

Project organization: structure and development, resource organization, demobilization

Project monitoring: progress reporting, alarm reports, review meetings, updating plans
Project control: control system framework, baselines, codification

Scope control: extras, variations and additional work

Time control: reasons for schedule delays, productivity control measures

Cost control: variance analysis, s-curves, control measures

Quality control and assurance: tools and procedures

Safety: common causes of accidents, occupational health hazards, general measures to ensure safety and safe environment

Risk management: project risks, tools of assessment and methods of mitigation

Information systems: PMIS, integrated approach
HM 0321 COMMUNICATION SKILLS- II

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Course Outcomes
- C01 Know the essentials of preparation of resume, presentations etc..
- C02 Make effective oral presentations.
- C03 Understanding the topics such as time management, stress management, leadership etc.

Programme Outcomes:
- PO6. An ability to lead multidisciplinary teams.
- PO8. A skill for listening and communicating convincingly.

Course Content:
1. Interview: Pre-Interview Preparation, Interview Question Answer, Resume & Job Application, Group Discussion, Telephone Interviews.
2. Presentation Skills: Planning, preparing, Organizing, Delivery, Feed Back.
3. Seminar Presentation on the following Topics:
   - Time Management
   - Motivation
   - Negotiation & Conflict Management
   - Stress Management
   - IPR
   - Transactional Analysis
   - Leadership
   - Presentation Through Video conferences

Books Recommended:
Effective Technical Communication- M.AshrafRizvi (McGraw Hill)
### CE 1421 Project management laboratory II

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**Course Outcome:**
- C01 Preparation of plans and schedules using project management software.
- C02 Use of software to develop applications on cash flow generation, resource planning and variance analysis.

**Programme Outcome:**
- PO3. An ability to foresee & formulate problems and select and apply appropriate problem solving approach
- PO5. An ability to harness ICT tools including prediction and modelling
- PO6. An ability to lead multidisciplinary teams.

**Course Content:**
The laboratory includes use of project management software to develop a plan with overlapping relationships from the activities defined in PM laboratory I.

Application of software shall be demonstrated for:
- Cash Flow generation
- Resource leveling
- Updating of networks
- Variance analysis
CE 1422 Material testing laboratory

Course Outcomes:
- C01. Able to determine the properties of ingredients of concrete
- C02. Able to determine the properties of sand, bricks, steel, bitumen etc.
- C03. Design a mix ratio for required grade of concrete or bituminous mixes.

Programme outcomes:
- PO2. An ability to critically analyse engineering problems to facilitate theoretical and practical research
- PO10. An understanding of professional and ethical responsibility.

Course Content:
Testing of key materials such as cement, sand, aggregates, concrete, blocks, bricks, steel, asphalt, bitumen, etc. is necessary before use. To understand sub soil strata, tests on soil samples are also essential.
Performing laboratory tests on such materials with the use of advanced testing facilities and study of relevant IS Codes for sampling and testing will be included in the assignments.
CE 1423 Maintenance management laboratory

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Course Outcomes:
- C01 Demonstrate the various types of distress in concrete structures.
- C02 Identify the effects due to climate, temperature, chemicals, wear and erosion on structures.
- C03 Analyze the failures in structure due to design and construction errors.
- C04 Able to prepare Structural audit report by carrying out Condition survey.

Programme Outcome:
- PO2. An ability to critically analyse engineering problems to facilitate theoretical and practical research
- PO3. An ability to foresee & formulate problems and select and apply appropriate problem solving approach

Course Content:
The laboratory course comprises of study of Maintenance Management System for building projects such as hospitals, five star hotels, educational complexes, housing colonies and also other civil engineering projects like tunnels, bridges, flyovers, etc. The report of one such project will include structural audit and condition survey, organization set up, routine inspection, periodic inspections, procedures to be used for addressing complaints, registration of contractors, approvals, budgets, etc.
## CE 2421 SEMINAR II

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### Course Outcome:

C01  Able to understand the reading, understanding the research paper and able to develop skill to summarize it with optimum words.

C02  Able to give presentation on allotted research topic.

### Programme outcome:

PO8. A skill for listening and communicating convincingly.

PO9. An ability to lifelong learning technological advances in construction technologies and management methodologies.

### Course Content:

Students are required to select a topic in relevant area (new equipment/new process/new design methodology etc.). Students should review literature through Journal Papers, Manufacturer’s catalogues etc., Prepare a report & present a Seminar.
ELECTIVE
CE0451 Value Management

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Course outcomes:
- C01 Able to appreciate concept of value to consumer
- C02 Able to conduct value engineering exercise for a constructed facility
- C03 Able to prepare a report of value engineering exercise
- C04 Able to work out life cycle costs of facility
- C05 Able to appreciate importance of energy consumption during construction and operation of a facility

Programme outcome:
- PO2. An ability to critically analyse engineering problems to facilitate theoretical and practical research
- PO4. An ability to use systems approach to formulate, analyse and seek solutions to relevant problems

Course Content:

Introduction
Definitions: Value, value engineering, value analysis, value management, Habits, Roadblocks & attitudes and their relation to value engineering
Function Analysis
Function & its role in achieving value, function in terms of its cost & worth, Graphical function analysis, function analysis system technique
Creative thinking
creative people, creative processes, conducting creative session
Life cycle costing
purpose& implications, economic principles for life cycle costing, types of life cycle costs.
Energy
Energy resources & consumption, energy cost escalation, sources of energy supply, end use of energy, energy embodiment of construction materials, buildings, infrastructures facilities & energy systems, energy models, factors affecting energy consumption

References:
- Value Engineering; L.W. Zimmerman, G.D.Hart, CBS publishers & distributor
- Value analysis in design & Construction, O’brien, J J, McGraw Hill
- Techniques of Value Analysis & Engineering; L.D. Miles; McGraw Hill
CE0452 Construction Marketing
Scheme

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<th>Course Code</th>
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Course Outcomes

- C01  Able to develop a product and brand the same.
- C02  Able to price the products keeping the competition and other factors in mind.
- C03  Design suitable advertisement and promotional strategies.
- C04  Assess understand and influence purchase behavior of individual and organizational consumers.
- C05  Gain the skill of developing and price new products that meet customer needs.

Programme Outcome:

- PO6. An ability to lead multidisciplinary teams.
- PO10. An understanding of professional and ethical responsibility

Course Content:

Marketing environment: impact of internal and external environment, socio-economic, demographic, political, technological and legal environment, nature and impact of competition, marketing strategy

Basics of marketing: features of marketing of consumer goods, industrial products and services, product and marketing, marketing organization structures, societal role of marketing

Marketing projects: characteristics of construction projects, sources of information, pre-qualification documents, bid preparation – estimating, provision for overheads and profit, bidding models, bidding strategy, pre-bid meetings, negotiation, legal aspects, impact of joint ventures, collaborations and alliances, impact of globalization and privatization, strategies for project export

Marketing real estate: characteristics of real estate, demand and supply relationship, segmentation, product mix, pricing strategies, advertising strategies, legal aspects

Marketing products for construction: characteristics of construction materials and equipment, strategies for marketing of materials and equipment for construction, demand surveys, advertising strategies, communication, exhibitions and product demonstrations, pricing strategies, financing arrangements

References:

- Published books in the relevant areas to be supplemented by latest journal articles and papers, seminar and conference proceedings, in-house publications, monographs etc.
### CE0453 International Construction Business

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#### Course Outcomes
- C01 Able to understand the International business aspects in terms of economy, political system, payments etc.  
- C02 Able to know cultural environment of international business.  
- C03 Analyze the foreign exchange market and take appropriate measures for export promotion.  
- C04 Skill of assessing the nations on different parameters and arrive at a decision on feasibility of entering into international business of construction industries.

#### Programme outcome:
- PO7. An understanding of management principles with the consideration of social, economical and financial aspects  
- PO10. An understanding of professional and ethical responsibility.

- International economy  
- International political system, economic system, multinationals, features of international trade & investment, national interest in international trade  
- International payments  
- International monetary system, balance of international payments, transfer of international payments, foreign exchange rates and their determination  
- Theories of international trade  
- Developing countries in the world economy, international differences in technology, policy implications for host countries  
- Cultural environment of international business  
- Effect of culture, language, education, religion, value systems on business, impact on management styles in selected countries  
- Role of Indian construction industry in international business, role of foreign companies in Indian business, some case studies  

### References:
- Published books in the relevant areas to be supplemented by latest journal articles and papers, seminar and conference proceedings, in-house publications, monographs etc.
CE0454 Pavement Management System Scheme

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Course outcomes:

C01 Acquisition of skills in selecting the best maintenance operations / alternatives of pavements.
C02 Planning and designing of pavement management system.
C03 Ability to design new as well as overlay on exiting flexible and rigid pavements as per IRC codes.
C04 Able to carry out the cost-benefit analysis in pavements projects.

Programme outcomes:

PO2. An ability to critically analyse engineering problems to facilitate theoretical and practical research
PO4. An ability to use systems approach to formulate, analyse and seek solutions to relevant problems

Course Content:

Pavement Distresses
Distresses in flexible/rigid pavements causes & remédies.
Visual Surface distress survey procedures and techniques.
Serviceability Indicators for roads
Measurement of Serviceability Indicators using various equipments like Bump Indicator, Skid tester, Distress surveys & Benkelman Beam
Inventory System
Maintenance operations/alternatives
Classification of maintenance operations, Routine, Periodic, Special.
Common types of maintenance: Potholes, Cracked surface, Ruts & undulations, Resurfacing, Interface treatments,
Bituminous Thin Surface Courses: Seal Coat, Surface Dressing, Premixed carpet, Mixed seal surfacing, Micro asphalt concrete (MAC)
Bituminous Surface Courses: Semi-Dense Bituminous Concrete, Bituminous Concrete, and Bitumen Mastic.
Road maintenance in high rainfall areas. Choice of materials. Modified bitumen & geo-fabrics. Maintenance alternatives including recycling

Pavement Management System (PMS)
Components of PMS and their Activities, Major Steps in Implementing PMS, Inputs, Design, Construction and Maintenance, Rehabilitation and Feedback Systems
Pavement Structural Design and Economic Analysis
Emerging Technology in Pavement Management Systems

References:
- IRC 58-2001, Guidelines for the design of rigid pavements for highways
- Specifications for rural road, Indian Road Congress
- Rural roads manual, Indian Road Congress
- Guidelines for the design of flexible pavements, Indian Road Congress
- IRC 81-1997, Guidelines for strengthening of flexible road pavements using Benkalman beam deflection technique
CE0455 Rehabilitation of Structures
Scheme

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Course Outcomes:

C01 Demonstrate the various types of distress in concrete structures and pavements
C02 Able to understood the methods of inspection, report preparation and repairs to structures
C03 Recommend the best Materials and Techniques for Repair.

Programme Outcome:

PO1. An ability to evaluate and gauge appropriateness of construction technologies
PO2. An ability to critically analyse engineering problems to facilitate theoretical and practical research

Course Content:

Infrastructure management
Need and concept, expected performance, survey and evaluation of distresses, inspection checklists, organization for rehabilitation, policies, funding
Concept of infrastructure upkeep
Buildings
Post occupancy evaluation of buildings, deformation and common defects in buildings, restoration & rehabilitation measures
Pipelines (water/ sewage/ air/ gas)
Purpose and methods of evaluation, evaluation of physical condition, methods of rehabilitation
Pavements (roadways / runways)
Evaluation and performance surveys, distress evaluation, methods of resurfacing, overlays, restoring and rehabilitation, up-gradation and maintenance of permanent way
Bridges
Inspection and reporting methods, rehabilitation measures
Ports & harbors
Maintenance of ports, port buildings, and services

References:
- Published books in the relevant areas to be supplemented by latest journal articles and papers, seminar and conference proceedings, in-house publications, monographs etc.
CE0456 Advanced Construction Materials

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Course outcome:
- C01 Able to use appropriate alternative for traditional construction materials
- C02 Make aware of impact on environment due to use of advances construction materials.

Programme outcome:
- PO1 An ability to evaluate and gauge appropriateness of construction technologies
- PO3 An ability to foresee & formulate problems and select and apply appropriate problem solving approach

Course Content:
Types and properties of construction materials and components, and corresponding experimental work. Aggregates types, sources and quality. Inorganic cements. Concrete mix design, admixtures and quality control. Asphalt cement, asphalt concrete mix design and quality control. Steel in construction. Masonry materials, timber, insulation materials and coatings. Various types of advanced concrete, metals, and highway materials. Examples are
- concrete admixtures, light weight aggregates, polymers, prestressed concrete, high strength, high durability and corrosion resistant materials
- soil stabilizers,
- bituminous materials and ‘Superpav’
- high strength low alloy steels, special construction alloys,
- special concretes, soil stabilizers, and high strength low alloy steels.
Environmental-friendly use of materials and incorporation of waste materials.
Advanced quality control techniques. Laboratory experiments are conducted for demonstration purposes.

References:
Various standards and handbooks detailing properties, acceptance criteria for various purposes of use and test procedures.
CE0457 Risk and Disaster Management

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Course Outcomes
C01 Able to do the identification, analysis of Risk and to develop Risk response plan.
C02 Able to understand various risks involved in construction project in terms of Cost and time.
C03 Able to handle technology to mitigate disaster
C04 Able to rehabilitate victims of various disasters.

Programme Outcomes:
PO2. An ability to critically analyse engineering problems to facilitate theoretical and practical research
PO10. An understanding of professional and ethical responsibility.

Course content:
Risks: risks in construction, risk management framework
Risk identification: sources of risk, risk classification, risk effects, common tools and techniques of identification
Risk analysis: risk measurement, qualitative and quantitative techniques
Risk response: risk management plan, risk retention, risk reduction, risk transfer, risk avoidance, attitudes towards risk
Risks in construction projects: money, time and technical risks, contracts and risks, risks in the context of global project teams
Disasters, Disaster management framework, pre-disaster, during disaster and post-disaster activities

References:
- Published books in the relevant areas to be supplemented by latest journal articles and papers, seminar and conference proceedings, in-house publications, monographs etc.
CE0458 Operational Health & Safety Management Scheme

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Course outcome:
- C01 Able to work as safety engineer in construction industry
- C02 Able to make aware about the hazards, causes of accidents to the labours.

Programme Outcome:
- PO7. An understanding of management principles with the consideration of social, economical and financial aspects
- PO10. An understanding of professional and ethical responsibility.

Course Content:
- Hazards and causes of accidents, safety measures
- Safety legislation and standards for construction industry
- Safety precautions and practices in various construction activities like excavation, concreting, scaffold erection and dismantle, concreting, steel erection and demolition of structures
- Occupational hazards and personal protective equipment
- Management of accidents
- Organization for safety, site management, safety manual and check lists
- Safety officer, safety committee, safety training, safety audit

References:
- Safety and Health in Construction, ILO, 1992
- Construction hazard & Safety handbook, R Hudson and R W King, Butterworths
CE0459 Project Management Information Systems

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<tr>
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Course Outcomes:
C01 Able to manage the Information Systems Resources.
C02 Development and Administration of Database Systems.
C03 Able to conduct a feasibility study on System Design.

Programme Outcome:
PO5. An ability to harness ICT tools including prediction and modelling

Course Content:
Information, Overview of system development, system development life cycle: methodology and alternatives
Planning information systems
Feasibility study, user requirements analysis,
Design of system, design of databases, software alternatives, forms, codes, procedures
Implementing system, Organizational adjustment, testing and conversion
Evolution and maintenance
Characteristics of construction projects and specific requirements for MIS, Integrated information systems

References:
- MIS: Solving business problems with IT, Jerry Post & David Anderson, Tata McGraw Hill
- Management information system, A O’Brien, Galgotia Publications
CE0460 Facilities Management

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<tr>
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Course Outcomes:
- C01 Able to prepare MIS for facility management
- C02 Able to carry out workers productivity,
- C03 Able to carry out space planning,
- C04 Able to carry out facility performance audit.

Programme Outcome:
- PO6. An ability to lead multidisciplinary teams.
- PO7. An understanding of management principles with the consideration of social, economical and financial aspects
- PO10. An understanding of professional and ethical responsibility.

Course content:
- Types, mechanisms and analyses of deterioration of concrete and steel structures, approaches and means of damage assessment, assessing structural stability and integrity of existing structures, development of sound strategy for repair and restoration. Protection and repair materials, techniques, design and economic aspects.
- Introduction to built facility management
- Need, functional planning, workspace ecology, worker productivity, space planning, needs analysis
- Property maintenance
- Maintenance planning, support services, obsolescence and refurbishment, outsourcing
- Facility performance audit
- Premises audit, health & safety, whole life assessment.
- Financial aspects
- Budgets, budgetary control depreciation.
- Disaster recovery plans
- MIS for facility management

References:
- Strategic management of built facility ; Craig Langston & Rima LaugeKristensen; Butter worth, Heinemann
- Facilities Management -Theory & Practice; E & F N Sons
- Total Facilities Management; Atkins & Book; Blackwell Science
CE0461 Managerial Decision making

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Course Outcomes:

- C01 Interpret the collected data using statistical tools and establish statistical significance.
- C02 Able to apply LPP for profit maximization and cost minimization.
- C03 Able to apply transportation and assignment technique for optimization.
- C04 Able to apply the queuing model and replacement model for enhancing operational efficiency.

Programme Outcomes:

- PO2. An ability to critically analyse engineering problems to facilitate theoretical and practical research
- PO3. An ability to foresee & formulate problems and select and apply appropriate problem solving approach
- PO4. An ability to use systems approach to formulate, analyse and seek solutions to relevant problems

Course Content:

Management Decision Making
Management decision making, art of modeling, systems approach, concept of optimization, attitudes of decision maker

Linear programming
LP formulation, solution by graphical method, simplex method, duality, sensitivity and parametric analysis, transportation model, assignment model, Integer programming - branch and bound algorithm

Network model
Network definition, shortest route problem, maximal flow problem

Waiting Lines: Basic structure of queuing models, M/M/1 model

Dynamic programming: Formulation of model and recursive equations, and applications

Group decision making
Behavior of a decision maker as an individual and in a group, compromise and consensus decision making

Decision theory and games: Decisions under uncertainty and risk: decision trees, game theory

Simulation: Monte Carlo method, applications

References:
- Shrivastava, Shenoy& Sharma, Quantitative Techniques for Managerial Decisions, Wiley
- TahaHamdy, Operations Research, An Introduction
- Rao S S, Optimization: Theory and applications
**Course Code** | **Course Name** | **Hr/Week** | **Credits** | **Examination Scheme** (Evaluation in % Weightage) | **Total** | **ESE (hrs)** | **(W)**
---|---|---|---|---|---|---|---
CE0462 | Elective | 3 | - | - | 3 | 20 | 20 | 60 | 100 | 3

**Course Outcomes:**
- C01 Analyze a spatially referenced data using the scientific method to address an inquiry based study
- C02 Acquire and create spatial data from satellite imagery, printed maps, online sources, GPS, etc.
- C03 Develop spatial and temporal models for presentation, analysis and decision-making
- C04 Achieve competency in the use of the GIS software packages
- C05 Designing and executing a workflow GIS techniques appropriate to an applied field

**Programme Outcomes:**
- PO2. An ability to critically analyse engineering problems to facilitate theoretical and practical research
- PO4. An ability to use systems approach to formulate, analyse and seek solutions to relevant problems

**Course Content:**

**Geographical Information System (GIS):**
Information systems, spatial and non-spatial information, geographical concept and terminology, advantages of GIS, Basic component of GIS
Commercially available GIS hardware and Software
Field data, statistical data, maps, aerial Photographs, satellite data, points, lines, and areas features, vector and raster data, data entry through keyboard, digitizer and scanners, preprocessing of data rectification and registration, interpolation techniques

**Global Positioning System (G.P.S)**
G.P.S. Segments: Spaces Segment, Control Segment, User Segment
Features of G.P.S. Satellites, Principle of Operation
G.P.S. Receivers: Navigational Receivers, Surveying Receivers, Geodetic Receivers, Computation of Co-ordinates: Transformation from Global to Local Datum, Geodetic Coordinates to map co-ordinates, G.P.S. Heights and mean sea level Heights
Applications of G.P.S.

**Civil Infrastructure Management:**
Introduction, Infrastructure Life Cycle, Challenges of Infrastructure Management, meeting the challenges, Infrastructure Management services tier, GIS based civil Infrastructure management.
Case Studies:

i. GIS based management approach for Transportation Infrastructure Construction
ii. Application of GIS in Transportation
iii. GIS based applications in Airfield Infrastructure system management and maintenance
iv. Developing Enterprise GIS based data repositories for Municipal Infrastructure asset management
v. GIS based decision support system for optimal renewal planning of sewers
vi. GIS based integrated infrastructure Management
vii. GIS based technologies for watershed management
viii. Single frequency GPS for Bridge deflection monitoring : progress and results
ix. Monitoring of rigid structures using GPS and RTS – Experiment
x. Real-time bridge health monitoring for management
xi. Deformation studies of Koyana Dam, Western India using GPS.

Reference Books:-

4. International and National Journals on GIS and GPS
CE 0463 Energy conservation in building design & construction

Course Code | Course Name | Hr/Week | Credits | Examination Scheme (Evaluation in % Weightage)
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CE0463 | Elective | 3 | - | 3 | 20 | 20 | 60 | 100 | 3

**Course Outcomes:**
- C01 Able to do energy analysis and heat transmission for buildings
- C02 Able to do the planning of energy efficient building and landscaping.
- C03 Understood the thermal Analysis and design energy efficient building for human Comfort

**Programme outcomes:**
- PO1. An ability to evaluate and gauge appropriateness of construction technologies
- PO4. An ability to use systems approach to formulate, analyse and seek solutions to relevant problems
- PO7. An understanding of management principles with the consideration of social, economical and financial aspects

**Course Content:**

Introduction to Energy
Definition and units of energy, power, Forms of energy, Conservation of energy, second law of thermodynamics, Energy flow diagram to the earth. Origin of fossil fuels, time scale of fossil fuels, Renewable Energy Resources, Role of energy in economic development and social transformation.

Global Energy Scene
Energy consumption in various sectors, projected energy consumption for the next century, exponential increase in energy consumption, energy resources, coal, oil, natural gas, nuclear power and hydroelectricity, impact of exponential rise in energy consumption on global economy, future energy options.

Indian Energy Scene
Commercial and non-commercial forms of energy, energy consumption pattern and its variation as a function of time, energy resources available in India, urban and rural energy consumption, nuclear energy - promise and future, energy as a factor limiting growth, need for use of new and renewable energy sources.

Introduction to architecture; Architecture as the art of science of designing buildings; Building science
and its significance; Energy management concept in building; Bioclimatic classification of India; Passive concepts appropriate for the various climatic zones in India; Typical design of selected buildings in various climatic zones; Thumb rules for design of buildings and building codes. Energy Efficient Landscape Design Modification of microclimatic through landscape element for energy conservation; Energy conservation through site selection, planning, and design; Siting and orientation.

Thermal Analysis And Design For Human Comfort

Thermal comfort; Criteria and various parameters; Psychometric chart; Thermal indices, climate and comfort zones; Concept of sol-air temperature and its significance; Calculation of instantaneous heat gain through building envelope; Calculation of solar radiation on buildings; building orientation; Introduction to design of shading devices; Overhangs; Factors that effects energy use in buildings; Ventilation and its significance; Air-conditioning systems; Energy conservation techniques in air-conditioning systems Application of wind, water and earth for cooling; Shading, paints and cavity walls for cooling; Roof radiation traps; Earth air-tunnel

Heat Transmission In Buildings

Surface co-efficient: air cavity, internal and external surfaces, overall thermal transmittance, wall and windows; Heat transfer due to ventilation/infiltration, internal heat transfer; Solar temperature; Decrement factor; Phase lag. Design of daylighting; Estimation of building loads: Steady state method, network method, numerical method, correlations; Computer packages for carrying out thermal design of buildings and predicting performance.
CE0464 Quality control & audit on Construction projects

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Course Outcomes:
- C01 Capable of applying quality Control concepts for improving the quality of construction materials and techniques in Construction projects
- C02 Able to maintain the documentations and records of quality audits.
- C03 Implement statistical tool for better quality control in construction projects.

Programme outcome:
- PO7. An understanding of management principles with the consideration of social, economical and financial aspects
- PO10. An understanding of professional and ethical responsibility.

Course content:
Introduction: Quality basics and history, Quality advocates, Quality improvement
Total Quality Management: Deming, Juran, Crosby
Quality Improvement Techniques
Pareto Diagrams, Cause-Effect Diagrams, Scatter Diagrams, Run Charts, Cause and Effect Diagrams
Statistical Concepts
Definitions, Measures of Central Tendency, Measure of Dispersion, Concepts of Population and Samples, Normal Curves, Control Charts for Variables, Variation: Common vs. Special Causes
Control Chart Techniques
X-bar and R chart Correlation. X-bar and S charts, Control Chart Interpretation and Analysis, Using Charts to Pinpoint Problems, Other Variable Control Charts, Individuals and Moving Range Charts, Moving Average and Moving Range Charts, Median and Range Charts
Fundamentals of Probability
Basic Concepts and Definitions, Discrete Probability Distributions, Continuous Probability Distributions, Control Charts for Attributes, Control Charts for Non-conforming Units, Control Charts for Counts of Non-conforming Units
Quality Costs
Quality Cost Measurement, Utilizing Quality Costs for Decision-Making
Quality of construction materials and workmanship
Specifications, How to define, standard documents and specifications therein, Evolving Standards, Benchmarking
Quality Function Deployment
Design of Experiments, Quality Systems: ISO 9000, Six sigma, Certification Requirements, and Auditing