SYLLABUS

AND

SCHEME OF TEACHING

MASTER OF ENGINEERING

IN

CIVIL ENGINEERING

(CONSTRUCTION TECHNOLOGY & MANAGEMENT)

REGULAR & MODULAR PROGRAMME

(2019 – 20)

CIVIL ENGINEERING DEPARTMENT
NATIONAL INSTITUTE OF TECHNICAL TEACHERS'
TRAINING & RESEARCH
CHANDIGARH
Instructions to Paper Setter

1. The question-paper should be fairly distributed over the whole course of study and not concentrated on any one or a few portions only.

2. The question-paper is to be set strictly according to the syllabus and not according to the last years question paper, which is being sent just as a sample only.

3. Special instruction if any, in regard to the paper set by the examiner should be followed.

4. Paper setter will set eight questions covering the whole syllabus. The candidate will be required to attempt any five questions out of eight questions.

5. For University examination the maximum marks are 50 and duration of examination is 3 hours.
## TABLE – I

STUDY & EVALUATION SCHEME OF M.E. IN CIVIL ENGINEERING (CONSTRUCTION TECHNOLOGY & MANAGEMENT)

**REGULAR PROGRAMME**

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Note: Requirement for the award of M.E. degree in Civil Engineering (Construction Technology and Management) is 75 credits in theory/practical papers with minimum CGPA of 6.0 and successful completion of thesis work.
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**Note:** Requirement for the award of M.E. degree in Civil Engineering (Construction Technology and Management) is 75 credits in theory/practical papers with minimum CGPA of 6.0 and successful completion of thesis work.
OBJECTIVES
After going through the course on Construction Management the students shall be able to:

i) Understand the concepts and principles of Modern day Construction
ii) Understand the Network Techniques, Construction Planning and Management.
iii) Find the time cost optimization of the projects.
iv) Understand the site layout, inspection, supervision and quality control.
v) Implement the safety in construction.
vi) Implement the labour laws and Acts

IMPLEMENTATION:
This subject shall be conducted through lecture-cum-discussion sessions, expert lectures by working professionals, field visits, practice tasks/assignments and educational films.

EVALUATION STRATEGY :
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Assignments, seminars & quizzes : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS
UNIT-I
Introduction:
Definition, functions and scope of construction management; scientific methods of management; construction team. [2]

Construction Contracts and Specifications:
Types of construction contracts; contract documents; specifications; general and special conditions; contract management; arbitration and settlement. [5]

UNIT-II
Construction Planning and Network Techniques:
Pre-tender planning; contract planning; planning and scheduling construction jobs by bar charts; Planning and scheduling construction jobs by critical path network techniques; allocation of resources; techniques of development and analysis of PERT/CPM networks for building project, bridge project and industrial shed constructions; updating of network; examples and case studies; Computer software for network analysis [10]

Time-cost Optimization:
Direct cost, indirect cost, total cost; purpose, stages and methods of cost control techniques of time cost optimization; examples and case studies. [7]
UNIT-III
Labour Laws and Acts

Project Management:
Feasibility study; project reports; progress reports; monitoring and controlling project activities.

UNIT-IV
Site Layout:
Principles governing site lay out; factors effecting site lay out; preparation of site lay out.

Supervision, Inspection and Quality Control:
Supervisor's responsibilities; keeping records; control of field activities handling disputes and work stoppages; storage and protection of construction materials and equipment; testing and quality control.

Purpose of inspection:
Inspection of various components of construction; reports and records; statistical quality control.

UNIT-V
Safety in Construction:
Safety: importance of safety, accident-prone situations at construction site i.e, safety measures for excavation, drilling/blasting, scaffolding/formwork, hoisting & erection demolition and hot bituminous work.

Fire Safety: Safety record of construction industry, safety campaign

PRACTICAL EXERCISES:
i) Identification of distinct activities in a building project, allocation of resources and time durations as per constraints in IS: 7272.
ii) Preparation of bar charts and material schedules.
iii) Preparation of CPM Network and project completion time for a single storey house, multi-storeyed building, bridge construction, highway construction, industrial structure etc.
iv) Allocation of resource and resource leveling for a small construction project.
v) Time cost optimization and crashing of project time for a small project.
vi) Preparation of different kinds of reports.
vii) Preparation of contract documents.
viii) Use of computer software for scheduling and related applications.

BOOKS AND REFERENCE MATERIALS:
OBJECTIVES
After going through the course on Concrete Construction Technology the learners are expected to:

i) Understand the principles of concrete technology and apply them during construction supervision and testing.

ii) Supervise and manage concrete manufacturing and construction.

iii) Develop skills in selecting and testing concrete ingredients for certain specific requirements.

iv) Interpret the test results in accordance with BIS Stipulations.

v) Plan the quality checks and bring about economy in concrete construction.

vi) Know the advancements in concrete constructions as also the various types of special concretes.

IMPLEMENTATION:
The course shall be mainly dealt with, through lecture sessions practical work, field visits and self-study. The practical work shall include testing of cement and aggregates, non-destructive testing of concrete, analysis of structure using profilometer, and concrete mix design. The lab work shall also include the chemical analysis of concrete for verifying the proportions of various ingredients of hardened concrete.

EVALUATION STRATEGY:

1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Practice tasks, assignments, seminars & quizzes & Lab Work : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
Principles of concrete mix design procedures:
Concrete materials; mix proportioning and early age properties, strength, permeability and durability.
BIS/ACI/British Standards, mix design procedures using fly ash, fibers and design of high performance concrete.

Inspection and quality control of concrete construction –
Stages, Principles, Checklist, Statistical Controls, Procedures.

UNIT-II
Concreting operations
Practices and equipment, batching; mixing; transporting; shuttering and staging; placing and compacting; curing, accelerated curing; finishing and jointing.
UNIT-III
Properties and Techniques of Construction for Conventional and Special Concretes

Operations, shotcrete, grouting, guniting, under water concreting, hot and cold weather concrete, pumpable concrete, ready mixed concrete.

UNIT-IV
Construction techniques for reinforced concrete
Elements - materials, principles and procedures for beams, slabs, columns, foundations, walls and tanks, design and fabrication of formwork for R.C.C elements, features of slip forming and precautions, details of special shuttering required for lining of tunnel, procedures and precautions.

UNIT-V
Pre-stressed concrete construction-
Principle, methods, materials, tools and equipment for the construction of a pre-stressed concrete.

PRACTICAL EXERCISES:

i) Testing of aggregates - fine and coarse as per BIS procedure.
ii) Testing of cement with reference to IS specifications and cement grade.
iii) Concrete mix design for desired grade from given materials.
iv) (a) Design and testing of workability of concrete for a given C.C proportion.
      (b) Design and determination of cube strength with given materials and proportions.
      (c) Design of concrete mix proportions.
vi) Study of effect of compaction on strength of concrete
vii) Study the effect of plasticizers on workability of concrete.
viii) Study the permeability of concrete.
ix) Conduct chemical analysis of hardened concrete to determine the cement content.
x) Inspection of a concrete construction site and preparation of report showing correct and incorrect practices.

REFERENCE BOOKS
Note: Examiner shall set eight questions covering the whole syllabus. The candidate will be required to attempt any five questions.

OBJECTIVES
After going through this course, of the subject of pavement design, construction and maintenance, students will be able to:

i) Understand the basic principles of design of flexible pavements.

ii) Know various methods of design of crust thickness.

iii) Determine the crust thickness by various methods.

iv) Use IRC-37 (2012) for determining thickness of various layers.

v) List various types of materials used in construction of flexible roads and their classification.

vi) Know specifications of common types of granular and bituminous layers used.

vii) Outline procedure for execution of granular and bituminous works.

viii) List types of defects in flexible pavements, their causes and rectification measures.

ix) List types of defects in rigid pavements, their causes and rectification measures.

x) Classify the soil and determine sub-grade class of soils for airport pavements.

xi) Design the Airport pavement by FAA method, LCN method and CBR method.

IMPLEMENTATION:
The course shall be conducted mainly through lecture-cum-discussion sessions, expert lectures from guest faculty, screening of educational films and practice tasks/assignments/seminars.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular) (One class test for Modular) : 30
2. Practice tasks, assignments, seminars & quizzes and field visits and reports : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
Introduction:
Types of pavement structure, Functions of pavement components. Factors affecting pavement design. (02)

UNIT-II
Design of Highway Pavements:
Design considerations in Rigid Pavements, Methods for design of rigid pavements: Westergaard's method, F.A.A. method, types of joints and their design in cement concrete pavements. (12)
UNIT-III
Airport Pavements
Difference between design approach between Highway & Airport Pavements. Thickness design, FAA method for Flexible and Rigid pavements, Soil Classification for FAA, ESWL Concept – design data of various aircrafts, CBR method (USACE), LCN system of pavement design, problem solving on all these methods. Introduction to ACN method PCN. Software applications (Introduction only) (10)

UNIT-IV
Construction of Highways:
Types of Highway Construction and their selection, materials for construction, Types of binders and their grades e.g. Emulsion, Bitumen, CRMB, Cut-back PMB, NRMB etc. needed for modifying binders. Brief Specifications and Construction procedure of different Granular layers: G.S.B., WBM and W.M.M.,
Introduction to various Equipment used for highway construction. Hot mix plant, Paver, Rollers. Bituminous pavements, Brief Specifications and Constructional features for Pre-Mix Carpet, Mix Seal Surfacing, B.M., SDBC. Other higher quality pavement layers – DBM, BC (introduction only).
Prime coat and Tack coat- their application and brief specifications, Seal coat
Cement concrete pavements, Joints in cement concrete pavements, (14)

UNIT-V
Maintenance of Highways:
Types of highway maintenance: routine, periodic and special type. Need for Inspection and schedule of maintenance. Pavement failures, their causes and remedial measures typical flexible and rigid pavement failures
Defects/ Failures in Flexible Pavement- their types and causes: Design and Construction lapses. Surface defects, Cracks, Deformation, disintegration, Surface Defects: Fatty Surface, Polishing, Hungry Surface Deformation: Rutting, shallow Depression, settlement & upheaval
Disintegration: Loss of Aggregate, Stripping, pot-hole.
Remedial Measures Slurry Seal, Liquid Seal, Fog Seal, Patching, Ready mix patch
Rigid Pavement: Various stresses, types of defects, cracking, spalling, slab rocking and settlement, joint sealant failure.

Methods of Repair Rectification: Repair of Spalled Joints, Full Depth Reconstruction, Replacement of Dowel Bar.


REFERENCE BOOKS:
OBJECTIVES
After going through this course, of the subject of Construction Costing and Financial Management, students will be able to:

i) List various methods of costing and make cost estimates of simple items of construction works.

ii) To list various methods of measurements of quantities of various construction works and their applications.

iii) Determine factors of cost variations

iv) Understand cash flow and funding methods of project.

v) List and describe various types of payments in a project and their implementation.

vi) Know various methods of material classification, their inventory, management and safety aspects.

vii) Know techniques of cost benefit analysis and comprehend elements of financial statements and fund flows.

viii) Prepare cash flow statements, balance sheets etc.

IMPLEMENTATION:
The course shall be conducted mainly through lecture-cum-discussion sessions, expert lectures from guest faculty, screening of educational films and practice tasks/assignments/seminars.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Assignments, seminars & quizzes : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
Construction Costing:
Costing of construction Works; different methods of costing, cost elements in a projects; analysis of rates; non-scheduled items of work; cost estimation for a small construction job; purpose, methods and stages of cost control; cost monitoring; cost forecasting methods; variations in individual items of work and their effect on total contract price; valuation of variations. Methods of measurement of earthwork, RCC, Brickwork, Woodwork joinery, steel and iron work plastering/ painting and white/colour washing & painting

UNIT-II
Cash Flow:
Determining the funds required for a construction job; preparing cash flow statements; cash inflow and outflow during contract period; project expectations.
UNIT-III
Cash and Payment of Works:
Precautions in custody of cash, imprest account and temporary advance; maintenance of temporary advance; and advance account; different types of payment, first, running, advance and final payments.

UNIT-IV
Material Management:
Objectives and scope of material management classification, codification, ABC analysis, standardization and substitution; introduction to inventory control; stores management; organization and lay out; receipt, inspection and issue; care and safety; store records and store accounting.

UNIT-V
Financial Management:
Meaning and scope; financial statement analysis; funds flow analysis; capital budgeting; cost-benefit analysis.

PRACTICAL/ASSIGNMENT EXERCISES:
i) Preparation of cost estimates for a small project.
ii) Filling up of prescribed treasury challan form and imprest account form with given data.
iii) Preparation of cash flow statement for a small construction project with given data and cost benefit analysis.
iv) Filing up of daily labour report on prescribed form with given data.
v) Preparation of analysis of rates for different items of work.
vi) Material statement and material analysis.
vii) Carry out financial statement analysis, ratio analysis and funds flow analysis for projects from given case studies.
viii) Exercise on software applications.

REFERENCE BOOKS:
iii) Schedule of rates, specification manuals etc. from PWD
OBJECTIVES
After going through this course, it is intended to acquire necessary knowledge and develop skills and practical competencies for the following:

i) List of Appropriate machinery used in construction of highways and their application areas
ii) Evaluate existing strengths of flexible pavements by various common methods.
iii) Determine sub-grade strength by suitable methods.
iv) Carry out analysis of mixes high quality bituminous mixes.

IMPLEMENTATION:
The subject involves instruction mainly through demonstration, laboratory and field work. In addition education films may be used for demonstration purpose and teaching correct practices. Attempts shall be made to conduct visits to sites of relevant nature.

EVALUATION STRATEGY:

1. Practice tasks : 15
2. Practice tasks in Field : 20
3. Quizzes/viva, Record & Presentation of Reports etc. : 15
4. Total Marks : 50

No theory examination shall be conducted.

CONTENTS

PRACTICAL EXERCISES:

i) Determination of CBR value of sub-grade soils.
ii) Determination of stripping value of road aggregate.
iv) Evaluation of pavement strength by using Benkelman’s Beam.
v) Determination of strength of existing pavement by Dynamic Cone Penetration Test.
vi) Roughness measurement of road surface (Demonstration)
vii) Determination of Hardness Number of Mastic Asphalt by Hardness tester

STUDY VISITS:

i) Study of Sensor-paver and other construction machinery
ii) Study of batching and mixing plant for construction of roads (Hot mix plant/WMM plant)
MCE- 6171 COMPUTER APPLICATIONS IN CIVIL ENGINEERING
(Elective Course )

Maximum marks : 50
Time Allowed : 3 hours

Note: Examiner shall set eight questions covering the whole syllabus. The candidate will be required to attempt any five questions.

OBJECTIVES
The subject will enable students to understand the application of computers in various fields like CAD, System Simulation, Finite Element Analysis.

IMPLEMENTATION:
This subject shall be conducted through Lecture-cum-discussion session, expert lectures by working professionals, tutorials/practical assignments.

EVALUATION STRATEGY :
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Practice tasks, assignments, seminars & quizzes & Lab Work : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
ABAQUS Software:
Geotechnical Applications, Classical and Modern Design Approaches, Numerical FE Analysis, Constitutive Models, Modeling Aspects for elements, stress, forces, pore fluid surface interactions, reinforced concrete slopes, other applications.

UNIT-II
ABAQUS : Finite elements and Rigid Bodies, non linearity, material, boundary conditions, multiple step analysis, contact interaction analysis, other analysis techniques, ABAQUS syntax and conventions.

UNIT-III
AUTOCAD Software:
Drawing, Drafting and Modeling of 2D and 3D objects.

LABORATORY WORK:
1. Exercises on ABAQUS Geotechnical and Finite Element modeling
2. Exercises on AUTOCAD

REFERENCE BOOKS:
i) ABAQUS Software Manuals
OBJECTIVES
After going through course on Advanced Structural Design & Detailing students are expected to:

i) Understand the concept of analysis on a design of complex structures in reinforced concrete.

ii) Be able to design common type of RCC Structures.

iii) Analyse & Design complex structures based on understanding developed with this course.

IMPLEMENTATION:
Instruction in the subject will be imparted with focus on BIS codes of practice wherever available and will be done through lecture-cum discussion sessions, tutorial classes where the students will be asked to analyze and design practical structures. The students will also be required to give seminars on different design aspects. Case studies of designs will be discussed by internal and visiting faculty.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular): 30
   (One class test for Modular)
2. Practice tasks, assignments, seminars & quizzes: 20
3. Final Examination: 50
4. Total Marks: 100

CONTENTS
UNIT-I
Limit State Design
Introduction to limit state design philosophy; provisions in the Indian Standard codes for loading. Ductile detailing of reinforced concrete structures.

Design of slender columns [6]

Curved beams [4]
Design on circular beams supported symmetrically, curved beam fixed at ends, semicircular beam simply supported on three equally spaced columns.

UNIT-II
Design of Underground Water Tanks

Silos and bunkers: Design of bunkers. Design of silos using Janssen’s theory and Airy’s theory. [8]

Design of Reinforced Concrete Chimneys [6]

UNIT-III
Multi-Storey Building Frames: Structural systems, loads, wind loads and earthquake loads calculations, Analysis for vertical loads, analysis for lateral loads, Substitute frames, Design of structural elements of multi storey buildings.

Use of computer software for analysis and design of multistory building [8]
PRACTICE TASKS :
  i)  Complete analysis and design of an underground water tank.
  ii) Analysis and design of a silo.
  iii) Analysis and design of a concrete chimney.
  iv) Analysis and design of a 10-storey building using a computer programme.

SUGGESTED READINGS :-
  v)  Punmia, B.C., Jain, A.K, Jain, Arun Kumar, (2007), R.C.C. Designs (Reinforced Concrete Structures), New Delhi, Laxmi Publications (P) Ltd.
OBJECTIVES
After going through course on Design of Pre-stressed Concrete Structures students are expected to:
i) Understand the concept of pre-stressing analysis.
ii) Understand the construction of various pre-stress structure using modern techniques.
iii) Design pre-stressed concrete structures.

IMPLEMENTATION
Instruction will focus on relevant knowledge on Basic concepts of Pre-stressing. Design of various members using Pre-stressing technique. The instructions strategies will include lecture-cum-discussion sessions, field visits and practical exercise/assignments/seminars etc.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Assignments, seminars : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS
UNIT-I
Design of Symmetrical sections: Unsymmetrical Sections and composite sections as per elastic procedures- tension allowed and tension not allowed. Ultimate load design of sections.. Cracking load as basis of design: Design of Bridges/Long span structure of Pre-stressed concrete. (12)

UNIT-II
Limiting zones. Cable profile and cable layout. Calculations of stresses due to sequence of tensioning, Calculations of deflections. (6)
Design for shear-elastic and ultimate. Design for bond, Transfer length in pretension members. Discussion of codal provisions and provision of web reinforcement. (6)
Various theories for design of End Block., Practical design of end block for a typical I section. (4)

UNIT-III
Design of continuous beams, Concordant and non-concordant cables, Location of steel for a practical design problem. (6)
Partial pre-stress and use of ordinary mild steel and high tensile steel in the tension zone as ordinary reinforcement. (5)
UNIT-IV
Method of load balancing and its applications to particular problems of slabs, beams and portals.

Design of pre-stressed members subjected to tension and compression, Circular pre-stressing.

Discussion of various provisions in the code for pre-stressed concrete members.

REFERENCE BOOKS
OBJECTIVES
After going through the course on Technology Management the learner are expected to know various issues related to:

i) Business Strategies for implementing New Technologies
ii) Technology forecasting and Management Pertaining to Research & Development.
v) Issues Related to Venture Capital and Technology Development.

CONTENTS

UNIT-I
Introduction to Technology Management
i) Introduction to Technology Management

UNIT-II
i) Technology Forecasting: Techniques of Forecasting, Technology Forecasting- Relevance, Strategic alliance and Practicality, and Technology transfer.
ii) Management of Research, Development and Innovation: Technology mapping, Comparison of types of R&D Projects and development approaches- radical platform and incremental projects, innovation process.

UNIT-III
i) Management of Intellectual Property Rights
ii) Strategic value of patents, trade secrets and licensing

UNIT-IV
i) Managing scientist and Technologists: Identification, Recruitment, Retention, Team work and Result Orientation.
ii) Management Roles and Skills for New Technology

UNIT-V
i) Technology for Managerial Productivity and Effectiveness, Just-in-Time
ii) Venture Capital & Technology Development

PRACTICE TASKS:
i) Technology forecasting and Technology mapping
ii) Technology Strategy Development
iii) Exercise on Just-in-Time
iv) Cases on Venture Capital
REFERENCE BOOKS
i) Technology and Management, Cassell Educational Ltd., London
iii) S.A. Bergin R&D Management, Basil Blackwell Inc.
iv) Richard M.Burton & Borge Obel Elsevier Innovation and Entrepreneurship
v) in organizations
vi) Spyros Maksidkis & Steven C Wheelwright The Handbook of Forecasting- A Management Guide, John Wiley & Sons
OBJECTIVES

After going through the course on Optimization Techniques the students shall be able to:

- Understand the optimization Techniques for the various manufacturing processes for the best utilization for men, material and machines.

CONTENTS

UNIT-I

Introduction to Optimization and Numerical Techniques
i) Introduction and Engineering applications of optimization
ii) Optimal Problem Formulation; Design- Variables. Constraints, Objective function, Variable bounds.
iii) Introduction to numerical techniques
iv) Numerical differentiation and numerical integration
v) Eigen value problem
vi) Newton-Raphson’s method
vii) Computer based numerical analysis

UNIT-II

Single-variable Optimization
i) Optimality Criteria
ii) Bracketing Methods – Exhaustive search and Bounding phase methods
iii) Region- Elimination Methods-Interval halving method; Fibonacci search method, golden section search method.
iv) Point-Estimation Method: Successive Quadratic estimation method

UNIT-III

Multivariable Optimization
i) Optimality Criteria
ii) Unidirectional Search
iii) Direct Search Methods: Simplex, Hooks-Jeeves pattern search and Powell’s conjugate direction method.

UNIT-IV

Constrained Optimization
i) Kuhn-Tucker Conditions
ii) Transformation Methods: Penalty function method.
iii) Sensitivity Analysis
iv) Direct Search for Constrained Minimization: Variable elimination, Complex search and Random search methods.

UNIT-V

Integer and Geometric Programming

BOOKS AND REFERENCE MATERIALS
OBJECTIVES
After going through course on Environmental Engineering & Management the students are expected to:

i) To create awareness about harmful effects of pollution and to take preventive steps for controlling the pollution.

ii) To help the students to acquire knowledge with reference to various sources of pollution and planning of remedial measures to control pollution.

IMPLEMENTATION:
The course shall be mainly dealt with through lecture sessions, field visits, practical work and self study, students will prepare case studies on the pollution aspects of nearby Industries/Cities. The lab work shall include determination of level of pollutants of air and water samples, vehicular emission and determination of concentration of metals in industries effluents. Field visits and submission of report on features of effluent treatment plants will be part of instructions.

EVALUATION STRATEGY :

1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)

2. Practice tasks, assignments, seminars & quizzes & Lab Work : 20

3. Final Examination : 50

4. Total Marks : 100

CONTENTS

UNIT-I
Environment & Ecology
Definition and understanding of concepts, ecosystem, energy flow in ecosystem, water, carbon and nitrogen cycle, community’s inter-relationships in an ecosystem.

UNIT-II
Type of Pollutants and Protection of Environment
Water Pollution:
Sources, causes and measurement of water pollutants in surface and ground water, water quality criteria for various uses of fresh water, river basin studies for surface water pollution control, biochemical oxygen demand, effect of oxygen demanding wastes on rivers.

Domestic and industrial Pollution:
Sources, Standards for disposal of waste water and industrial effluents, basic unit operations in control of waste water pollution, C.P.C.B./M.O.E.F. for abatement of Industrial Pollution and Pollution Control/Treatment methods and technologies.
Air Pollution:
Definition, principle materials causing pollution, types of air contaminants, their sources and ill effects on living and nonliving materials, permissible limits. Air pollution control - basic principles, natural self cleansing, pollution control methods and various engineering devices to control particulate and gaseous pollutants, controlling air pollution from automobiles.

Noise Pollution:
Definition, sources of noise and its units, adverse effects of noise pollution, sound pressure level and its measurement, octave band and its importance; noise pollution control measures.

Solid Waste Pollution:
Sources, public health aspects, solid waste management and disposal methods including E-waste.

UNIT-III
Degradation of Land Resources:
Deforestation: Forest land, deforestation and its effects on land use and environmental quality, wetland and their importance in environment, causes and extent of wasteland, Soil degradation problems, erosion, salinization, water logging, land use management & planning.

UNIT-IV
Global Environmental Problems
Global warming, green house effect, ozone depletion, acid rain, oil pollution, radiation hazard and control, global climate change.

Environment Impact Assessment:
Definition and its importance for environment management, constituents of environment impact assessment, project data for EIA study, prediction of impacts, EIA methodologies, constraints in implementation of EIA, impact prediction on water resources projects and other relevant case studies. Environment pollution.

UNIT-V
Environmental Management System; International cooperation and Laws:
Main clauses and basic steps for EMS certification. Environmental Laws/Acts.

Cleaner Production Technologies
Need and benefits, cleaner production techniques and options, zero impact manufacturing initiatives CDM and carbon credits/case studies.

LABORATORY WORK/FIELD TASKS
i) Analysis of water for various parameters using spectrophotometer and flame photometry.
ii) Determination of BOD for domestic waste/industrial waste.
iii) Determination of MPN of given sample.
iv) Air sampling and determination of standard particulate matter and other gaseous contaminants.
v) Measurement of CO₂, CO, NOₓ levels in ambient air by gas analyzer.
vi) Monitoring of vehicular pollution emission.
vii) Determination of noise levels for indoor and outdoor noise.
viii) Use of Atomic Absorption spectroscopy (Demonstration only).
ix) Visit and submission of report for treatment of wastewater in measuring trace element plant of any industry/city.

REFERENCE BOOKS:
MCT- 6202       BUILDING MAINTENANCE
(Core Course)

Maximum marks :  50

L    P/ T
3     2

Note: Examiner shall set eight questions covering the whole syllabus. The candidate will be required to attempt any five questions.

OBJECTIVES
The course aims at exposing the participants to the methods of repairs and maintenance of structures and enable them to:

i) Become aware about the principles of maintenance

ii) Diagnose the causes of various types of defects in structures.

iii) Plan and schedule the maintenance of structures as per maintenance management techniques.

iv) Develop capabilities in field practices for repairs of structures.

IMPLEMENTATION:
The course shall be mainly dealt with through lecture sessions, field visits, practical work and self study. The practical work shall include use of non-destructive method in investigation of causes application of modern repair materials and field visits to rehabilitation sites. The lab work shall include determination of extent of dampness, carbonation, efflorescence and their analysis to determine the extent and cause of damage in structures.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular) (One class test for Modular) : 30
2. Practice tasks, assignments, seminars & quizzes & Lab Work : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
Principles of Maintenance:
Importance of maintenance, deterioration and durability, factors affecting decision to carryout maintenance, maintenance and GNP, agencies causing deterioration, effect of deterioration agencies on materials. (4)

Design and Economic Consideration in Maintenance
Factors to reduce maintenance at design stage, consideration of maintenance aspects in preparing tender document and specifications, sources of error in design which enhances maintenance, importance of working drawings and schedules, provision of access for maintenance and its importance at design stage.

Economic consideration in maintenance: physical life, functional life, economic life of different types of buildings, discounting technique for assessment of economic life. (9)

UNIT-II
Maintenance Management:
Definition, organization structure, work force for maintenance, communication needs, building inspections, maintenance budget and estimates, property inspections and reports, specification for maintenance jobs, health and safety in maintenance, quality in maintenance, maintenance manual and their importance. (5)
Materials for Maintenance:
Compatibility of repair materials, durability and maintenance, types of materials, their specification and application, criteria for selection of material, use of commercial available materials in maintenance.

UNIT-III
Investigation and Diagnosis for Repair of Structures:
Basic approach to investigations, physical inspection, material tests, non destructive testing for diagnosis, estimation of actual loads and environmental effects, study of design and construction practices used in original construction, retrospective analysis and repair steps.

Maintenance Problems and Root Causes:
Classification of defects, need for diagnosis, type of defects in building elements and building materials defect location, symptoms and causes.

UNIT-IV
Remedial Measures for Building Defects:
- Preventive maintenance and special precautions- considerations, preventive maintenance for floors, joints, wet areas, water supply and sanitary systems, termite control, common repair techniques, common methods of crack repair. (4)
- Repair of existing damp proofing systems in roofs, floors and wet areas. (2)
- Protection, repair and maintenance of RCC elements. (2)
- Repair, maintenance of foundations, basements and DPC. (2)
- Repair of finishes. (4)
- Repair of building joints. (2)
- Repair of water supply and sanitary systems, under ground and over head tanks. (2)
- Common strengthening techniques. (2)
- Maintenance of Industrial Floors (2)

UNIT-V
Maintenance of Multistorey Buildings:
Specials features for maintenance of multi-storeyed buildings, including fire protection system, elevators booster pumps, generator sets.

PRACTICAL WORK/FIELD TASKS
i) Conduct of non destructive tests in diagnosis of cracks, strength, moisture level, corrosion rate, depth, cover and spacing of steel reinforcement.
ii) Testing of properties of repair materials
iii) Determination of extent of carbonation in concrete by phenolphthalein test
iv) Determination of efflorescence in bricks in laboratory.
v) Preparation of report
   - On maintenance of firefighting equipment after visiting Fire Station
   - On maintenance aspects of treatment plants.
   - Special repair work sites for rehabilitation of structures.

REFERENCE BOOKS
iii) Ransom W.H. Building Failures : Diagnosis and Avoidance, New Age Publications (P) Ltd.
MCT- 6208 FOUNDATION DESIGN AND CONSTRUCTION
(Core Course)

Maximum marks : 50
Time Allowed : 3 hours

Note: Examiner shall set eight questions covering the whole syllabus. The candidate will be required to attempt any five questions.

OBJECTIVES
The subject is intended to impart the knowledge and skills to the students as mentioned below:

i) estimate bearing capacity for different types of shallow foundations under different soil conditions and placement of footing.

ii) know construction aspects of various types of shallow foundations and their suitability under various conditions.

iii) know various types of pile foundations and estimate the carrying capacity of pile(s) or design pile/pile group.

iv) explain various methods of improvement of soils and select a suitable method for given conditions.

v) describe various methods of rectification of foundations.

IMPLEMENTATION:
The subject involves instruction through various methods e.g. lecturer cum discussion, tutorial work, laboratory work, educational films, field work and site visits.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular) (One class test for Modular) : 30
2. Practice tasks, assignments, seminars & quizzes & Lab Work : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
Principles of Foundation Design:
Functions of foundations, essential requirements of a good foundation, types of foundations, principal modes of failure, estimation of allowable bearing pressures, calculation of ultimate bearing capacity by theoretical and empirical methods: Terzaghi’s Method, Skempton's analysis for clays, Mayerhof’s analysis BIS Method (IS:6403), Settlement of foundations. Factors to be considered for foundation design, numerical problem based on BIS method.

(09)

UNIT-II
Shallow Foundations:
Introduction, essential requirements, types and depth of footing like Strip footing, Isolated footing, Combined footing, Strap footing, Raft footing, electrically loaded footings; design features and construction details related to size and depth of footing problem of frost heave, its causes and prevention, effect of ground water and environmental considerations; Numerical problems related to size and depth of footings

(08)

Special Considerations in Foundation Design and Construction:
Elementary principles of design and construction of foundations subjected to earthquake or dynamic loads, special measures for foundations constructed under water.

(04)
UNIT-III
Pile Foundations:
Purpose/uses of pile foundations, Classification of piles based on different criteria, Brief details of timber, concrete, steel piles their advantages and disadvantages, selection of pile type, pile action, behaviour of pile and pile groups under load, definition of failure load. Method of installation of piles. Replacement and Displacement Piles. Stresses during pile installation and protection measures.

Estimation of carrying capacity: Single driven pile in cohesionless soils - methods based on SPT and CPT, ultimate load on driven and cast-in-place piles and bored and cast-in-place piles in cohesionless soils. Factors affecting pile capacity. - Numerical problems for Piles in purely cohesive or cohesionless soils and rocky state


Carrying capacity of piles on Rocks.
Effect of Very long Pile length
Piles in fills - negative skin friction
Carrying capacity of pile groups in cohesive soil and cohesion less soils, Efficiency of pile group, Spacing of Piles

Piles subjected to horizontal or inclined loads.
Mode of failure of piles
Equipment for Installation of Piles by Driving and Boring and cast in place method

UNIT-IV
Soil Stability:
Un-braced excavations, braced excavations.
Sheet piles - types anchors and tie backs.
Shoring and Underpinning - necessity and methods

UNIT-V
Improvement of Foundation Soils
Purpose: Improvement of granular soils: term used to describe degree of compactness – relative density, density ratio and degree of compaction;
Methods: Vibration at ground surface, factors influencing roller compaction; deep dynamic compaction, vibro-compaction impact at depth.
Improvement of cohesive soils: preloading, or dewatering, methods of installing sand drains, drain wicks, electrical and thermal methods.
Geo-synthetics: types, functions, manufacturing of geo-textiles, Classification of geo-textiles.
Specific Applications: Bearing capacity improvement, reinforcement, retaining walls, embankment etc. testing of geo-synthetics, usage in India and a case study.

REFERENCE BOOKS
i) Tomlinson MJ (1996), Foundation Design and Construction , ELBS-Longman, 6e,
MCT- 6206  ADVANCED CONSTRUCTION TECHNOLOGY
(Core Course)

Maximum marks : 50
Time Allowed : 3 hours

Note: Examiner shall set eight questions covering the whole syllabus. The candidate will be required to attempt any five questions.

OBJECTIVES
After going through this course, students will be able to:
i) Understand the necessity and behaviour of the composite construction (Steel and Concrete) and their application.
ii) Understand need for recycling in road construction and various/technologies and procedures related.
iii) Various types of special foundations and their suitability and application areas.
iv) Various aspects of high rise construction and special methods/techniques deployed in it.
v) Special aspects for design and construction of tall chimneys.
vi) Understand the necessity of Pre-fab construction, various components and different aspects in planning and execution of it.
vii) List various types of elements in used in Pre-fab construction and their applications.
viii) List various new materials like. Geo-synthetics, polymers, Special Coatings etc. and their properties and suitability for use.

IMPLEMENTATION :
This subject shall be conducted through lecture cum discussion session, expert lectures by working professionals, tutorial/assignments, educational films and field visits.

EVALUATION STRATEGY :
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Assignments, seminars & quizzes : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS
UNIT-I
Advance Technologies :
Composite Structures in Buildings :

New Technologies in Road and Bridges :
Recycling of Pavements – purpose , usage of old material ,reclaiming bitumen , usage of granular material . Cold Mix Technologies, Warm Mixes -

(12)
UNIT-II
Special Foundations :
Necessity for special foundations, Problems in expansive Soils, Loose sand deposits and organic soils, Black cotton soils - soil potential to expand and related soil properties, measures to counteract the problems in expansive soils. Frost action and measures to counter the related problems. Foundations for chimney, cooling towers, telecommunication/transmission towers, foundations for underground structures, coastal and off shore structures in different soil conditions, gravity platforms, Raker. dewatering and its various methods.

UNIT-III
High Rise Construction :
High rise buildings; architectural & structural aspects; special features of construction; tall chimneys, components, design aspects; slip form method, lift slab method; special problems of high rise construction.

UNIT-IV
Prefabricated Construction :
Advantages of pre fabricated construction; Basic elements, selection of structural elements; design aspects; assembly of precast elements; jointing, modular co-ordination and tolerances; structural systems for buildings; single and multi-storey building systems; methods and equipments for handling and placement. Applications for rural and military areas.

UNIT-V
Advanced Construction Materials:
Geo-synthetics: various, types; geo-textiles, geo-grids, geo-membranes, geo-cell, geo-composites; functions and general applications, advantages, properties of geo-textiles, epoxy, resins, polymers, grouts and anchors, special flooring materials, sealants and adhesives, protective coatings. Micro-Silica in Concrete

PRACTICE TASKS:
Any two or more :
i) Visit to a Pre-Fab building or manufacturing Unit
ii) Enumerate major design parameters and data requirements of any one type of special foundations.
iii) Visit the construction site of multi storeyed building and prepare report on techniques employed and suggest further scope of improvement.
iv) Visit to a Site of Geo-synthetic Application area.

REFERENCES:
OBJECTIVES
The subject is primarily intended to develop skills and competencies in measurement of various engineering properties of soil and bearing capacity of shallow foundation.

IMPLEMENTATION:
The subject involves instruction mainly through tutorial work, laboratory work, and field work. In addition education films may be used for demonstration purpose and teaching correct practices. Attempts shall be made to conduct visits to sites of relevant nature.

EVALUATION STRATEGY:
1. Lab Work, field work : 30
2. Site visit and report, lab record, internal viva : 20
3. Total Marks : 50
   No theory examination shall be conducted.

PRACTICAL EXERCISES:
i) Conduct of Standard Penetration Test and estimation of bearing capacity for shallow foundation case.

ii) Determination of shear strength characteristics by field tests like in situ vane shear test, pocket penetrometer etc.

iii) Determination of shear strength characteristics by laboratory tests (Direct Shear Test).

iv) Determine unconfined compression strength of cohesive soil.

v) Recommend a field investigation programme to obtain design data.

vi) Computation of bearing capacity and settlement for given conditions of soil, depth and type of foundation and loading.

vii) Determine Relative Density of Soil.

viii) Visit to construction site and preparation of report.

ix) Conduct Tri-axial test on soil.

REFERENCES:

MCT-6203 CONSTRUCTION EQUIPMENT
(Elective Course)

Maximum marks : 50
Time Allowed : 3 hours

Note: Examiner shall set eight questions covering the whole syllabus. The candidate will be required to attempt five questions.

OBJECTIVES
The subject will give them a deep insight into different types of construction equipment, their uses, operations & efficiency, owning procedures, costs and maintenance.

IMPLEMENTATION:
This subject shall be conducted through lecture-cum-discussion sessions, expert lectures by working professionals, field visits, practice tasks/assignments and educational films.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Practice tasks, assignments, seminars & quizzes & Lab work. : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS
UNIT-I
Introduction:
Construction economy; Factors affecting the selection of construction equipment; rolling resistance, effect of grade on required tractive effort, effect of altitude and temperature on the performance of internal combustion engines, drawbar pull, rimpull and acceleration, owning and operating cost of equipment.

Earth Moving Equipment:
Crawler and wheel tractors-their functions, types and specifications; grade-ability, bull dozers and their use; tractor pulled scrapers, their sizes and output; effect of grade and rolling resistance on the output of tractor pulled scrapers; earth loaders; placing and compacting earth fills.

Power shovels - functions, selection, sizes, shovel dimensions and clearances, output, Draglines – functions types, sizes, output, Clamshells; Safe lifting capacities and working ranges of cranes; Hoes, trenching machines, types and production rates calculation of production rates of equipment; examples.

UNIT-II
Hauling Equipment:
Trucks; capacities of trucks, balancing the capacities of hauling units with the size of excavator; effect of grade and rolling resistance on the cost/performance of hauling equipment.

Compaction Equipment:
Roller class: sheep's foot rollers, pneumatic tyre rollers, steel wheel rollers, vibrating rollers, grid type rollers-their applications.

(4)
UNIT-III
Drilling, Blasting and Tunneling Equipment:
Definition of terms, bits, jackhammers, drifters, wagon drills, churn drills, piston drills, blast hole drills, shot drills, diamond drills; Tunneling equipment; selecting the drilling method and equipment; selecting drilling pattern; rates for drilling rock, air compressors.

UNIT-IV
Piling Equipment:
Pile hammers, selecting a pile hammer loss of energy due to impact, energy losses due to causes other than impact.
Equipment for bored and cast in-situ piles

Pumping Equipment:
Pumping equipment in construction, Classification of pumps; Selection of pumps – Air-operated centrifugal type sump pumps; performance of centrifugal pumps; well point system.

UNIT-V
Economic Considerations in the procurement and use of construction equipment; Time value of money; ROR and IROR analysis; depreciation; costing of construction equipment operation;

REFERENCE BOOKS:
i) Verma, Mahesh Construction equipment and its planning and applications, Metropolitan Book Co. Ltd.
iii) Jagman Singh : Heavy construction Planning ,Equipment and Methods, Oxford and IBH
v) Christian John ; Management, Machines and Methods in Civil Engineering, John Wiley and Sons.
vi) Frank Harris, Modern Construction Equipment and Methods, John Wiley and Sons.
OBJECTIVES
After going through the course on Green Buildings and Services, the students shall be able to:

i) Understand the issues of environmental degradation on account of Buildings Sector.
ii) Understand the Concept of Green Buildings and its importance.
iii) Learn the Design factor of Green Buildings.
iv) Be able to apply the concepts to Building Design & Rehabilitation.

IMPLEMENTATION
The subject involves introduction through various methods of lecture-cum-discussion, tutorial work, educational video films, laboratory, field work and site visits.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Practice tasks, assignments, seminars & quizzes & Lab. Work : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
Introduction to Green Buildings

Design Features for Green Building Construction
Site selection strategies, landscaping, building form, orientation, building envelope and fenestration – material and construction techniques, roofs, walls, fenestration and shaded finishes, advanced passive heating and cooling techniques, Waste reduction during construction.

UNIT-II
Water and Waste Water Management
Compliance, fixtures, rainwater harvesting and techniques, water and waste water management, solid waste management.

Energy Management
Appliances, compliance energy performance, solar water heating system, use of renewable energy options. High performance glass, other energy saving options, provisions of ECBC, insulating materials.
UNIT-III
Eco-friendly Materials
Various types of eco-friendly materials, use of recycled materials like: flyash bricks, recycled ceramic tiles, recycled glass tiles, porcelain tiles, natural terracotta tile, wood, steel, aluminium and renewable materials, agrifibre, linoleum, salvaged material – properties and applications. Recycling of aggregate, use of plastic, recycled material

Indoor Air Quality
Natural air ventilation systems, different types of low VOC materials, day lighting.

UNIT-IV
Rating Systems and Certification for Green Building
Different rating of rating like lead, systems and their special features. Criteria, compliance, appraisal for rating systems. Case study on rating of green buildings.

PRACTICAL TASKS/TUTORIALS
i) Case studies of Green Buildings in different climate zones.
ii) Project on rating of Green Buildings
iii) Design of Green Building
iv) Field visits for study of green building construction and design features.

SUGGESTED READINGS
vii) Halpeth, M.K; Kumar, T Senthil and Harikumar, G. Light Right – A Practising Engineer’s Manual on Energy Efficient Lighting, TERI Publications
Maximum marks : 50
Time Allowed : 3 hours

Note: Examiner shall set eight questions covering the whole syllabus. The candidate will be required to attempt any five questions.

OBJECTIVES
The learner after going through the subject of Bridge Engineering shall be able to:

i) Gain knowledge concerning the standard specifications for road bridges.
ii) Understand general arrangement and suitability of various types of RCC, PRC and steel bridges.
iii) Design substructure
iv) Know construction details of shallow foundations, pile and well foundation for bridges.
v) Understand the details of bearings, expansion joints, footpaths and handrails.
vi) Understand the principles of construction and maintenance of bridges.

IMPLEMENTATION:
Instruction will focus on providing relevant data and construction and maintenance aspects of foundation, sub-structure and super-structure of bridges. The instructional strategies will include lecture-cum-discussion sessions, field visits, screening of educational film and practice tasks/assignments/seminars.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Practice tasks, assignments, seminars & quizzes : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
Introduction and Standard Specifications for Road Bridges:
Definition; components of a bridge; classification; importance of bridges.

Indian Roads Congress Bridge Code; width of carriageway; clearances; loads to be considered; dead load; I.R.C. standard live load; impact effect; application of live load on decks; wind load; longitudinal forces; centrifugal forces; horizontal forces due to water current; Buoyancy effect; earth pressure; temperature effects; seismic force.

UNIT-II
Reinforced Concrete Bridges: General arrangement and suitability: T-beam bridges; Balanced cantilever bridges; Continuous girder bridges; Rigid frame bridges; Arch bridges; Steel bridges (Familiarization with MOST specifications and drawings)
UNIT-III
Sub-Structure & Foundations
Design of piers and abutments (Masonry & R.C.C).

Types of foundations; Open; Piled and Well foundations; including construction details.
Pile Foundations: Suitable Pile types for bridges, Pile Installation, Carrying capacity of bored and cast- in-situ pile (No numericals)
Well Foundations various Components and brief description, Well Cap, Stability of a single well.

UNIT-IV
Bearings, Joints, and Handrails: Different types of bearings, joints and handrails.

UNIT-V
Construction and Maintenance of Bridges.

REFERENCE BOOKS
OBJECTIVES:
After going through the course of Transportation Engineering the learners are expected to
i) Understand the traffic flow characteristics
ii) Understand the principles governing highway capacity and level of services
iii) Design the intersections, interchanges and rules pertaining to placement of Road signs and
signals.
iv) Know the urban highway utilities for smooth movement of traffic and mitigate the road
accidents.
v) Understand the Environmental impact Assessment of Highway Projects & Softwares used for
Planning & Designing of Highway Projects.

IMPLEMENTATION
Instruction will focus on relevant knowledge on Basic concepts of traffic flow characteristics and
highway capacity, Design of various components e.g. intersections, and other highway facilities shall
be learnt. The instructions strategies will include lecture-cum-discussion sessions, field visits and
practical exercise/assignments/seminars etc.

EVALUATION STRATEGY
1. Two class test of 15 marks each (regular) : 30
    (One class test for Modular)
2. Assignments, seminars & quizzes : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS
UNIT-1
Traffic Flow Characteristics :
i) Nature of Traffic Flow
ii) Various Parameters e.g speed, rate of flow, density, spacing and headway, lane occupancy,
clearance etc.
iii) Categories of traffic flow, uninterrupted and interrupted flow.
iv) Analysis of speed, flow and density relationship.
v) General Model of Vehicle stream flow.

UNIT-II
Highway Capacity :
i) Highway Capacity and level of Service
ii) Basic Freeway Capacity Studies
iii) Level of Service- various categories and criteria
iv) Criteria and Different Levels of Service for Freeways, Multi-lane highways and 2-lane roads.
v) Determination of level of Service (including numerical problems)
UNIT-III
Intersection Control and Design:
i) Design features & Installation of Road traffic signals as per IRC : 93
ii) Road – Rail Level Crossing IRC : 39
iii) Accommodation of underground utility services along and across roads in Urban Areas as per IRC : 98
iv) Interchanges in Urban Areas as per IRC : 92
(10)

UNIT-IV
Urban Highway Utilities:
i) Design and layout of Cycle Tracks as per IRC : 11
ii) Recommended practice for Traffic Rotaries as per IRC : 65
iii) Provision of speed Breakers for Control of Vehicular speeds on Minor Roads as per IRC : 99
iv) Software applications in Transportation Planning & Highway Design
(8)

UNIT-V
i) Environmental Impact Assessment of Highway Projects as per IRC : 104
(4)

PRACTICAL WORK:
i) To carry out speed studies
ii) To carry out traffic volume studies.

REFERENCES BOOKS
i) Indian Roads Congress : 93. New Delhi. Design & Installation of Road Traffic Signals,
ii) Indian Roads Congress : 39. New Delhi. Road-Rail Level Crossing
iii) Indian Roads Congress : 98. New Delhi. Accommodation of underground utility services along and across roads in Urban Areas
iv) Indian Roads Congress : 92. New Delhi. Interchanges in Urban Areas
MCT-6207 - DESIGN AND CONSTRUCTION OF HYDRAULIC STRUCTURES  
(Elective Course)

Maximum marks : 50  
Time Allowed : 3 hours  

Note: Examiner shall set eight questions covering the whole syllabus. The candidate will be required to attempt any five questions.

OBJECTIVES
The subject of "Design & Construction of Hydraulic Structures" will enable the students to:

i) Acquire knowledge concerning construction of various types of dams, lining of irrigation channels, construction of wells provision of various energy dissipation works and construction river training works etc.

ii) Acquire relevant knowledge for construction of various types of hydraulic structures.

IMPLEMENTATION:
Instruction will focus on providing relevant knowledge in construction of concrete dam, earth dams and rock fill dams, construction of water wells and lining of irrigation channels. The instructional strategies will include lecture-cum-discussion sessions, field visits, and practical exercises/assignments/seminars.

EVALUATION STRATEGY:
1. Two class test of 15 marks each (regular) : 30  
   (One class test for Modular)
2. Assignments, seminars & quizzes : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
Elements of Dam Engineering:  
Embankment dam types and characteristics, concrete dam types and characteristics spillway types, site selection for dams.  (4)

Coffer Dams:  
Types of coffer dams, suitability criteria, design considerations, and construction of different types of cofferdams.  (4)

UNIT-II
Concrete Dams:  
Gravity dams, loading and forces on gravity dams, Considerations and design aspects of basic profile of gravity dam, stability criteria, galleries in dams, instrumentation in dams, temperature control, control of cracking, raising and strengthening of existing dams.  (8)

Mass Concreting of Dams:  
Concrete mixes, ad-mixtures, batching, mixing, transportation and placing and compaction and curing of concrete, heights of lifts, Joints and tests on concrete.  (6)
UNIT-III
Earth Dams:
Factors influencing design, criteria for safety, design aspects of earth dams, seepage control, methods of construction of earth dams and bonding dam to foundation, building embankment, compaction protection of u/s slope, top and d/s slope, rip rap and concrete lining of slopes.

Rockfill Dams:
Design consideration and various forces in rock fill dam, rubble backing of impervious face, impervious u/s facing, settlement and sluicing.

UNIT-IV
Lining of Irrigation Channels:
Types of lining, design considerations of concrete lining for channels, concrete lining, shotcrete lining, brick lining, tiles, asphaltic lining, stone and concrete block lining, lining of earth materials, comparative water tightness of different types of lining, use of Geo-textiles in canal works. Provision of filters for canals in areas having high sub surface water level.

UNIT-V
Well Design and Construction:
Material selection, design of well & selection of site, drilling methods, methods of sampling, selection and lowering of well assembly, plumbness and alignment, methods of gravel packing, placing cement seal and grout, well development methods and pump selection.

Introduction to Miscellaneous Structures:
River training works, flow measuring structures, river improvement, scale models in hydraulic engineering. Model Investigations, Similitude model laws.

PRACTICE TASKS:
i) Practical exercises relating to design considerations and construction of hydraulic structures
ii) Field visits to dam sites to be conducted for practical training, and preparation of report.

REFERENCE BOOKS:
iii) P. Novak; A.I.B Maffat & C.Nalluri, Hydraulic Structures, Unwin Hyman.
v) Davis Handbook of Applied Hydraulics, Tata McGraw Hill.
vi) Bharat Singh, Engineering for Embankment Dams Oxford & IBH.
OBJECTIVES
After going through the course on Steel Construction Technology the students shall be able to:
i) Do analysis of various steel structures using latest revision of IS 800 to Limit state Design theory,
ii) Carry out erection and fabrication of different steel structures.
iii) Carry out maintenance of Steel Structures

IMPLEMENTATION
Instruction will focus on providing the knowledge of steel sections, their behavior construction and fabrication. The instructional strategies will include lecture-cum-discussion sessions, field visits and practical exercises/assignments/seminars etc.

EVALUATION STRATEGY :
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Assignments, seminars : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS
UNIT-I
Materials, classification and properties, Structural steel sections and data
Limit State: Introduction, working stress design, limit state design, partial safety factors, section classification

UNIT-II
Introduction to Limit State Design Concept of beams under bending: unrestrained beams and laterally restrained beams; Beam Columns and design of hollow sections.

UNIT-III
Structural Steel Detailing:
Symbols, layout drawings, shop detail drawings, assembly marking.

Fabrication and Erection of Steel Structures:
Methods, tools, equipment and practices, Transportation of fabricated components, Erection equipment, erection tools, methods of erection, section sequence field connections, detailing to facilitate erection. Storage and handling.

UNIT-IV
Specifications, Estimating and costing steel work.
Fire protection, Maintenance and repair of steel construction.
PRACTICAL EXERCISES:
i) Structural detailing exercise for an industrial building
ii) Practical exercises on cutting, drilling, bolting, welding, riveting
iii) Study and demonstration of erection of steel components in a construction site.

REFERENCE BOOKS:
iv) Guidebook for Fabrication and Erection of Steel Structures (2005) Kolkata INSDAG
MCT- 6104 RURAL CONSTRUCTION TECHNOLOGY
(Elective Course)

Maximum marks : 50
Time Allowed : 3 hours

Note: Examiner shall set eight questions covering the whole syllabus. The candidate will be required
to attempt any five questions.

OBJECTIVES
The subject of Rural Construction Technology will expose the students to learning the learning of:
i) Appropriate technology in the area of housing,
ii) Water supply Sanitation,
iii) Rural roads construction and
iv) Minor irrigation works etc.

IMPLEMENTATION:
Instruction strategy will focus on providing relevant knowledge in construction of rural housing,
water supply and sanitary schemes, all weather roads and minor irrigation facilities through use
of appropriate technologies for rural areas. Lecture-cum-discussion sessions, field visits,
practical exercise/assignments, seminars and video film shows will be part of the instruction strategy
for providing knowledge and skills to the students.

EVALUATION STRATEGY
1. Two class test of 15 marks each (regular) : 30
   (One class test for Modular)
2. Assignments, seminars & quizzes : 20
3. Final Examination : 50
4. Total Marks : 100

CONTENTS

UNIT-I
Rural Development Planning and Concept of Appropriate Technology:
Scope; development plans; various approaches to rural development planning; concept of appropriate
technology. Rural development programme/projects.

UNIT-II
Rural Housing:
Low cost construction materials for housing; Architectural considerations for individual and
group housing; Composite material - ferro-cement & fly ash, autoclaved calcium silicate bricks and
soil-stabilized un-burnt brick; Plinth protection of mud walls; design consideration and construction
of: non-erodible mud plaster, Water-proof and fire-retardant roof treatment for thatch roofs. Pre-
cast stone masonry; rat-trap bond for walls; Panels for roof, ferro-cement flooring / roofing units,
Thin R.C. ribbed slab for floors & roofs, pre-cast R.C. channel, Unit for flooring/roofing scheme,
pre-cast R.C. flooring/roofing scheme-Pan roofing scheme; manual & power scaffold hoist,
lifting device for prefab components; Earthquake resistant measures for low cost houses.

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[12 ]
UNIT-III
Water Supply and Rural Sanitation:
Sources of water. BIS & WHO water standards. Quality, Storage and distribution for rural water supply works; basic design principles of treatment-low cost water treatment technologies; Hand pumps-types, installation, operation, and maintenance of Mark-II hand pumps; conservation of water; rainwater harvesting; drainage in rural areas, design of low cost waste disposal systems; design and construction of low cost latrines: 2 pit pour flush water seal, VIP latrines, septic tank etc; Biogas technology; low cost community & individual Garbage disposal systems, Ferrocement water storage tanks.

UNIT-IV
Low Cost Roads and Transport:

UNIT-V
Low Cost Irrigation:
Design Consideration and construction of tube-well, drip & sprinkler irrigation systems. Watershed and catchments area development - problems and features of watershed management, watershed structures.

i) Field visits to any 3-4 of the following to be arranged and prepare the report of the visit.
   - CBRI Roorkee, UP.
   - CDC, Govt. Polytechnic, Sundernagar, HP.
   - CDC, Thapar Polytechnic, Patiala, Pb;
   - Bunga Villages and Sukhomajri villages (HR);
   - Central Soil-Water Management Research and Training Institute, Sector 27, Chandigarh. UT;
   - Central Road Research Institute (CRRI), Mathura Road, Delhi, UT;
   - SERC, Ghaziabad, UP;
   - Villages around Chandigarh.
   - Site of Rural Road (PMGSY)

ii) Drawing Exercises on the following to be done:
   - Rural Housing;
   - Water Supply Project (Safe drinking water treatment, storage and distribution scheme);
   - Rural Latrines;
   - X-sections of Rural Roads;
   - Methods of Irrigation and Watershed Projects.
   - Testing of construction materials for Housing.
   - Testing of construction materials for Roads;
   - Testing of construction materials for Ferrocement
REFERENCE BOOKS:
ii) CBRI, Roorkee, Advances in Building Materials and Construction.
iii) Satyanarayana Murthy C., Design of Minor Irrigation and Canal Structures. Wiley Eastern Ltd.,
iv) Park K. Preventive and Social Medicine, M/s. Banarsi Das Bhanot.
v) Yash Pal Bedi, A Hand book of Preventive and Social Medicine; Delhi, Atam Ram & Sons,
vi) Document on Rural Road Development in India Volume1& 2. New Delhi, Central Road Research Institute,
MTE 6202  RESEARCH METHODOLOGY
(Elective Course)

Maximum marks :  50
Time Allowed : 3 hours

OBJECTIVES
After the completion of the course, students will be able to:
i) Identify and define research problems
ii) Select appropriate method of research
iii) Select sample for the study
iv) Design/develop tools for collecting relevant information/data
v) Analyze the data
vi) Write a research report
vii) Formulate a research proposal
viii) Evaluate research report/journal article

Final examination of Theory (50 Marks)
i) Final paper of 100 marks (Weightage towards final will be counted out of 50)
ii) Set eight questions strictly covering the whole syllabus for the course (Weightage should be assigned to various topics keeping in view the hours of teaching specified against each topic in the syllabus).
iii) Students are required to attempt any five out of the eight given questions.

Weightage to various components for Sessional (50 Marks)
i) Class Tests: Weightage = 30 Marks
   - M.Tech. Engg. Edu. (Regular) Programme:
     Two class tests of Maximum marks 60 with Two Hours duration covering about 30% of the syllabus
   - M.Tech. Engg. Edu. (Modular) Programme:
     One class test of Maximum marks 60 with Two Hours duration covering more than 75% of the syllabus
   - Weightage halved for awarding sessionals

ii) Home Assignments: Weightage = 20 Marks
   - 2-3 assignments of 10 marks each, However sum of all weightage will be restricted to 20 marks OR One assignment and one seminar presentation: Weightage can be decided by the teacher. However sum of all weightage will be restricted to 20 marks

CONTENTS

UNIT –I
Introduction to Research
Concept, types – basic, applied and action, Need for research in Engineering & Technical Education

Reviewing Literature
Need, Sources – Primary and Secondary, Purposes of Review, Scope of Review, steps in conducting review.

Identifying and defining research problem
Locating, analyzing stating and evaluating problem. generating & evaluating different types of hypotheses
UNIT-II
Methods of Research
Descriptive Research: Survey, Case Study and Content Analysis – Concept, types, procedure for conducting descriptive research.
Correlation Research: Concept, types, procedures for conducting correlational research
Expost Facto Research: Concept and procedure for conducting research
Experimental Research: Concept, design of experimental research, internal and external validity of experimental research

UNIT-III
Sampling Techniques
Concept of population and sample, sampling techniques - simple random sampling, stratified random sampling, systematic sampling and cluster sampling, snow ball sampling, purposive sampling, quota sampling techniques. Determining size of sample.

i) Design and development of measuring instruments, Tests, questionnaires, checklists, observation schedules, interview schedules, evaluating research instruments, selecting a standardized test.

ii) Procedure for data collection
Aspects of data collection, coding data for analysis

UNIT-IV
Statistical Methods of Analysis
Descriptive statistics: Meaning, graphical representations, mean, range and standard deviation, characteristics and normal probability curve: concept & characteristics
Inferential statistics: t-test, Chi-square tests, correlation (rank difference and product moment), ANOVA (one way)
including numerical problems on above Statistical Methods
Selecting appropriate Statistical Methods of analysis.

UNIT-V
Procedure for writing
Research proposal; Purpose, types and components of research proposal, Funding Agencies
Procedure for writing a research report : Audiences and types of research reports, Format of research report .
Procedure for Writing Journal Article
Strategies for evaluating, Research disseminating and utilizing research – An Overview

PRACTICE TASKS
i) Define a research problem in technical education/industry after studying problem situation and literature
ii) Write objectives for the selected problem
iii) Write hypotheses for the problems
iv) Select research design for the given research
v) Select appropriate measuring instruments for collecting the given data/information
vi) Design a questionnaire, interview schedule for the given problems and its objectives
vii) Identify the appropriate statistical methods of analysis for the given research proposal.
viii) Critically analyze the given research reports on various aspects such as rational, objectives, hypothesis, design, measuring tools, statistical analysis, interpretation etc. to identify the gaps or weaknesses in the study.
REFERENCE/RECOMMENDED BOOKS


iv) CPSC: Developing Skills in Technician Education Research Modules 1 to 11 Singapore, Colombo Plan Staff College for Technician Education


