MASTER OF ENGINEERING
IN
CONSTRUCTION TECHNOLOGY AND MANAGEMENT

STUDY & EVALUATION SCHEME
(For Regular & Modular Programmes)

FOR
EXAMINATION OF 2010-2011
SCHEME OF EVALUATION
FOR M.TECH/ ME REGULAR & MODULAR PROGRAMMES

1. Duration of the Programmes

i) For Regular M.Tech./M.E. Programmes
The normal duration of M.Tech./ME programmes including Thesis will be 2 academic years (4 semesters). The maximum period of completion of the programme including Thesis shall be 4 academic years (8 semesters). 2 years (4 semesters) extension in genuine hardship cases is allowed by the Vice-Chancellor of Panjab University, Chandigarh for submission of thesis.

ii) For Modular M.Tech./M.E. Programmes
The normal duration of Modular M.Tech./M.E. Programmes including Thesis will be 3 academic years (to be approved by University), (6 spells, each spell of 5 weeks duration including Saturdays & Sundays. The maximum period of completion of the programme including Thesis shall be 6 academic years. 2 years extension in genuine hardship cases is allowed by the Vice-Chancellor of Panjab University, Chandigarh for submission of thesis.

2. Number of Theory Papers allowed in a Semester/Spell

i) For M.Tech./M.E. Regular Programmes
All students will be required to qualify twelve theory papers during the course. No student will be allowed to qualify more than 5 papers at the end of first semester and not more than 10 papers (including the papers passed in the first semester), at the end of second semester or first year. Two papers will be offered in the 3rd semester.

ii) For M.Tech./M.E. Modular Programmes
All students will be required to qualify 12 theory papers during the course. No student will be allowed to qualify more than two papers at the beginning of the 2nd
spell and not more than four papers (including the papers passed in the beginning of IIInd spell) at the beginning of 3rd spell and so on.

3. Conditions For Appearing In End-Semester Examination

   i) Periodic Tests (for M. Tech./ME Regular Programmes)

   Every student has to appear in two periodic tests as decided by the Institute and must qualify the same. There will be only one make-up test for those students who are unable to appear in one or both mid-semester tests due to genuine reasons to the satisfaction of Coordinator.

   Students, whose performance in the class-tests/sessionals is not satisfactory, are liable to be detained by the Director from appearing at the University Examinations. The detailed rules of the University Examinations are available at Panjab University, Chandigarh and all students are advised to get the latest copy for guidance and further information.

   ii) Periodic Tests (for M. Tech./ME Modular Programmes)

   Every student has to appear in one periodic test as decided by the Institute and must qualify the same. There will be only one make-up test for those students who are unable to appear in the test due to genuine reasons to the satisfaction of Coordinator.

   Students, whose performance in the test/sessionals is not satisfactory, are liable to be detained by the Director from appearing at the University Examinations. The detailed rules of the University Examinations are available at Panjab University, Chandigarh and all students are advised to get the latest copy for guidance and further information.

4. Examination And Result

   (For M. Tech./ME Programmes both Regular and Modular)

   - Minimum marks to pass examination: 50% in the sessional in each subject and 40% in each theory paper. Both the theory and sessional marks will be considered
independent of each other. Aggregate pass percentage will be 50% in each subject.

- Weightage in each subject  
  50 marks: Sessional  
  100 marks: Final theory examination

- The students who obtain in first attempt 75% or more of the aggregate marks in both theory and sessionals and also if the thesis has been adjudged to merit distinction are awarded **First Division with Distinction.** If the thesis has not been adjudged to merit distinction then the students are awarded first division.

- The students who obtain 60% or less than 75% of the aggregate marks in all theory papers and the sessionals are awarded **First Division.**

- The students who obtain less than 60% of the aggregate marks in all the theory papers and the sessionals but not less than 40% in each theory paper and 50% in the sessionals will be awarded **Second Division.**

**Preliminary Thesis/Thesis**

Four neatly typed or printed copies of Thesis properly bound, shall be submitted to the University through Guide and ME Cell of the institute.

5. COURSES OF STUDY AND EVALUATION SCHEME

(a) **M. Tech/ME Regular Programmes**

In each of these Regular programmes, there are a total of 12 theory subjects, each of 150 marks (including sessional of 50 marks), a preliminary thesis based project work of 100 marks (only sessionals), and thesis work of 100 marks (only sessional/seminar), a total of 2000 marks. No numerical marks will be assigned to thesis work. It will be either accepted or rejected. However, quality of work reported in the thesis can be graded in terms of “Very Good”, “Good” or “Average”. A candidate will study 05 theory subjects each in first and second semesters, two theory subjects and thesis based project work in third semester and thesis work in fourth semester. The courses of study and evaluation scheme for M. Tech./ME Modular programmes are the same as described for M. Tech./ME Regular programmes and is detailed here:
## M.TECH./M.E. REGULAR PROGRAMMES

### Semester – I

<table>
<thead>
<tr>
<th>Code No.</th>
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</table>
b) M. TECH/ME MODULAR PROGRAMMES

In each of these Modular programmes, there are a total of 12 theory subjects, each of 150 marks (including sessional of 50 marks), a preliminary thesis based project work of 100 marks (only sessionals), and thesis work of 100 marks (only sessionals), a total of 2000 marks. No numerical marks will be assigned to thesis work. It will be either accepted or rejected. However, quality of work reported in the thesis can be graded in terms of “Very Good”, “Good” or “Average”. A candidate will study 02 theory subjects each in first to six spells; preliminary thesis based project work in fifth spell, and thesis work in sixth spell. The courses of study and evaluation scheme for M. Tech./ME Modular programmes are the same as described for M. Tech./ME Regular programmes and is detailed here:

### Spell – 1

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5.1 STUDY SCHEME FOR MASTER OF ENGINEERING (I.P.) IN CONSTRUCTION TECHNOLOGY & MANAGEMENT (REGULAR) PROGRAMME.

Ist SEMESTER

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<tr>
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<td>A . CORE SUBJECTS (Compulsory)</td>
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B. ELECTIVE SUBJECTS

Only Two Elective Subjects to be taken:

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Total 5 subjects (3 Core plus 2 Elective) is to be taken.

* Total contact hours depending on subjects taken.

2nd SEMESTER

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### A. CORE SUBJECTS (Compulsory)

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### B. ELECTIVE SUBJECTS

Only Two elective Subjects to be taken:

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<td>100</td>
<td>50</td>
<td>150</td>
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<tr>
<td>MCT 6204</td>
<td>Green Buildings and Services</td>
<td>3</td>
<td>1</td>
<td>100</td>
<td>50</td>
<td>150</td>
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<tr>
<td>MCT 6205</td>
<td>Bridge Engineering</td>
<td>3</td>
<td>1</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>MCT 6206</td>
<td>Advanced Construction Technology</td>
<td>3</td>
<td>1</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>MCT 6207</td>
<td>Design &amp; Construction of Hydraulic Structures</td>
<td>3</td>
<td>1</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

Total 5 subjects (3 Core plus 2 Elective) is to be taken.

### 3rd SEMESTER

**TWO ELECTIVES & THESIS BASED PROJECT WORK**

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Theory/Viva</th>
<th>Sessional</th>
<th>Total</th>
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<tbody>
<tr>
<td>MCT 7101</td>
<td>Steel Construction Technology</td>
<td>3</td>
<td>2</td>
<td>100</td>
<td>50</td>
<td>150</td>
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</tr>
<tr>
<td>MCT 7102</td>
<td>Ground Water Engineering</td>
<td>3</td>
<td>2</td>
<td>100</td>
<td>50</td>
<td>150</td>
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</tr>
<tr>
<td>MCT 7103</td>
<td>Design of Pre-stressed Concrete Structures</td>
<td>3</td>
<td>2</td>
<td>100</td>
<td>50</td>
<td>150</td>
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</tr>
<tr>
<td>MCT 7104</td>
<td>Transportation Engineering</td>
<td>3</td>
<td>2</td>
<td>100</td>
<td>50</td>
<td>150</td>
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</tr>
<tr>
<td>MTE 7103</td>
<td>Technology Management</td>
<td>3</td>
<td>2</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td></td>
</tr>
<tr>
<td>MCT 7151</td>
<td>Thesis Based Project Work</td>
<td>-</td>
<td>-</td>
<td>15</td>
<td>-</td>
<td>100</td>
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<td>4</td>
<td>15</td>
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### 4th SEMESTER

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Subject</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>Theory/Viva</th>
<th>Sessional</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>MCT 7251</td>
<td>THESIS WORK</td>
<td>-</td>
<td>-</td>
<td>25</td>
<td>-</td>
<td>100</td>
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</tr>
</tbody>
</table>

**Evaluation Scheme:**

The existing evaluation scheme of the Panjab University, Chandigarh for its M.E. programmes will be followed for the 12 subjects of study (6 core and 6 elective) and thesis work.
### 5.2.1 Study Scheme

<table>
<thead>
<tr>
<th>Module</th>
<th>Code</th>
<th>Core/Elective</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module A</td>
<td>MCT 6102</td>
<td>Core</td>
<td>Concrete Construction Technology</td>
</tr>
<tr>
<td></td>
<td>MCE 6171</td>
<td>Elective</td>
<td>Computer Programming and Applications</td>
</tr>
<tr>
<td></td>
<td>MCT 6104</td>
<td>Elective</td>
<td>Rural Construction Technology</td>
</tr>
<tr>
<td>Module B</td>
<td>MCT 6103</td>
<td>Core</td>
<td>Foundation Design and Construction</td>
</tr>
<tr>
<td></td>
<td>MCT 6105</td>
<td>Elective</td>
<td>Construction Costing &amp; Financial Management</td>
</tr>
<tr>
<td></td>
<td>MCT 6207</td>
<td>Elective</td>
<td>Design and Construction of Hydraulic Structures</td>
</tr>
<tr>
<td>Module C</td>
<td>MCT 6101</td>
<td>Core</td>
<td>Construction Management</td>
</tr>
<tr>
<td></td>
<td>MCT 6206</td>
<td>Elective</td>
<td>Advanced Construction Technology</td>
</tr>
<tr>
<td></td>
<td>MCT 7102</td>
<td>Elective</td>
<td>Ground Water Engineering</td>
</tr>
<tr>
<td>Module D</td>
<td>MCT 6201</td>
<td>Core</td>
<td>Environmental Engineering &amp; Mgt.</td>
</tr>
<tr>
<td></td>
<td>MCT 7104</td>
<td>Elective</td>
<td>Transportation Engineering</td>
</tr>
<tr>
<td>Module E</td>
<td>MCT 6202</td>
<td>Core</td>
<td>Building Maintenance</td>
</tr>
<tr>
<td></td>
<td>MCT 6203</td>
<td>Elective</td>
<td>Construction Equipment</td>
</tr>
<tr>
<td></td>
<td>MCT 6205</td>
<td>Elective</td>
<td>Bridge Engineering</td>
</tr>
<tr>
<td></td>
<td>MCT 7151</td>
<td></td>
<td>Preliminary Thesis</td>
</tr>
<tr>
<td>Module F</td>
<td>MCT 6208</td>
<td>Core</td>
<td>Pavement Design, Construction and Maintenance</td>
</tr>
<tr>
<td></td>
<td>MCT 6106</td>
<td>Elective</td>
<td>Advanced Structural Design and Detailing</td>
</tr>
<tr>
<td></td>
<td>MCT 6204</td>
<td>Elective</td>
<td>Green Buildings and Services</td>
</tr>
<tr>
<td></td>
<td>MCT 7251</td>
<td></td>
<td>Thesis Work</td>
</tr>
</tbody>
</table>

Each module comprise of 2 subjects - 1 core and 1 elective
Total of 6 modules are required to be completed
Note: A student can select maximum of two electives from other discipline.
## List of Electives from Other Disciplines

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTE – 6105</td>
<td>Technical and Vocational Education System</td>
</tr>
<tr>
<td>MTE – 6201</td>
<td>Human Resource Development and Training Methods</td>
</tr>
<tr>
<td>MTE – 7102</td>
<td>Organization Behavior and Human Relations</td>
</tr>
<tr>
<td>MTE – 6208</td>
<td>Entrepreneurship Development</td>
</tr>
<tr>
<td>MTE – 7103</td>
<td>Technology Management</td>
</tr>
</tbody>
</table>
Course Plan for Modular Programme

1. Course plan begins w.e.f. 1st week of June/2nd week of December for respective module. (two subjects). Study work including assignments shall be completed within 6 weeks. This includes Teaching work of 34 working days with contact period of about 6 hours/day. Thus, 90 hour of study work per subject is completed by student which is at par with the regular programme. The examination shall be conducted in the beginning of next module.

2. The entrants at particular session shall be offered the module designated for that particular period/session. For example, if the module 3 is currently offered, the batch at entry level shall also take up module 3 along-with previous batch. The detailed sequence of study is given in table below:

<table>
<thead>
<tr>
<th>Batch 1,4</th>
<th>Module A</th>
<th>Module B</th>
<th>Module C</th>
<th>Module D</th>
<th>Module E</th>
<th>Module F</th>
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</thead>
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<table>
<thead>
<tr>
<th>Batch 2,5</th>
<th>Module A</th>
<th>Module B</th>
<th>Module C</th>
<th>Module D</th>
<th>Module E</th>
<th>Module F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Batch 3,6</th>
<th>Module A</th>
<th>Module B</th>
<th>Module C</th>
<th>Module D</th>
<th>Module E</th>
<th>Module F</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Notes:

(i) 1,2,3,4,5,6 … indicates the sequence of module to be followed by the particular batch as given above. For example, at entry point batch 2 shall take up module C along-with batch 1. Thus during any session one module is being taken up.
(ii) Each Module comprises of two subjects

1.2. Evaluation for a Module

The Evaluation will be done on continuous and progressive basis. The continuous assessment shall be based on class test, assignments/practical and tutorial work. Final examination shall be conducted just before the commencement of the next module.

**Evaluation Scheme**

The proposed evaluation scheme for the 12 subjects of study (6 core and 6 electives) and thesis work is as below:

- Each subject carries a total of 150 marks
  - Theory (End semester Examination) = 100
  - Sessional /Practical = 50
  - Total = 150

- Total marks = 150 x 12 = 1800
- Preliminary Thesis (100 only sessionals) = 100
- Final thesis (100 only sessionals) = 100

**Total marks** = 2000
MCT -6102 CONCRETE CONSTRUCTION TECHNOLOGY
(Core Course)

CONTENTS

1. Principles of concrete mix design : concrete materials, mix proportioning and early age properties, strength, permeability and durability. (12)

2. Concrete mix design procedures by : IS/ACI British Standards, mix design procedures using fly ash, fibers and design of high performance concrete. (20)

3. Concreting operations - practices and equipment, batching; mixing; transporting; shuttering and staging; placing and compacting; curing, accelerated curing; finishing and jointing. (04)


5. Special concrete operations, shotcrete, grouting, uniting, under water concreting, hot and cold weather concrete, pumpable concrete, ready mixed concrete. (02)

6. 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. (06)

7. Pre-stressed concrete construction-principle, methods, materials, tools and equipment for the construction of a pre-stressed concrete. (04)

8. Inspection and quality control of concrete construction - stages, principles, checklist, statistical controls, procedures. (02)
Practical Exercises:

1. Testing of aggregates - fine and coarse as per BIS procedure.
2. Testing of cement with reference to IS specifications and cement grade.
3. Concrete mix design for desired grade from given materials.
4. (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.
5. Study of effect of compaction on strength of concrete
6. Study the effect of plasticizers on workability of concrete.
7. Study the permeability of concrete.
8. Conduct chemical analysis of hardened concrete to determine the cement content.
9. Inspection of a concrete construction site and preparation of report showing correct and incorrect practices.

Reference Books

3. Neville, Brooks, Concrete Technology, Addison – Wesley, England 
7. Young, Concrete, Prentice Hall Inc. New Jersey. 
10. Sood, Hemant; Jyoti P.M. ; Software on Concrete Mix Design ConMD – 2000, NITTTR, Chandigarh. 
11. Shetty, M.S.’ Concrete Technology, M/S S. Chand & Co. Ltd. New Delhi 
12. Mehta P. Kumar & Monteiro, Paulo J.M., Concrete Microstructure, Properties and Materials, M/S Indian Concrete Institute, Chennai. 
MCT- 6103 FOUNDATION DESIGN AND CONSTRUCTION  
(Core Course )

CONTENTS

1. General 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 foundation design, numerical problem based in BIS method.

( 09)

2. 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)

3. 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.


Ultimate capacity of single pile driven in cohesive soils; modification for driven and cast-in-place piles and bored and cast-in-place piles. Capacity of very long piles – Numerical problems

Carrying capacity of piles on rocks.

Piles in fills - negative skin friction

Carrying capacity of pile groups in cohesive soil and cohesionless soils,
Efficiency of pile group.
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

4. **Soil Stability:**

Retaining walls – Introduction, types, Principles of design, Modes of failure, drainage of the back fill, problems related to design of gravity retaining wall and stability of retaining walls.

Unbraced excavations, braced excavations.

Sheet piles - types anchors and tie backs.

Shoring and Underpinning - necessity and methods

5. **Improvement of Foundation Soils**

**Purpose:**

(a) 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.

(b) Improvement of cohesive soils: preloading, or dewatering, methods of installing sand drains, drain wicks, electrical and thermal methods.

(c) Grouting: purpose, functions, types of grouts; soil bentonite - cement mix, cement mix, emulsions, solutions: grout injection methods.

(d) 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.

(09)
6. 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)

Practical Exercises:


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

3. Determination of shear strength characteristics by laboratory tests.

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

5. Recommend a field investigation programme to obtain design data.

6. Design of a shallow foundation. (Determination of depth and size of footing)

7. Recommend suitable dimensions, depth and spacing of pile/pile group for given loading conditions.

Reference Books

13. Peck, Hanson, Thonbhn, Foundation Engineering, Wiley Eastern Ltd. 2e, 1980
18. Duggal A K, Pile Foundations, NITTTR, Chandigarh, 2005
19. IS : 6403 Determination of bearing capacity of Shallow foundations
20. IS 8007- Part –I Calculation of Settlement of Foundation
MCT- 6101 CONSTRUCTION MANAGEMENT  
(Core Course)

CONTENTS

1. **Introduction:**
   
   Definition, functions and scope of construction management; scientific methods of management; construction team. [2]

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

3. **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]

4. **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]

5. **Site Layout:**
   
   Principles governing site lay out; factors effecting site lay out; preparation of site lay out. [3]

6. **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.

7. 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

8. Labour Laws and Acts:

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

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:

1. Challahan, M.T., Construction Project Scheduling.
3. Austen: Managing Construction Projects, A guide to Processes & Procedures
   International Labour office, Geneva
8. Gehlot and Dhir: Construction Planning and Management, New Age International
   (P) Ltd.
10. Raina: Construction Management Practice
12. S. Choudhury; Project Management, Tata McGraw Hill
MCT-6201   ENVIRONMENTAL ENGINEERING & MANAGEMENT
(Core Course)

CONTENTS

1. Environment & Ecology

Definition and understanding of concepts, ecosystem, energy flow in ecosystem, water, carbon and nitrogen cycle, community’s inter-relationships in an ecosystem. Importance of clean environment. (2)

2. Type of Pollutants and Protection of Environment

2.1 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.

2.2 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.

2.3 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.

2.4 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.

2.5 Solid Waste Pollution:

Sources, effects and treatment of solid wastes. (15)
3. **Degradation of Land Resources**:

3.1 Deforestation and Wetlands: 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.

(8)

4. **Current Issues in Environmental Engineering**:

Global warming, ozone depletion, acid rain, oil pollution, radiation hazard and control, role of non-conventional sources of energy in environment.

(5)

5. **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.

(6)

6. **Environmental Management System**:

Main clauses and basic steps for certification. Water pollution, air pollution and EPA and their salient features.

(6)

7. **Cleaner Production Technologies**

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

(6)
Laboratory Work/Field Tasks

1. Analysis of water for various parameters using spectrophotometer and flame photometry.

2. Determination of BOD for domestic waste/ industrial waste.

3. Determination of MPN of given sample.

4. Air sampling and determination of standard particulate matter and other gaseous contaminants

5. Measurement of CO$_2$, CO, NO$_X$ levels in ambient air by gas analyzer


7. Determination of noise levels for indoor and outdoor noise.

8. Use of Atomic Absorption spectroscopy (Demonstration only)


Reference Books:


5. GN Panday, GC Carney Environmental Engineering, Tata McGrawHill.


8. P Venugopala Rao ; Text Book of Environmental engineering, PHI

CONTENTS

1. **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)

2. **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.


   (8)

3. **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.

   (4)

4. **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.

   (4)

5. **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, confirmation and repair steps.

   (4)
6. **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.

7. **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)

8. **Maintenance of Multistorey Buildings:**

Specials features for maintenance of multi-storeyed buildings, including fire protection system, elevators booster pumps, generator sets. (2)

**Practical Work/Field Tasks**

1. Conduct of non destructive tests in diagnosis of cracks, strength, moisture level, corrosion rate, depth, cover and spacing of steel reinforcement.

2. Testing of properties of repair materials

3. Determination of extent of corbonation in concrete by phenolphethalien test

4. Determination of efflorescence in bricks in laboratory.

5. Preparation of report

   - On maintenance of fire fighting equipment after visiting Fire Station
   - On maintenance aspects of treatment plants.
   - Special repair work sites for rehabilitation of structures.
Reference Books:


2. R. Chudley; Building finishes, fittings and domestic services, Longman Technical Services

3. G. Szechy, D.Sc; Foundation Failures, Concrete Publications limited, 14 Dartmouth street, London

4. Whitney Clark Huntington Probert E. Mickadeit; Building Construction materials and types of construction, Allan Hancock College


6. W.H. Ransom; Building Failures: Diagnosis and Avoidance, New Age Publications (P) Ltd.


9. Repair of Concrete damaged by reinforcement Corrosion - Report of working party, The Concrete Society

10. R. Chudley; The maintenance and adaption of buildings, Longman Technical Services

11. Common Building Defects - Diagnosis & Remedy, National Building Agency

12. B.D. Hutchinson, J. Barton, Nellis; Maintenance and Repair of Buildings And their internal environment, New Age International (P) Ltd.

MCT- 6208      PAVEMENT DESIGN, CONSTRUCTION AND MAINTENANCE  
(Core Course)

CONTENTS

1. Introduction:
Types of pavement structure, functions of pavement components, factors affecting pavement design.  

(07)

2. Design of Pavements:
Design considerations, methods for design of rigid pavements:
Westergaard's method, F.A.A. method, types of joints and their design in cement concrete pavements.
Thickness design for Airport pavement, FAA method for Flexible and Rigid pavements, ESWL Concept, CBR method (USACE), LCN system of pavement design,  

(12)

(10)

(08)

3. Construction of Highways:
Types of Highway Construction and their selection, materials for construction, construction procedure of different highways: Gravel roads, WBM, W.M.M., Bituminous pavements, cement concrete pavements, Joints in cement concrete pavements, introduction to various Equipment used for highway construction. Constructional features for Pre-Mix Carpet, Mix Seal Surfacing, B.M., SDBC. Other higher quality pavement layers – DBM, BC (introduction only)  

(10)

4. Maintenance of Highways:
Pavement failures, their causes and remedial measures typical flexible and rigid pavement failures, types of highway maintenance: routine, periodic and special type,
materials used for maintenance of different pavement such as bituminous pavements, cement concrete roads.

Slurry Seal, Liquid Seal, Fog Seal, Patching
Defects/ Failures in Flexible Pavement- their types and causes
Remedial Measures
Surface defects, Cracks, Deformation, disintegration,
Cracks, Spalling, Slab Rocking, Joint Sealant Failure and Rectification

Practical Exercises:

i) Determination of CBR value of sub-grade soils.
ii) Determination of stripping value of road aggregate.
iii) Study of Sensor-paver and other construction machinery
iv) Study of batching and mixing plant for construction of roads.
vi) Evaluation of pavement strength by using Benkelman's Beam.
vii) Determination of strength of existing pavement by Dynamic Cone Penetration Test.
viii) Roughness measurement of road surface

Reference Books:

1. Khanna and Justo; Highway Engineering, Nemchand & Bros. Roorkee
2. Clarkson H.Oglesby and Gary Hicks; Highway Engineering. John Wiley & Sons, London,
4. Khanna and Arora.; Airport Planning and Design
6. Vaswani, Highway Engg Roorkee Publishing House, Roorkee
1. **Rural Development Planning and Concept of Appropriate Technology:**

Scope; development plans; various approaches to rural development planning; concept of appropriate technology; role of civil engineering in rural development; organizational structures & management rural development programme/projects.

2. **Rural Housing:**

Low cost construction materials for housing; low cost housing designs- 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-erodable mud plaster, water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry block walling scheme; rat-trap bond for walls; prefab brick, 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. cored unit for flooring/roofing scheme, pre-cast R.C. plank flooring/roofing scheme-Pan roofing scheme; glued plywood web beams and roof panels; manual & power scaffold hoist, lifting device for prefab components; solar passive building design; building economics and management.

3. **Water Supply and Rural Sanitation:**

Epidemiology 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, recycling of organic/ agricultural wastes; development of village ponds; ferro-cement water storage tanks & latrines. cattle shed management; sewage farming standards for disposal and use for irrigation.
4. **Low Cost Roads and Transport:**


5. **Low Cost Irrigation:**

Design Consideration and construction of tube-well, drip & sprinkler irrigation systems; water logging; reclamation of land; watershed and catchment area development - problems and features of watershed management, management plans, 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.

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 Ferro-cement
Reference Books:

2. CBRI, Roorkee, Advances in Building Materials and Construction.
4. K. Park Preventive and Social Medicine, M/s. Banarsi Das Bhnot.
5. Yash Pal Bedi, A Handbook of Preventive and Social Medicine; Atam Ram & Sons, Delhi.
6. Document on Rural Road Development in India Volume 1& 2; Central Road Research Institute, New Delhi.
11. Biogas Slurry Utilisation; Consortium on Rural Technology (CORT), New Delhi.
MCT 6105  CONSTRUCTION COSTING AND FINANCIAL MANAGEMENT
(Elective Course)

CONTENTS

1. 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  

2. Cash Flow:

Determining the funds required for a construction job; preparing cash flow statements; cash inflow and outflow during contract period; project expectations.

3. 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.

4. 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.

5. Financial Management

Meaning and scope; financial statement analysis; funds flow analysis; capital budgeting; cost-benefit analysis.
Practical 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.

Reference Books:


ii) Gobourne: Cost control in the construction industry.

iii) Schedule of rates, specification manuals etc. from PWD

iv) Chris Hendrickson and Tung Au: Project Management for Construction

v) Datta : Material Management Procedures, Text and Cases, 2e Prentice Hall


vii) Dobbler and Bart: Purchasing and Supplies Management, Text and Cases, 6e

MCT-6207  DESIGN AND CONSTRUCTION OF HYDRAULIC STRUCTURES  (Elective Course)

CONTENTS

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

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

3. 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)

4. 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)

5. Earth Dams:  
   Factors influencing design, criteria for safety, design aspects of earth dams, seepage control, methods of construction of earth dams, clearing, removal of vegetable matter, bonding dam to foundation, building embankment, compaction protection of u/s slope, top and d/s slope, rip rap and concrete lining of slopes. (8)

6. Rockfill Dams:  
   Design consideration and various forces in rock fill dam, rubble backing of impervious face, impervious u/s facing, settlement and sluicing. (6)
7. **Lining of Irrigation Channels:**

Advantages and suitability, types of lining, design considerations of concrete lining for channels, concrete lining, shotcrete lining, brick lining, tiles, asphalitic 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.

(6)

8. **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.

(8)

9. **Introduction to Miscellaneous Structures:**

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

(4)

**Practice Tasks:**

1. Practical exercises relating to design considerations and construction of hydraulic structures

2. Field visits to dam sites to be conducted for practical training and preparation of report.

**Reference Books:**


6. Bharat Singh, Engineering for Embankment Dams Oxford & IBH.
MCT- 6206  ADVANCED CONSTRUCTION TECHNOLOGY  
(Elective Course)

CONTENTS

1. **Earthen Dams** :
   
   Introduction, types , design considerations/aspects to suit available materials, causes of failures, criteria for safe design, section, d/s drainage system, seepage analysis, stability analysis, stability of d/s slope during steady seepage, stability of u/s slope during sudden draw down, stability of u/s and d/s slopes during construction, stability of foundation against shear, seepage control measures, design considerations in earthquake regions, design of earthen dam. Quality control in construction of embankments - monitoring of post - construction behaviour and instrumentation.  

2. **Special Foundations** :
   
   Foundations for chimney, cooling towers, telecommunication/transmission towers, foundations for underground structures, coastal and off shore structures in different soil conditions, foundations in expansive soils. dewatering and its various methods.

3. **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.

4. **Prefabricated Construction** :
   
   Advantages of pre fabricated construction; 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

5. **Advanced Construction Materials**:
   
   Geo-synthetics: Various, types; geo-textiles, geo-grids, geo-membranes, 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.
Practice Tasks:

1. Prepare design and drawing of an Earthen Dam and specify the construction procedure, equipment and quality control measures.

2. Enumerate major design parameters and data requirements of any one type of special foundations.

3. Visit the construction site of multi storeyed building and prepare report on techniques employed and suggest further scope of improvement.

References:

1. Bharat Singh and Varshney RS, Engineering for Embankment Dams - Oxford and IBH.

2) Sharma RK and Sharma TK; Dam Engineering - Oxford and IBH

3) RS Varshney, SC Gupta and RL Gupta. Theory and Design of Irrigation Structures


7) Bungale S Taranath; Structural Analysis and Design of Tall Buildings, Tata McGraw Hill

8) Monohar SN; Tall Chimneys-Design and Construction Tata McGraw Hill.


10) CBRI Roorkee, Advances in Building Materials and Construction.

11) Bohdan Lewicki; Building with large Prefabricates, Elsevier Publishing Company

12) ASG Bruggeling GF Hugghe Prefabrication with Concrete, AA Balkema/Rotterdam/Brookfield

MCT- 6203  CONSTRUCTION EQUIPMENT
(Elective Course )

CONTENTS

1. 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.  

2. 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.  

3. 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.

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

5. 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.  


6. **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

7. **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.

8. **Compaction Equipment:**

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

**Reference Books :**

1. Verma , Mahesh Construction equipment and its planning and applications , Metropolitan Book Co. Ltd.
3. Jagman Singh : Heavy construction Planning ,Equipment and Methods, Oxford and IBH
5. Christian John ; Management, Machines and Methods in Civil Engineering, , John Wiley and Sons.
6. Frank Harris, Modern Construction Equipment and Methods, , John Wiley and Sons.
CONTENTS

1. Introduction to Green Buildings


2. 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. (08)

3. Water and Waste Water Management

Compliance, fixtures, rainwater harvesting and techniques, water and waste water management, solid waste management. (08)

4. 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, insulator materials. (10)

5. 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. (08)

6. Indoor Air Quality

Natural air ventilation systems, different types of low VOC materials, day lighting. (06)
7. **Rating Systems and Certification for Green Building**

Different types of rating systems and their special features. Criteria, compliance, appraisal for rating systems. Case study on rating of green buildings.

(08)

**Practical Tasks/Tutorials**

2. Project on rating of Green Buildings
3. Design of Green Building
4. Field visits for study of green building construction and design features.

**Reference Books**

CONTENTS

1. Introduction

   Definition; components of a bridge; classification; importance of bridges. (03)

2. Standard Specifications for Road 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. (12)

3. 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) (15)

4. Sub-Structure: Design of piers and abutments (Masonry & R.C.C). (04)

5. Foundations: 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 in Components and brief description, Well Cap, Stability of a single well. (07)

6. Bearings, Joints, and Handrails: Different types of bearings, joints and handrails. (04)

7. Construction and Maintenance of Bridges.

**Reference Books**

3. Rangwala; Bridge Engg
4. Rowe, R.E., Concrete Bridge Design, John Wiley & Sons, Inc. New York
5. Raina, V.K., Concrete Bridges Practice Book, Tata McGraw Hill, New Delhi
7. Raina, V.K. Concrete Bridges Handbook, Galgotia Publications (P) Ltd,
8. New Delhi
9. IRC.78.200
10. IS 5050
11. IS 3955
MCT- 6106 ADVANCED STRUCTURAL DESIGN AND DETAILING
(Elective Course)

CONTENTS

1. Introduction:

Introduction to limit state method of design; provisions in the Indian Standard codes for loading, wind loads and seismic loads, design and detailing of concrete structures.

2. BIS handbook for design: Examples of design using handbook

3. Structural Analysis and Design for:

* Columns with biaxial moments.
* Curved beams
* Intze tank and underground water tanks
* Silos and bunkers
* Concrete Chimneys
* Multi-storey building frame design
* Use of computer software for analysis and design

Practice tasks:

i) Analysis and design of beams using the BIS handbook for design

ii) Complete analysis and design of an underground water tank

iii) Analysis and design of a silo

iv) Analysis and design of a concrete chimney using design tables.

v) Analysis and design of a 10-storey building using a computer programme.
Reference Books:

1. Dayaratnam, P: Reinforced Concrete Structures.


4. Jain and Jaikrishna: Plain and Reinforced Concrete Vol II.

5. STAAD Pro- (Software)
MCT 7101  STEEL CONSTRUCTION TECHNOLOGY  
(Elective Course)

CONTENTS

1. Materials, classification and properties (2)
2. Structural steel sections and data (4)
3. Behaviour of steel structures:
   Steel water tanks, Chimneys and Stacks, Bridge Structures, Building Frames,
   Steel Space grids. (8)
4. Structural Steel Detailing:
   Symbols, layout drawings, shop detail drawings, assembly marking. (4)
5. Structural steel fabrication:
   Methods, tools, equipment and practices, Punching, Reaming and drilling, cutting
   operations, fittings, fasteners, bolting, riveting and welding, Assembly,
   inspection, cleaning, sand blasting and painting: Transportation of fabricated
   components, Storage and handling. (12)
6. Erection of steel structures
   Erection equipment, erection tools, methods of erection, section sequence field
   connections, detailing to facilitate erection. (6)
7. Specifications, Estimating and costing steel work. (8)
8. Fire protection of steel construction (2)
9. Maintenance and repair of steel structures (4)

Practical Exercises:

1. Structural detailing exercise for an industrial building
2. Practical exercises on cutting, drilling, bolting, welding, riveting
3. Study and demonstration of erection of steel components in a construction site.
Reference Books:

2. Bryan E.R., ‘The stressed skin design of steel buildings’
3. Malhotra M.M. ‘Design of Steel Structures’
4. Bresker Boro, ‘Design of steel Structures’
5. Dayaratnam, ‘Design of Steel Structures’.
MCT- 7102  GROUND WATER ENGINEERING  
(Elective Course)  

CONTENTS  

1. **Ground Water in Hydrologic Cycle**  
   Hydrological properties of water bearing strata-confined aquifers, transmissibility, storage coefficient, Safe Yield, Optimal yield concept.  
   (6)  

2. **Flow in to Wells**  
   General flow equations, ground water flow lines, flow in relation of ground water contours, water table maps. Steady and unsteady radial flow to a well, well in a uniform flow; steady flow with uniform recharge, non-equilibrium equation for pumping test data, Multiple well systems, partially-penetrating well, well-losses. Leaky aquifers.  
   (12)  

3. **Design of Wells**  
   Design Particular for surface casing, Pump Chamber, Screen Assembly Gravel packing, reduces, overlaps seals and Grouts Tmie pipe centering guides, foundation requirement for installation of wells.  
   (10)  

4. **Construction of wells**  
   (14)  

5. **Replenishment of Ground Water**  
   Requisites of artificial recharge, Artificial recharge by surface spreading and by injection, Roof top water harvesting.  
   (6)  

6. **Investigations of Ground Water:**  
   Surface investigations Electrical resistivity method. Surface investigations – Test drilling, Well logs.  
   (6)
Practicals/ Field work:

(i) Field visit to well drilling sites
(ii) Use of logger and its interpretation for installation of well-screens
(iii) Resistivity study
(iv) Testing of gravel for gravel packing of well
(v) Report on well Pumping Tests.

Reference Books:

MCT 7103  DESIGN OF PRESTRESSED CONCRETE STRUCTURES  
( Elective Course)  

CONTENTS  

1. 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.  


4. Various theories for design of End Block., Practical design of end block for a typical section.  

5. 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.  

7. Method of load balancing and its applications to particular problems of slabs, beams and portals.  

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

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

Reference Books  

1. N. Krishna Raju, Pre-stressed Concrete, Tata McGraw Hill, New Delhi  
2. Nebhrain A.T., Pre-stressed Concrete, Basic Principles and Design Consideration  
3. Dayaratnam, Pre-stressed Concrete Structures  
4. Grawick Ben C., Construction of Pre-stressed concrete structures  
5. Ramamurtham S., Pre-stressed concrete.
MCT- 7104 TRANSPORTATION ENGINEERING  
(Elective Course)

CONTENTS

1. Traffic Flow Characteristics :
   a) Nature of Traffic Flow
   b) Various Parameters e.g speed, rate of flow, density, spacing and headway, lane occupancy, clearance etc.
   c) Categories of traffic flow, uninterrupted and interrupted flow.
   d) Analysis of speed, flow and density relationship.
   e) General Model of Vehicle stream flow.

2. Highway Capacity :
   a) Highway Capacity and level of Service
   b) Basic Freeway Capacity Studies
   c) Level of Service
   d) Criteria and Different Levels of Service
   e) Determination of level of Service

3. Intersection Control and Design :
   a) Design & Installation of Road traffic signals as per IRC : 93
   b) Road – Rail Level Crossing IRC : 39
   c) Accommodation of underground utility services along and across roads in Urban Areas as per IRC : 98
   d) Interchanges in Urban Areas as per IRC : 92

4. Urban Highway Utilities :
   a) Design and layout of Cycle Tracks as per IRC : 11
   b) Recommended practice for Traffic Rotaries as per IRC : 65
   c) Provision of speed Breakers for Control of Vehicular speeds on Minor Roads as per IRC : 99

5. Environmental Impact Assessment of Highway Projects as per IRC : 104
References Books

1. IRC : 93 - Design and Installation of Road traffic Signals
2. IRC : 39 - Road-Rail Level Crossing
3. IRC : 98 - Accommodation of underground utility services along and across roads in Urban Areas
4. IRC : 92 - Interchanges in Urban Areas
5. IRC : 11 - Design and layout of Cycle Tracks
6. IRC : 65 - Recommended practice for Traffic Rotaries
7. IRC : 99 - Provision of Speed breakers for Control of Vehicular speed on Minor Roads
8. IRC :104 - Environmental Impact Assessment of Highway Project
9. Khanna & Justo Highway Engineering ;Nem Chand & Brothers, Roorkee
MCE- 6171 COMPUTER PROGRAMMING AND APPLICATIONS  
(Elective- non- branch)

CONTENTS

1. Introduction to Computers:

   An overview of the functioning of computer, block diagram of computer system, I/O and auxiliary storage devices, machine, assembly and high level languages, assemblers, compliers, interpreters.

   Representation of information: Number systems-binary, octal, hexadecimal systems, character and codes-ASCII and EBCDIC.

   Need for operating system, concepts of operating system, disk storage and its characteristics.

   (07)

2. Programming Language C:

   Introduction: History of C, Variable, Constants & Keywords in C, Operators in C, data types in C, instruction in C.

   Control structures-Decision control structures, Loop control structures, case control structures.

   Functions - Scope rule of functions, parameter passing techniques.

   Storage Classes in C

   Introduction to C preprocessor-features of C, preprocessor, macro expansion, file inclusion, conditional compilation.

   Introduction to Pointers
   Arrays - Initialization, arrays in terms of pointers, passing array to a function, multidimensional arrays, array of pointers.
   Strings- standard library string functions, two dimensional array of characters.
   Structures - accessing structure elements, representation of structures in memory.
   Enumerated data types
   Fundamentals computer graphics
   Points plotting, lines, curves, circles, fill in C.

   (28)
3. **Simulation**:

Basic concepts of simulation and modelling. Types of simulations - deterministic and stochastic and continuous and discrete simulations and their application. Monte-Carlo simulations, design methodology of a simulation system. Overview of simulation languages. 

4. **Measurement and Control**:

Overview of measurement system- transducer, signal conditioning and display/recording sub-systems. Output standards of signal conditioning systems. Basic principles of digitising the analog signals, facilities available and specifications of analog to digital converter cards in PC environment, programming for data acquisition and processing, outlines of digital control.

5. **CAD**:

Familiarization with the use of drafting tool.

**Laboratory work:**

1. Exercises on C programming.
2. Exercise on Graphics programming.
3. Design of Simulation for an Engineering System
4. Interfacing equipment for measurement of standard physical parameters.
5. Programming for data acquisition and analysis.

**Assignments:**

1. Assignments involving programming of problems of relevance to the respective disciplines.
2. Developing a simple data acquisition or control set up for parameters of relevance.

**Reference Books:**

1. P.K.Sinha; Computer Fundamentals -, BPB Publications
3. Byron S.Gottfried ; Programming with C - Schaum's Outline Series, Tata McGraw Hill
4. Geoffrey Gordon; System Simulation -
5. Mikell T.Groover; CAD/CAM -
MTE- 7103 TECHNOLOGY MANAGEMENT
(Elective – non branch )

CONTENTS

1. Introduction to Technology Management
3. Technology Forecasting: Techniques of Forecasting, Technology Forecasting- Relevance, Strategic alliance and Practicality, and Technology transfer.
4. 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.
5. Management of Intellectual Property Rights
   Strategic value of patents, trade secrets and licensing
7. Management Roles and Skills for New Technology
8. Technology for Managerial Productivity and Effectiveness, Just-in-Time
9. Venture Capital & Technology Development

Practice Tasks:
- Technology forecasting and Technology mapping
- Technology Strategy Development
- Exercise on Just-in-Time
- Cases on Venture Capital

Reference Books:

1. Technology and Management, Cassell Educational Ltd., London
2. John Humbleton Elsevier ; Management of High Technology Research and Development
5. Richard M.Burton & Borge Obel Elsevier Innovation and Entrepreneurship in organizations
6. Spyros Maksidkis & Steven C Wheelwright The Handbook of Forecasting-A
8. C. Marle Crawford IRWIN, . New Product Management USA