MCE- 6171 COMPUTER PROGRAMMING AND APPLICATIONS
(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.

Rationale:
Since no field has remain untouched with the impact of Information Technology, therefore this subject is introduced to enable the professionals to find the applications of computers in Civil Engineering. This subject will enable students to understand the fundamentals of computers, computer language like C & application of computers in various fields like CAD, System Simulation, Measurement & Control etc.

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

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.
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.

(6)

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.

(7)

5. CAD:

Familiarization with the use of drafting tool.

(6)
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 -
MCT- 6106  ADVANCED STRUCTURAL DESIGN AND DETAILING
(Elective Course)

Maximum marks : 50        L   P
Time Allowed : 3 hours     4   -

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

Rationale:

All civil engineers must be familiar with structural design and detailing for effective implementation of projects involving construction of different types of structures. The subject of structural design and detailing is included in the Construction Technology and Management course to give an insight to the student about analysis and design of complex structures in concrete and steel. While the different types of structures being constructed are many, it is hoped that this introduction to common types of structures will enable them to get a good understanding of structural design and detailing.

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) (One class test for Modular) : 30
2. Practice tasks, assignments, seminars & quizzes : 20
3. Final Examination : 50
4. Total Marks : 100

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. [4 ]
* Curved beams [4 ]
* Intze tank and underground water tanks [10 ]
* Silos and bunkers [8 ]
* Concrete Chimneys [6 ]
* Multi-storey building frame design [8 ]
* Use of computer software for analysis and design [6 ]

**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 7103       DESIGN OF PRESTRESSED CONCRETE STRUCTURES
( Elective Course )

Maximum marks :  50  L   P
Time Allowed :  3 hours  4 -

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

Rationale

Pre-stressed structures are important in construction of Heavy Sections. To reduce dead weight of the concrete sections and also to reduce construction time, pre-stressed construction plays an important and vital role. This course will help the students to understand the concepts of pre-stressing design and construction of various pre-stressed structures using modern techniques.

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) (One class test for Modular) : 30
2. Assignments, seminars : 20
3. Final Examination : 50
4. Total Marks : 100

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. (12)
2. Limiting zones. Cable profile and cable layout. Calculations of stresses due to sequence of tensioning. Calculations of deflections. (6)
3. Design for shear-elastic and ultimate. Design for bond, Transfer length in pretension members. Discussion of codal provisions and provision of web reinforcement. (6)
4. Various theories for design of End Block., Practical design of end block for a typical I 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.
MTE- 7103 TECHNOLOGY MANAGEMENT
(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.

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
7. C. Marle Crawford IRWIN, . New Product Management USA
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.

Rationale:

Construction work is being carried out in a large scale all around the world and construction equipment happens to be its integral part. Due to extensive use of different types of equipment in modern day construction, this subject has been introduced at the post-graduate level of degree programme. During the last over five decades, rapid growth has taken place in the advancement of construction equipment. The subject will give them a deep insight into the different types of construction equipment, their efficiency, uses, operations and maintenance costs and procedures.

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) (One class test for Modular) : 30
2. Practice tasks, assignments, seminars & quizzes & Lab work. : 20
3. Final Examination : 50
4. Total Marks : 100

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.

(4)
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. 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.

5. 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

6. 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.

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

8. 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:

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


6. Frank Harris, Modern Construction Equipment and Methods, John Wiley and Sons.
MCT 6204  GREEN BUILDINGS AND SERVICES
(Elective Course)

Maximum marks :  50 L  P
Time Allowed :  3 hours 3 2

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

RATIONALE

Buildings account for a large amount of land use, water and energy consumption causes air and atmospheric pollution. Considering the statistics, reducing the amount of national resources buildings consume and the amount of pollution given off is seen as crucial for future sustainability as per EPA. Green buildings bring together a vast array of practices and techniques to reduce and ultimately eliminate the impacts of buildings on environment and human health. Hence, this subject is introduced in the curriculum of ME (Modular) Construction Technology and Management.

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

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, insulating 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.
- Recycling of aggregate, use of plastic, recycled material (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 rating of rating like lead, 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

MCT - 6205  BRIDGE 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 five questions.

Rationale :
In the coming five year plan there is heavy emphasis on infra-structure development including the construction of highways of which construction of bridges forms an integral part. The subject of bridge engineering aims at providing knowledge concerning the standard specifications for road bridges, general arrangement and suitability of various types of RCC, PRC and steel bridges, design of substructure, construction details of shallow foundations, pile and well foundation for bridges, details of bearings, expansion joints, footpaths and handrails and construction and maintenance of bridges. The study of the subject will enable the students to acquire relevant knowledge for 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) (One class test for Modular) : 30
2. Practice tasks, assignments, seminars & quizzes : 20
3. Final Examination : 50
4. Total Marks : 100

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.

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)

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

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)

6. **Bearings, Joints, and Handrails**: Different types of bearings, joints and handrails.

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
8. IRC.78.200
9. IS 5050
10. IS 3955
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 five questions.

Rationale :

The construction of hydraulic structures ranks with the earliest and most fundamental of civil engineering activities. The proper and timely utilization of water resources is one of the basic issues connected with the development. Property health and material progress are linked to the ability to use various water resources in an effective way. The subject of "Design & Construction of Hydraulic Structures" aims at providing 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. The study of the subject will enable the students to 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

1. Elements of Dam Engineering.:

Embarkment 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 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. (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:**

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. (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.

**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.
Rationale

Steel is versatile material for structural and other construction uses. It is used in construction of bridges, buildings and other structures as major material or as reinforcing material. All Civil Engineers must be familiar with construction of steel structures.

This subject will help the students to do analysis of various steel structures, carryout erection and fabrication of different steel structures and their maintenance. The subject deals with the selection of proper material, proper sizes, proportions and shape of each member and its connection details for fabrication of 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

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’.
### RATIONALE

The need of the vulnerable section of society will continue to be attended to, through government and non-government organizations as part of implementation of National Agenda for Governance, "Shelter for All". The Agenda envisages provision of 20 lakh additional houses every year out of which 13 lakhs will be in Rural areas. Moreover according to recent survey, it has been brought about that as on April, 1998 out of total 14.3 lakh habitations 62,964 habitations do not have any source of drinking water and another 3,13,265 have only partially covered drinking water facilities i.e. less than 40 liters per capita per day. According to National Sample Survey, about 89.04% rural households don't have access to sanitary facilities. Out of 5,67,000 villages in the country, according to a recent survey conducted by IRC, 54 percent do not have all-weather road/fair-weather road connectivity. Irrigation potential targeted under minor irrigation, having culturable Command Area (CCA) up-to 2,000 hectares individually, for the year 1997-98 was targeted to be 0.80 M.ha. In all the above area of development, the civil engineers have a direct and vital role to play. In fact in other areas of development also the civil engineers have indirect role. So the students of Master of Engineering in Construction Technology must be given appropriate knowledge and skills in this field where there is a lot of scope for self/wage employment in the years to come. Through the subject of Rural Construction Technology, the students will be given exposure related to appropriate technology in the area of housing, water supply Sanitation, Rural roads construction and 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

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<td>2.</td>
<td>Assignments, seminars &amp; quizzes</td>
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<td>Final Examination</td>
<td>50</td>
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CONTENTS

1. 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.

2. 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-erodable 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.

3. 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, Ferro-cement water storage tanks.

4. Low Cost Roads and Transport:
5. **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.

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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.