

STEEL, TIMBER AND MASONRY STRUCTURES DESIGN AND DRAWING

L T P
5 - 2

RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise steel construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials. He must be able to read and interpret structural drawings of different elements. This subject thus deals with elementary design principles as per BIS code of practice BIS: 800 and their relevant drawings.

DETAILED CONTENTS

A) Steel Theory and Design

1. Structural Steel and Sections: (02 hrs)
 - 1.1 Properties of structural steel as per BIS Code
 - 1.2 Designation of structural steel sections as per BIS handbook and BIS:800
2. Structural Steel Connections: (10 hrs)
 - 2.1 Riveted Connections: Types of rivets, permissible stressed in rivets, types of riveted joints, specifications for riveted joints as per IS 800. Failure of a riveted joint. Assumptions in the theory of riveted joints. Strength and efficiency of a riveted joint. Design of riveted joints for axially loaded members (No Staggered riveting).
 - 2.2 Welded connections: Types of welds and welded joints, advantages and disadvantages of welded joints design of fillet and butt weld. Plug and slot welds (Descriptive No numerical on plug and slot welds)
3. Roof Truss (02 hrs)

Form of trusses, pitch of roof truss, spacing of trusses, spacing of purlins, connection between purlin and roof covering. Connection between purlin and principal rafter
4. Tension Members (06 hrs)

Analysis and design of single and double section tension members and their rivetted and welded connections with gusset plate as per BIS:800

5. Compression Members (06 hrs)
- Analysis and design of single and double angle sections compression members (struts) and their rivetted and welded connections with gusset plate as per BIS:800
6. Columns: (06 hrs)
- 6.1 Concept of buckling of columns, effective length and slenderness ratio, permissible stresses in compression as per BIS:800 for different end conditions. Analysis and Design of axially loaded single section steel column
- 6.2 Types of column bases (Descriptive only)
- 6.3 Beam and column, frame and seated connections (descriptive only, no design)
7. Beams (06 hrs)
- Analysis and design of single section simply supported laterally restrained steel beams. Introduction to plate girder and functions of various elements of a plate girder
8. Purlins, plate, girders gantry girders and Box girders (Descriptive only) (02hrs)
9. Timber Structures (08 hrs)
- Design of simply supported rectangular section beam subjected to uniformly distributed load as per provisions of BIS 883. Design of solid compression and tension members of a wooden truss as per provisions of BIS 883.
10. **Masonry Structure :** (16 hrs)
- 10.1 Design of Brick masonry Pillar and load bearing Masonry wall carrying axial loads as per IS: 1905.
- 10.2 Design of foundations for Brick masonry pillar and load bearing masonry wall carrying axial loads. Depth of footings by using Rankin's formula.
- 10.3 Masonry Retaining Walls : Active earth pressure, Rankin's formula for active earth pressure (No Derivation). To check the stability of masonry retaining walls against over turning and sliding while retaining dry or moist, fully or partly submerged soils. Retaining walls may be subjected to super loading (udl) over the soil and may be soil surcharged retaining walls.

B) Steel/Timber Structures Drawing

1.
 - a) Preparation of drawing of a steel roof truss with details of joints for the given span, shape of the truss and the design data regarding the size of the members and the connections. Fixing details of purlins and roof sheet
 - b) Drainage arrangement for a pitched roof
 - c) Preparing plan showing system of trusses along with bracing sag rods, purlins, runners etc.
 - d) Preparation of steel lean to roof drawing with fixing and anchorage, drawing system.
 - e) Details of splings for steel cooling and steel beams.

2. Column Beam Connection Drawings:
 - a) Beam to beam connections (Seated and framed)
 - b) Beam to column (Seated and framed)
 - c) Column bases (Slab base, and gusseted base)

3. Detailed drawing showing plan and elevation for a riveted plate girder with the given design data regarding the sizes of its parts, with details at the supports and connections of stiffeners, flange angles and cover plates with the web (06hrs)

4. Preparation of timber kingpost roof truss with details of joints for the given data (nail jointed fink truss) and cantilever truss (03hrs)

Very Important Note:

Examiner will be setting questions of 100 marks from part (A) and drawing questions of 50 marks from part (B) Use of BIS:800 and steel tables are permitted in the examination

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various steel structural members. For creating comprehension of the subject, teachers may prepare tutorial sheets, which may be given to the students for solving. It would be advantageous if students are taken at construction site to show fabrication and erection of steel structures. Practice of reading structural drawings is another important feature of this course. Commentary on BIS:800 may be referred along with code for relevant clauses

RECOMMENDED BOOKS

1. Duggal SK, "Design of Steel Structures", Standard Publishers Distributors.
2. Skelsbucures by Birinder Singh, SK kateria, Ludhiana

3. Ram Chandra, "Design of Steel Structures", Delhi, Standard Publishers Distributors
- 4.. LS Negi, 'Design of Steel Structure', Tata McGraw Hill, New Delhi
5. "Design of Steel Structures", by S Ramamurthan

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|------------------|----------------------------|---------------------------|
| 1 | 2 | 3 |
| 2 | 10 | 19 |
| 3 | 02 | 7 |
| 4 | 06 | 22 |
| 5 | 06 | 22 |
| 6 | 06 | 8 |
| 7 | 06 | 12 |
| 8 | 2 | 7 |
| 9 | 08 | 7 |
| 10 | 16 | 12 |
| Total | 64 | 100 |

EARTHQUAKE RESISTANT BUILDING CONSTRUCTION

L T P
4 - -

RATIONAL

Diploma holders in civil engineering have to supervise construction of various earthquake resistant buildings. Therefore, the students should have requisite knowledge regarding terminology of earthquake and the precautions to be taken while constructing earthquake resistant buildings

DETAILED CONTENTS

1. Elements of Engineering Seismology (14 hrs)
General features of tectonic of seismic regions. Causes of earthquakes, Seismic waves, earthquake size (magnitude and intensity), Epicentre, Seismograph, Classification of earthquakes, Seismic zoning map of India, Static and Dynamic Loading, Fundamental period.
2. Seismic Behaviour of Traditionally-Built Constructions of India (10 hrs)
Performance of building during earthquakes and Mode of failure (Out-of-plane failure, in-plane failure, Diaphragm failure, Connection failure, Non-structural components failure)
3. Special construction method, tips and precautions to be observed while planning, designing and construction of earthquake resistant building. (12hrs)
4. Introduction to BIS: 4326:1993, BIS: 13928:1993 and BIS: 1893(Part 1) B154326 and BIS 13920 (08 hrs)
5. Seismic Provision of Strengthening and Retrofitting Measures for Traditionally-Built Constructions (14 hrs)
6. Disaster Management: Disaster rescue, psychology of rescue, rescue workers, rescue plan, rescue by steps, rescue equipment, safety in rescue operations, debris clearance and casualty management. (06hrs)

INSTRUCTIONAL STRATEGY

The student may be taken for visit to various building construction sites where precautions related to earthquake resistant construction are being taken so that the students may appreciate the importance of the subject.

RECOMMENDED BOOKS

1. Elements of Earthquake Engineering by Jai Krishana and AR Chandrasekaran; Sarita Parkashan, Meerut.
2. Building Construction by BL Gupta and NL Arora, Satya Prakashan, New Delhi
3. Manual Published by Earthquake Engineering department, IIT Roorkee / IIT Kanpur
4. IS 13920, IS: 13927, IS: 13928, IS 1893-2002, IS 4326
5. Earthquake Engineering by RL Weigel, Prentice Hall Inc., N.I., 1970
6. Dynamics of Structure by AK Chopra, Prentice Hall Inc. New Delhi

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|--------------|---------------------|--------------------|
| 1 | 14 | 18 |
| 2 | 10 | 16 |
| 3 | 12 | 22 |
| 4 | 8 | 18 |
| 5 | 14 | 14 |
| 6 | 6 | 12 |
| Total | 64 | 100 |

COMPUTER APPLICATIONS IN CIVIL ENGINEERING - II

| | | |
|---|---|---|
| L | T | P |
| - | - | 4 |

RATIONALE

Computers play a very vital role in present day life, more so, in all the professional life of engineering. In order to enable the students use the computers effectively in problem solving, this course offers various engineering applications of computers in civil engineering.

DETAILED CONTENTS

Practical Exercises

1. Prepare various schedule rate, cost of various item works by the use of relevant software .
2. Networking techniques of the project using software such as primavera
3. Introduction and use of software like Auto Survey, Auto Read, Auto Water
4. Introduction and use of software for structural analysis and design of buildings .

Note: The polytechnic may use any other software available with them for performing these exercises

CONSTRUCTION MANAGEMENT AND ACCOUNTS

| L | T | P |
|---|---|---|
| 5 | - | - |

RATIONALE

This is an applied civil engineering subject. The subject aims at imparting basic knowledge about construction planning and management, site organisation, construction labour, control of work progress, inspection and quality control, accidents and safety, accounts and heavy construction equipment.

DETAILED CONTENTS

THEORY

CONSTRUCTION MANAGEMENT:

1. Introduction: (6 hrs)
 - 1.1 Significance of construction management
 - 1.2 Main objectives of construction management
 - 1.3 Functions of construction management, planning, organising, staffing, directing, controlling and coordinating, meaning of each of these with respect to construction job.
 - 1.4 Classification of construction into light, heavy and industrial construction
 - 1.5 Stages in construction from conception to completion
 - 1.6 The construction team: owner, engineer and contractors, their functions and inter-relationship

2. Construction Planning: (12hrs)
 - 2.1 Importance of construction planning
 - 2.2 Stages of construction planning
 - Pre-tender stage
 - Contract stage
 - 2.4 Scheduling construction works by bar charts
 - Preparation of bar charts for simple construction work

- Preparation of schedules for labour, materials, machinery and finances for small works
- Limitations of bar charts

2.5 Scheduling by network techniques

- Introduction to network techniques; PERT and CPM, differences between PERT and CPM terminology

3. Organization: (4 hrs)

3.1 Types of organizations: Line, line and staff, functional and their characteristics

3.2 Principles of organisation (only meaning and significance of the following)

- Span of control
- Delegation of authority
- Ultimate responsibility
- Unity of command
- Job definition

4. Site Organization: (4 hrs)

4.1 Factors influencing selection and design of temporary services for a construction site

4.2 Principle of storing and stacking materials at site

4.3 Location of equipment

4.4 Preparation of actual job layout for a building

4.5 Organizing labour at site

5. Construction Labour: (8 hrs)

5.1 Conditions of construction workers in India, wages paid to workers

5.2 Trade Unions connected with construction industry

5.3 Important provisions of the following Acts:

- Labour Welfare Fund Act 1936 (as amended)
- Payment of Wages Act 1936 (as amended)
- Minimum Wages Act 1948 (as amended)

- Workman Compensation Act 1923 (as amended)
- Indian Contract Act (main provisions)

6. Control of Progress: (4 hrs)
- 6.1 Methods of recording progress
- 6.2 Analysis of progress
- 6.3 Taking corrective actions keeping head office informed
- 6.4 Cost time optimization for simple jobs - Direct and indirect cost, variation with time, cost optimization
7. Inspection and Quality Control: (8hrs)
- 7.1 Need for inspection and quality control
- 7.2 Principles of inspection
- 7.3 Stages of inspection and quality control for
- Earth work
 - Masonry
 - RCC
 - Sanitary and water supply services
8. Accidents and Safety in Construction: (6 hrs)
- 8.1 Accidents – causes
- 8.2 Safety measures for
- Excavation work
 - Drilling and blasting
 - Hot bituminous works
 - Scaffolding, ladders, form work
 - Demolitions
- 8.3 Safety campaign

CONSTRUCTION EQUIPMENT

9. Earth Moving Equipment: (7 hrs)

Crawler and wheel tractors: their functions, types and specifications, gradability; bull dozers and their use, tractors 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

ACCOUNTS

10. PUBLIC WORK ACCOUNTS: (15hrs)

Introduction, accounts, work- major, repair, administrative approval – expenditure, Technical sanction, allotment of funds, Re-appropriation of funds bill, contractor ledger, measurement book running and final account bills complete, completion certificate & report, hand receipt, establishment-permanent, temporary, acquittance roll. Muster Roll labour, casual labour roll-duties and responsibility of different cadres, budget-stores, returns, account of stock, misc. P.W. advances T & P – verification, survey report, Road Metal Material charged direct to works, account - expenditure & revenue head, remittance and deposit head, definition of cash, precaution in custody of cash book, imprest account, temporary advance, treasury challan.

INSTRUCTIONAL STRATEGY

This is highly practice-based course and efforts should be made to relate process of teaching with direct experiences at work sites. Participation of students should be encouraged in imparting knowledge about this subject. To achieve this objective the students should be taken to different work sites for clear conception of particular topics, such as site organization, inspection of works at various stages of construction and working of earth moving equipment

RECOMMENDED BOOKS

1. Shrinath, LS, "PERT and CPM - Principles and Applications", New Delhi, East West Press
2. Harpal Singh, "Construction Management and Accounts", New Delhi, Tata McGraw Hill Publishing Company.
3. Peurifoy, RL, "Construction Planning, Equipment and Methods" Tokyo, McGraw Hill
4. Wakhlo, ON; "Civil Engineering Management", New Delhi Light and Life Publishers
5. Verma, Mahesh; "Construction Equipment and its Planning and Application

6. Dharwadker, PP; "Management in Construction Industry", New Delhi, Oxford and IBH Publishing Company.
7. Gahlot PS; Dhir, BM; "Construction Planning and Management", Wiley Eastern Limited, New Delhi
8. MS Project – Microsoft USA
9. Primavera

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|------------------|----------------------------|---------------------------|
| 1 | 6 | 9 |
| 2 | 12 | 14 |
| 3 | 4 | 6 |
| 4 | 4 | 6 |
| 5 | 8 | 12 |
| 6 | 4 | 6 |
| 7 | 8 | 11 |
| 8 | 9 | 9 |
| 9 | 9 | 11 |
| 10 | 15 | 16 |
| Total | 80 | 100 |

ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

L T P
4 - -

RATIONALE

Entrepreneurship Development and Management is one of the core competencies of technical human resource. Creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects can be helpful in motivating technical/vocational stream students to start their own small scale business/enterprise. Since diploma technicians are expected to take-up middle level managerial positions, their exposure to basic management principles is very essential. Based on the broad competencies listed above, following detailed contents have been finalized to develop the appropriate competencies.

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| (1) | Entrepreneurship | (10 hrs) |
| | 1.1 Concept/Meaning and its need | |
| | 1.2 Competencies/qualities of an entrepreneur | |
| | 1.3 Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institutes (SISIs), Small Industries Development Bank of India (SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State and national level | |
| (2) | Market Survey and Opportunity Identification (Business Planning) | (10 hrs) |
| | 2.1 How to start a small scale industry | |
| | 2.2 Procedures for registration of small scale industry | |
| | 2.3 List of items reserved for exclusive manufacture in small scale industry | |
| | 2.4 Assessment of demand and supply in potential areas of growth | |
| | 2.5 Understanding business opportunity | |
| | 2.6 Considerations in product selection | |
| | 2.7 Data collection for setting up small ventures | |
| (3) | Project Report Preparation | (08 hrs) |
| | 3.1 Preliminary Project Report | |
| | 3.2 Techno-Economic feasibility report | |
| | 3.3 Project Viability Report | |

- (4) Managerial Aspects of Small Business (10 hrs)
- 4.1 Principles of Management, Definitions, functions of management viz planning, organization, coordination and control
 - 4.2 Structure of an industrial organization.
 - 4.3 Basic principles of financial management
 - 4.4 Marketing Techniques
 - 4.5 Personnel Management, staff development and training strategies
 - 4.6 Importance and techniques of communication in business
- (5) Legal Aspects of Small Business (10 hrs)
- 5.1 Elementary knowledge of Income Tax, Sales Tax, Patent Rules, Excise Rules, provident fund
 - 5.2 Elementary knowledge of Factory Act, 1948 and Payment of Wages Act 1936, Workmen Compensation Act, Industrial Dispute act 1947, Employees State Insurance Act 1978
- (6) Environmental Considerations (04 hrs)
- 6.1 Concept of ecology and environment
 - 6.2 Factors contributing to Air, Water, Noise pollution
 - 6.3 Air, water and noise pollution standards and control
 - 6.4 Norms and standards of State pollution Board
 - 6.5 Disaster Management – basic idea
- (7) Miscellaneous (12 hrs)
- 7.1 Human resource development in an organization
 - 7.2 Motivation – Incentives, Rewards, Job Satisfaction
 - 7.3 Leadership- types, qualities, functions and factors of effective leadership
 - 7.4 Labor Welfare schemes including wage payment- types, system of wage payment and incentives
 - 7.5 Workers participation in management, case studies in effective Management.
 - 7.6 Accident and Safety: Classification, precaution and treatment after accident, safety practices promotion, personal protection equipment (PPFs) for safety at work places.
 - 7.7 Introduction to Total quality Management (TQM) and steps to achieve this .
 - 7.8 Intellectual Property Rights (IPR): Concept, definition, infringements and remedies related to patents, copy rights, trademarks, designs. Introduction to registering procedure

INSTRUCTIONAL STRATEGY

The aim of this subject is to develop conceptual understanding by giving inputs and exposure about starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also.

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
3. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi
4. Environmental and Pollution Awareness by Sharma BR, Satya Prakashan , New Delhi
5. Thakur Kailash, Environmental Protection Law and policy in India: Deep and Deep Publications, New Delhi
6. Handbook of Small Scale Industry by PM Bhandari
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Industrial management by N. Mohan, and AP Verma, SK Kataria and Sons, Nai Sarak, Delhi-110006
9. Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.
10. Principles of Management by Philip Kotler TEE Publication
11. Intellectual Property Rights and the Law by Dr. GB Reddy.

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|--------------|---------------------|--------------------|
| 1. | 10 | 10 |
| 2. | 10 | 20 |
| 3. | 08 | 10 |
| 4. | 10 | 15 |
| 5. | 10 | 15 |
| 6. | 04 | 10 |
| 7. | 12 | 20 |
| Total | 64 | 100 |

(Elective)

REPAIR AND MAINTENANCE OF BUILDINGS

L T P
3 - -

RATIONALE-

One of the major concerns of a civil engineer is to take care of the building works, already constructed, in order to keep these buildings in utmost workable conditions. Usually it is being felt that the buildings deteriorate faster for want of care and proper maintenance. The buildings usually have a shabby appearance due to cracks, leakage from the roofs and sanitary/water supply fittings. Thus the need for teaching the subject in proper perspective has arisen making students aware of importance of maintenance of buildings.

DETAILED CONTENTS

1. Need for Maintenance (6 hrs)
 - 1.1 Importance and significance of repair and maintenance of buildings
 - 1.2 Meaning of maintenance
 - 1.3 Objectives of maintenance
 - 1.4 Factors influencing the repair and maintenance

2. Agencies Causing Deterioration (Sources, Causes, Effects) (6 hrs)
 - 2.1 Definition of deterioration/decay
 - 2.2 Factors causing deterioration, their classification
 - 2.2.1 Human factors causing deterioration
 - 2.2.2 Chemical factors causing deterioration
 - 2.2.3 Environmental conditions causing deterioration
 - 2.2.4 Miscellaneous factors
 - 2.3 Effects of various agencies of deterioration on various building materials i.e. bricks, timber, concrete, paints, metals, plastics, stones

3. Maintenance Management (Principles, inspections, Practices) (6 hrs)
 - 3.1 Importance of maintenance management
 - 3.2 Organisational structure for maintenance
 - 3.3 Building inspections and reports

- 3.4 Maintenance budgets and estimates
- 3.5 Specifications for maintenance jobs
- 4. Investigation and Diagnosis of Defects (6 hrs)
 - 4.1 Systematic approach/procedure of investigation
 - 4.2 Objectives of investigation of building defects
 - 4.3 Sequence of detailed steps for diagnosis of building defects/problems
 - 4.4 List non-destructive and others tests on structural elements and materials to evaluate the condition of the building and study of three most commonly used tests
- 5. Defects and their root causes (6 hrs)
 - 5.1 Define defects in buildings
 - 5.2 Classification of defects
 - 5.3 Main causes of building defects in various building elements
 - 5.3.1 Foundations, basements and DPC
 - 5.3.2 Walls
 - 5.3.3 Column and Beams
 - 5.3.4 Roof and Terraces
 - 5.3.5 Joinery
 - 5.3.6 Decorative and protective finishes
 - 5.3.7 Services
 - 5.3.8 Defects caused by dampness
- 6. Materials for Repair, maintenance and protection (6 hrs)
 - 6.1 Basic characteristics of repair materials
 - 6.2 Compatibility aspects of repair materials
 - 6.3 State characteristics of and selection of following materials in repairs:
 - 6.3.1 Anti corrosion coatings
 - 6.3.2 Adhesives/bonding aids
 - 6.3.3 Repair mortars
 - 6.3.4 Curing compounds
 - 6.3.5 Joints sealants
 - 6.3.6 Waterproofing systems for roofs
 - 6.3.7 Protective coatings

- 6.4 Selection procedure of repair materials for specific job

- 7. Remedial Measures for Building Defects (12 hrs)
 - 7.1 Preventive maintenance considerations
 - 7.2 Surface preparation techniques for repair
 - 7.3 Crack repair methods
 - 7.3.1 Epoxy injection
 - 7.3.2 Grooving and sealing
 - 7.3.3 Stitching
 - 7.3.4 Adding reinforcement and grouting
 - 7.3.5 Flexible sealing by sealant
 - 7.4 Repair of surface defects of concrete
 - 7.4.1 Bug holes
 - 7.4.2 Form tie holes
 - 7.4.3 Honey comb and larger voids
 - 7.5 Repair of corrosion in RCC elements
 - 7.5.1 Steps in repairing
 - 7.5.2 Prevention of corrosion in reinforcement
 - 7.6 Material placement techniques with sketches
 - 7.6.1 Pneumatically applied (The gunite techniques)
 - 7.6.2 Open top placement
 - 7.6.3 Pouring from the top to repair bottom face
 - 7.6.4 Birds mouth
 - 7.6.5 Dry packing
 - 7.6.6 Form and pump
 - 7.6.7 Preplaced – aggregate concrete
 - 7.6.8 Trowel applied method
 - 7.7 Repair of DPC against Rising Dampness
 - 7.7.1 Physical methods
 - 7.7.2 Electrical methods
 - 7.7.3 Chemical methods
 - 7.8 Repair of walls
 - 7.8.1 Repair of mortar joints against leakage
 - 7.8.2 Efflorescence removal

- 7.9 Waterproofing of wet areas and roofs
 - 7.9.1 Water proofing of wet areas
 - 7.9.2 Water proofing of flat RCC roofs
 - 7.9.3 Various water proofing systems and their characteristics
- 7.10 Repair of joints in buildings
 - 7.10.1 Sealing of joints
 - 7.10.2 Types of sealant and their characteristics
- 7.11 Repair and maintenance of public health Services
 - 7.11.1 Low pressure
 - 7.11.2 Cisterns defects, blocked drains, damaged china ware
 - 7.11.3 Maintenance of GI Pipes
 - 7.11.4 Repair of traps
 - 7.11.5 Repair of overhead and underground water tanks

INSTRUCTIONAL STRATEGY

This is very important course and efforts should be made to find damaged/defective work spots and students should be asked to think about rectifying/finding solution to the problem. Visits to work site, where repair and maintenance activities are in progress can be very useful to students.

RECOMMENDED BOOKS

1. Nayak, BS; "Maintenance Engineering for Civil Engineers", Khanna Publishers, Delhi
2. Ransom, WH; "Building Failures - Diagnosis and Avoidance", Publishing E and F.N. Span
3. Hutchinson, BD;etc, "Maintenance and Repair of Buildings", Published by Newness – Butterworth
4. Gahlot P.S. Sanjay Building Defects and Maintenance Management by (B) Publishers New Delhi

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|------------------|----------------------------|---------------------------|
| 1 | 6 | 13 |
| 2 | 6 | 13 |
| 3 | 6 | 13 |
| 4 | 6 | 13 |
| 5 | 6 | 13 |
| 6 | 6 | 13 |
| 7 | 12 | 22 |
| Total | 48 | 100 |

Elective

ENVIRONMENTAL ENGINEERING

L T P
3 - -

RATIONALE

Civil Engineering diploma holders must have the knowledge of different types of environmental aspects related to development activities so that they may help in maintaining the ecological balance and control pollution. They should also be aware of the related environmental laws for effectively combating environmental pollution. The class room instructions should be supplemented by field visits to show the pollution caused by urbanization and the combatment measures being adopted at site. Extension lectures by experts may be encouraged.

DETAILED CONTENTS

1. Study of Importance of Environmental Engineering (2 hrs)
Importance of clean environment, control of environmental pollution with respect to air, land and water. Conservation of natural resources, environmental education and awareness sustainable development.
2. Environments and Ecology (4 hrs)
Definition and understanding of environment and ecology concept, ecosystem and types of ecosystems, energy flow in an ecosystem, food chain, ecological pyramids, consortium and ecological balance
3. Water Pollution (3 hrs)
Causes of pollution in surface and underground water eutrophication of lakes and its preventing measure; BIS standards for water quality.
4. Air Pollution (6 hrs)
Definition, principal air pollutants, atmospheric parameters influencing air pollution, types of air contaminants and their sources, effects of air pollution on human beings, plants, animals, automobile pollution, BIS ambient air quality standards and measures to combat air pollution
5. Noise Pollution (2 hrs)
Definition, unit of measurement of noise, sources and effects of noise pollution and control of noise pollution

6. Effects of mining, blasting and deforestation (2 hrs)
 Ill effects of mining, blasting and deforestation on the environment human life and wild life.
7. Land Use (6 hrs)
 Effect of land use on environmental quality, land use and natural disasters,(land slides etc) soil degradation problems - erosion, water logging, soil pollution etc.
8. Environmental Impact Assessment (4 hrs)
 Definition and requirements, environmental impact assessment as a result of constructional activities – housing, dams, roads, etc, case studies, environmental auditing - basic concepts, sustainable development – concept of carrying capacity, introduction to cleaner production techniques.
9. Legislation to Control Environmental Pollution (idea) (2hrs)
 Indian legislative acts for water, land and air pollution control – provisions, scope and implementation
10. Global Issues of Environmental Engineering (4 hrs)
 Global warming, ozone depletion, acid rain, oil pollution; radiation hazards and their control
11. Renewable Source of Energy (4 hrs)
 Role of non-conventional sources of energy (biogas, solar, wind etc) in environmental protection. Conservation of energy resources like coal, oil etc., alternative fuels, bio-diesel etc.

INSTRUCTIONAL STRATEGY

Students should be encouraged to undertake project work related to environmental problems. They should visit industrial effluent treatment plant, water treatment plant and environmental engineering laboratory and study the impact of utilization of reclaimed by products

RECOMMENDED BOOKS

1. Environmental Engineering by Deswal and SS Deswal; Dhanpat Rai and Company (P) Ltd., Delhi

2. Odum EP, "Fundamentals of Ecology", Amarind publication Co., Delhi
3. Environmental Engineering and Management by SK Dhamija; SK kataria and Sons, Delhi
4. De AK, "Engineers Chemistry", New Age Publication, Delhi
5. Kendeigh SC, "Ecology", Prentice Hall of India, Delhi
6. RK Khitoliya, Environmental Pollution, (2004), S Chand & Co. Ltd., New Delhi
7. Bhatia HS A text book of environmental pollution and control Galogotia.

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|--------------|---------------------|--------------------|
| 1 | 4 | 8 |
| 2 | 2 | 10 |
| 3 | 3 | 6 |
| 4 | 6 | 12 |
| 5 | 2 | 4 |
| 6 | 2 | 12 |
| 7 | 6 | 12 |
| 8 | 4 | 9 |
| 9 | 2 | 9 |
| 10 | 4 | 9 |
| 11 | 4 | 9 |
| Total | 48 | 100 |

(Elective)

RURAL CONSTRUCTION TECHNOLOGY

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RATIONALE

Considerable employment opportunities are available in rural sector if diploma holders in civil engineering are trained to undertake small entrepreneur activity in the rural areas. This subject aims at imparting knowledge and skill in the use of local materials for low cost housing, rural water supply and sanitation rural roads and other appropriate technologies, which can be promoted for upgrading standards of life in rural areas.

DETAILED CONTENTS

1. Introduction: (02 hrs)
 Scope and concept of appropriate technology as applicable to civil engineering, importance of low cost construction in rural areas.
2. Materials: (04 hrs)
 Importance of locally available material, bomboo, tree bushes, grass, mud, sand etc., treatment of materials for protection against termite, decay and for increasing their strength
3. Mud Walls: (05 hrs)
 Construction of plane and block mud walls, bamboo/bush reinforced mud walls, water proofing of mud walls, thickness of mud walls, mud plaster. Use of hollow blocks in the construction of walls for insulation
4. Thatched Roofs: (05 hrs)
 Constructional methods of thatched roofs, fire proofing of thatched roof, low cost treatment of thatched roof.
5. Low Cost Housing: (07 hrs)
 Planning and construction of low cost houses, cluster of houses, ventilation, low cost doors, construction of mud floors, construction of smokeless chullaha, construction of cement treated gunny bags – sheds and storage bins. Construction of sheds for animals
6. Rural Water Supply: (07 hrs)
 Construction of open well, chlorination of open well, construction of hand pumps, constructions of bathing cubicals, construction of low cost drains.

7. Rural Sanitations: (04 hrs)

Construction of low cost latrines, construction of pre-fabricated septic tanks, construction of soak pits.

8. Construction of fair weather roads, construction of bunds (04 hrs)

9. Miscellaneous: (10 hrs)

Low lift pumps, Ferro-cement storage tanks, Ferro-cement grain bins, red clay tiles for roof and floors, construction of rapid burning low cost brick kilns solar seasoning plants. Solar cookers, fiber corrugated sheets, individual and community biogas plants. Concrete blocks for wall construction, Brick, panels, precast lintels, slabs and beam, water harvesting techniques etc.

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|--------------|---------------------|--------------------|
| 1 | 2 | 4 |
| 2 | 4 | 8 |
| 3 | 5 | 10 |
| 4 | 5 | 10 |
| 5 | 7 | 14 |
| 6 | 7 | 14 |
| 7 | 4 | 10 |
| 8 | 4 | 10 |
| 9 | 10 | 20 |
| Total | 48 | 100 |

(Elective)

PRESTRESSED CONCRETE (ELECTIVE)

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RATIONALE

Now a days, diploma holders in Civil Engineering has to supervise prestressed concrete construction. So, it is necessary that they should have basic knowledge of prestressed concrete.

DETAILED CONTENTS

1. Introduction (10 hrs)

Basic concept of prestressed concrete, advantages of prestressed concrete in comparison with RCC application of prestressed to various building elements, bridges, water tanks and precast elements
2. Materials (08 hrs)

Materials requirement for prestressing concrete – High strength concrete, prestressing steel wires, strands and high strength bars. Stresses in high strength steel and stress-strain relationship, tendon profile
3. Prestressing Methods (08 hrs)

Introduction to prestressing methods – pre-tensioning and post-tensioning, their suitability and comparison, circular prestressing and its application
4. Bending and Shear Capacity (12 hrs)

Concept of bending and shear capacity of prestressed members. Calculation of bending stresses in rectangular simply supported beams with straight and parabolic profile of tendons
5. Losses in Prestressing (10 hrs)

Types of losses in prestress – Elastic shortening, creep and shrinkage of concrete, friction loss and stress relaxation in prestress steel. Computation of losses for simple beam problems

RECOMMENDED BOOKS

1. Prestressed Concrete by N Krishna Raju, Tata McGraw Hill, Delhi
2. Prestressed Concrete by P Dayaratnam

3. Prestressed Concrete by S Ramamurthum

SUGGESTED DISTRIBUTION OF MARKS

| Topic No. | Time Allotted (Hrs) | Marks Allotted (%) |
|------------------|----------------------------|---------------------------|
| 1 | 10 | 20 |
| 2 | 8 | 16 |
| 3 | 8 | 16 |
| 4 | 12 | 32 |
| 5 | 10 | 16 |
| Total | 48 | 100 |

MAJOR PROJECT WORK (INDUSTRY ORIENTED - PRACTICE BASED)

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As far as possible students should be given live project problems with a view to :

- i) Develop understanding regarding the size and scale of operations and nature of field work in which students are going to play their role after completing the courses of study.
- ii) Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- iii) Provide first hand experience to develop confidence amongst the students to enable them to use and apply polytechnic based knowledge and skills to solve practical problems of the world of work.
- iv) Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience. It is necessary that each organization is visited well in advance by respective teachers and activities to be performed by students are well defined. The chosen activities should be such which are of curricular interest to students and of professional value to industrial/field organizations. Each teacher is expected to supervise and guide 5-6 students.

Effort should be made to identify actual field problems to be given as project work to the students. Project selected should not be too complex which is beyond the comprehension level of the students. The placement of the students for such a practical cum project work should match with the competency profile and interest of students. Students may be assessed both by industry and polytechnic faculty. The suggested performance criteria is given below:

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| a) | Punctuality and regularity | 10 |
| b) | Initiative in learning/working at site | 10 |
| c) | Level/proficiency of practical skills acquired | 10 |
| d) | Sense of responsibility | 10 |
| e) | Self expression/Communication skills | 10 |
| f) | Interpersonal skills | 10 |
| g) | Report Writing skills | 20 |
| h) | Viva voce | 20 |

Some of suggested projects are given below: These are only guidelines, teacher may take any project related to Civil Engineering depending upon the availability of projects. Preference should be given to practical oriented projects.

According to the need of the polytechnic, the following major projects are suggested:

1. Construction of a small concrete road consisting of following activities
 - Survey and preparation of site plan
 - Preparation of drawings i.e. L-Section and X-Section
 - Estimating and earth work
 - Preparation of sub grade with stone ballast
 - Laying of concrete
 - Testing of slump, casting of cubes and testing
 - Material estimating and costing with specifications
 - Technical report writing
2. Water Supply system for a one or two villages
 - Surveying
 - Design of water requirements and water distribution system
 - Preparation of drawing of overhead tank
 - Material estimating and costing
 - Specifications
 - Technical report writing
3. Construction of seating benches in polytechnic campus
4. Welding of angle iron and Expanded metal jali to prepare fencing in polytechnic campus
5. Construction of toilets and baths for a shopping complex in a township
6. Construction of bridal path 4 kms long
7. Construction of shopping complex detailing of RCC drawings, estimating and costing of material
8. Rainwater harvesting
 - Assessment of catchment's area
 - Intensity of rainfall
 - Collection of water
 - Soak pit design
 - Supply of water
 - Monitoring during rainy season
9. Design and construction of septic tank with soak pit for 100 users
10. Preparing plumbing detailed drawings of a two storey building and material estimate and costing
11. Planning and design of sports stadium in a township or cluster of villages

12. Design of small residential building including structural members, specifications, estimating and costing of materials, report writing and municipal drawings for water supply and sewerage system
13. Concrete Mix Design

Note: The projects undertaken should be field oriented

GENERIC SKILL DEVELOPMENT CAMP – II

As per general feedback received from the employers regarding Technician Engineers during formal interactions, the pass outs of polytechnics are labeled of falling short of employable skills which comprises of Communication, inter-personal relationship, leadership qualities, team work, problem solving, managing task, managing self etc. in addition to technical knowledge and skills. We have, therefore, added papers such as English and Communication Skills and Entrepreneurship Development and Management in the curriculum in addition to proposed camps of 3-4 days to be conducted in polytechnics on common and vital issues e.g. Environmental Awareness, Entrepreneurship Development and Generic Skill Development.

It is proposed that a camp of 3-4 days duration on Generic Skills Development (GSD) during 6th semester be organized by arranging expert lectures/discussion sessions either by polytechnic teachers or by eminent educationists from the neighborhood to deal with the following topics. Few students may also be encouraged to prepare on some of these topics and make presentation during the camp. Expert lectures must be followed by distribution of relevant handouts for further study. The attendance of students should be compulsory and marks be awarded under provision of Student Centered Activities.

It is envisaged that such camps will bring in a significant improvement in confidence level and personality of the pass outs from polytechnics.

Suggested list of topics for arranging lectures/discussion sessions:

1. Ethics and Values
 - 1.1 Introduction and importance
 - 1.2 Ethics and values in profession and society
 - 1.3 Dignity of labour
 - 1.4 Net etiquettes

2. Group Dynamics
 - 2.1 Introduction
 - 2.2 Leadership
 - 2.3 Communication in group
 - 2.4 Team work

3. Personality Development
 - 3.1 PR technique
 - 3.2 Positive attitude
 - 3.3 Self-esteem
 - 3.4 Creativity

4. SWOT Analysis
 - 4.1 Importance
 - 4.2 Introduction to SWOT analysis steps
 - 4.3 SWOT analysis parameters