

## 6.1 STEEL STRUCTURES DESIGN

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### 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. This subject thus deals with elementary design principles as per BIS code of practice IS: 800

### DETAILED CONTENTS THEORY

1. Structural Steel and Sections: (02 hrs)
  - 1.1 Properties of structural steel as per IS Code
  - 1.2 Designation of structural steel sections as per IS handbook and IS:800-2007
2. Riveted Connections: (10 hrs)

Types of rivets, permissible stresses 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).
3. Welded connections: (06 hrs)

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)
4. Tension Members (16 hrs)

Analysis and design of single and double angle section tension members and their rivetted and welded connections with gusset plate as per IS:800
5. Compression Members (16 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. Roof Trusses (06hrs)
- 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 (no design, only concept)
7. Columns: (10 hrs)
- 7.1 Concept of buckling of columns, effective length and slenderness ratio, permissible stresses in compression as per IS:800 for different end conditions. Analysis and Design of axially loaded single section steel column
- 7.2 Types of column bases (Descriptive only)
- 7.3 Beam and column, frame and seated connections (descriptive only, no design)
8. Beams (10 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
- 9 Fabrication and Erection of Steel Structures like trusses, columns and girders (02 hrs)
- 10 Masonry structures – Design of brick column and wall foundations (02 hrs)

**Important Note:**

Use of IS: 800 and Steel Tables are permitted in 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. IS:800 may be referred along with code for relevant clauses

**RECOMMENDED BOOKS**

1. Duggal SK, "Design of Steel Structures" by Standard Publishers, Delhi
2. Birinder Singh, "Steel Structures Design and Drawing", Kaption Publishing House, Ludhiana
3. Ram Chandra, "Design of Steel Structures", Standard Publishers, Delhi
4. LS Negi, "Design of Steel Structure" Tata McGraw Hill, New Delhi
5. S Ramamurthan, "Design of Steel Structures",
6. Harbhajan Singh, "Design of Steel Structures", Abhishek Publishing, Chandigarh
- 7 IS Code : 800-2007

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	02	03
2	10	12
3	06	08
4	16	19
5	16	19
6	06	08
7	10	12
8	10	13
9	02	03
10	02	03
<b>Total</b>	<b>80</b>	<b>100</b>

## 6.2 EARTHQUAKE RESISTANT BUILDING CONSTRUCTION

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### 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: (08 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 (07 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. (08 hrs)
4. Introduction to IS: 4326, IS: 13828, IS: 1893(Part 1), 154326 and IS: 13920(latest edition). (05 hrs)
5. Seismic Provision of Strengthening and Retrofitting Measures for Traditionally-Built Constructions, Brick and RCC Structures (08 hrs)
6. Provision of reinforcement detailing in masonry and RC constructions (06 hrs)
7. 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. Manual Published by Earthquake Engineering department, IIT Roorkee / IIT Kanpur
3. IS 13920, IS: 13827, IS: 13828, IS 1893, IS 4326 (latest edition)
4. Singh, Harbhajan “ Earthquake Resistant Building Construction” Abhishek Publishers, Chandigarh

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	19
2	07	15
3	08	17
4	05	10
5	08	19
6	06	08
7	06	12
<b>Total</b>	<b>48</b>	<b>100</b>

## 6.3 STRUCTURAL DRAWINGS

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### RATIONALE

Diploma holders in Civil Engineering are required to supervise the construction of RC and Steel Structures. Thus one should be able to read and interpret structural drawings of RC and steel structures. The competence to read and interpret structural drawings is best learnt by being able to draw these drawings. Hence there is a need to have a subject devoted to preparation of structural drawings.

### DETAILED CONTENTS PART A

#### Drawing Exercises

##### 1. RC Structures:

Reinforcement details from the given data for the following structural elements with bar bending schedules

- (i) Drawing No. 1: RC Slabs - One way slab, Two way slab and Cantilever Slab.
- (ii) Drawing No.2 : Beams - Singly and doubly reinforced rectangular beams and Cantilever beam (All beams with vertical stirrups)
- (iii) Drawing No.3 : Columns and Footings – Square, Rectangular and Circular Columns with lateral ties and their isolated sloped column footings.
- (iv) Drawing No. 4 : Portal Frame – Three bay two storey RC portal frame with blow up of column beam junctions.
- (v) Drawing No.5: Dog legged stairs for single storey building
- (vi) Drawing No.6 : Draw atleast one sheet using CAD software

### PART B

##### 2. Steel Structures:

Structural drawing from given data for following steel structural elements.

- (i) Drawing No. 1: Roof Truss – Drawing of Fink Roof Truss with details of joints, fixing details of purlins and roof sheets.
- (ii) Drawing No.2 : Column and Column Bases - Drawing of splicing of steel columns. Drawings of slab base, gusseted base and grillage base for single section steel columns.

(iii) Drawing No.3 : Column Beam Connections

- (a) Sealed and Framed Beam to Beam Connections
- (b) Sealed and Framed beam o Column Connections

(iv) Drawing No. 4 : Plate Girder

Plan and Elevation of Plate Girder with details at supports and connection of stiffness, flange angles and cover plate with web highlighting curtailment of plates.

(v) Drawing No. 5 : Draw atleast one sheet using CAD software

### **RECOMMENDED BOOKS**

1. Loyal JS “Civil Engineering Drawing”, Satya Parkashan, New Delhi
2. Chandel RP “ Civil Engineering Drawings”
3. Kumar; NS “ Civil Engineering Drawing “ IPH, New Delhi
4. Malik RS and Meo GA, “Civil Engineering Drawing” Asian Publishing House, New Delhi
5. Singh, Birinder “RCC Design and Drawing” Kaption Publishing House, New Delhi.
6. Singh, Birinder “Steel Structures Design and Drawing”, Kaption Publishing House, New Delhi
7. Singh, Harbhajan, “Structural Drawings”, Abhishek Publishers, Chandigarh
8. B.V. Sikka, Civil Engineering Drawing.

## 6.4 QUANTITY SURVEYING AND VALUATION

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### RATIONALE

Diploma holders in Civil Engineering are supposed to prepare material estimates for various Civil Engineering works namely; buildings, irrigation works, public health works and roads etc. In addition, they must have basic knowledge regarding analysis of rates, contracting, principles of valuation. Therefore, this subject has great importance for diploma holders in Civil Engineering.

### DETAILED CONTENTS

1. Introduction to quantity surveying and its importance. Duties of quantity surveyor (02 hrs)
2. Types of estimates (03 hrs)
  - 2.1 Preliminary estimates
    - Plinth area estimate
    - Cubic rate estimate
    - Estimate per unit base
  - 2.2 Detailed estimates
    - Definition
    - Stages of preparation – details of measurement and calculation of quantities and abstract
3. Measurement (03 hrs)
  - 3.1 Units of measurement for various items of work as per BIS:1200
  - 3.2 Rules for measurements
  - 3.3 Different methods of taking out quantities – centre line method and long wall and short wall method
4. Preparation of Detailed and Abstract Estimates from Drawings for: (30 hrs)
  - 4.1 A small residential building with a flat roof and pitched roof building comprising of
    - Two rooms with W.C., bath, kitchen and verandah
  - 4.2 Earthwork for unlined channel
  - 4.3 WBM road and pre-mix carpeting
  - 4.4 Single span RCC slab culvert
  - 4.5 Earthwork for plain and hill roads
  - 4.6 RCC work in beams, slab, column and lintel, foundations
  - 4.7 users septic tank - 10 users  
- 50 users



5. Calculation of quantities of materials for (08 hrs)
- 5.1 Cement mortars of different proportion
  - 5.2 Cement concrete of different proportion
  - 5.3 Brick/stone masonry in cement mortar
  - 5.4 Plastering and pointing
  - 5.5 White washing, painting
  - 5.6 R.C.C. work in slab, beams
6. Analysis of Rates (10 hrs)
- 6.1 Steps involved in the analysis of rates. Requirement of material, labour, sundries, contractor's profit and overheads
  - 6.2 Analysis of rates for finished items when data regarding labour, rates of material and labour is given:
    - Earthwork in excavation in hard/ordinary soil and filling with a concept of lead and lift
    - RCC in roof slab/beam/lintels/columns
    - Brick masonry in cement mortar
    - Cement Plaster
    - White washing, painting
    - Stone masonry in cement mortar
    -
  - 6.3 Running and maintenance cost of construction equipment
7. Contractorship (06 hrs)
- Meaning of contract
  - Qualities of a good contractor and their qualifications
  - Essentials of a contract
  - Types of contracts, their advantages, dis-advantages and suitability, system of payment
  - Single and two cover-bids; tender, tender forms and documents, tender notice, submission of tender and deposit of earnest money, security deposit, retention money, maintenance period
  - Classification and types of contracting firms/construction companies
8. Preparation of Tender Document based on Common Schedule Rates (CSR) (12 hrs)
- Introduction to CSR and calculation of cost based on premium on CSR
  - Exercises on writing detailed specifications of different types of building works from excavation to foundations, superstructure and finishing operation
  - Exercises on preparing tender documents for the following
    - a) Earth work
    - b) Construction of a small house as per given drawing

- c) RCC works
  - d) Pointing, plastering and flooring
  - e) White-washing, distempering and painting
  - f) Wood work including polishing
  - g) Sanitary and water supply installations
  - h) False ceiling, aluminum (glazed) partitioning
  - i) Tile flooring including base course
  - j) Construction of W.B.M/Concrete road
9. Exercises on preparation of comparative statements for item rate contract (02 hrs)
10. Valuation (04 hrs)
- a) Purpose of valuation, principles of valuation
  - b) Definition of various terms related to valuation like depreciation, sinking fund, salvage and scrap value, market value, fair rent, year's purchase etc.
  - c) Methods of valuation (i) replacement cost method (ii) rental return method

### **INSTRUCTIONAL STRATEGY**

This is an applied engineering subject. Teachers are expected to provide working drawings for various Civil Engineering works and students be asked to calculate the quantities of materials required for execution of such works and use of relevant software for preparing estimates. Teachers should conceptualize making analysis of rates for different items of works. It will be advantageous if students are given valuation reports for reading.

### **RECOMMENDED BOOKS**

1. Pasrija, HD, Arora, CL and S. Inderjit Singh, "Estimating, Costing and Valuation (Civil)", New Asian Publishers, Delhi,
2. Rangwala, S.C, Estimating and Costing", Anand, Charotar Book Stall
3. Chakraborti, M, "Estimating, Costing and Specification in Civil Engineering", Calcutta
4. Dutta, BN, "Estimating and Costing
5. Mahajan Sanjay, "Estimating and Costing" Satya Parkashan, Delhi

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	02	03
2	03	04
3	03	04
4	30	40
5	08	08
6	10	12
7	06	08
8	12	12
9	02	03
10	04	06
<b>Total</b>	<b>80</b>	<b>100</b>

## 6.5 CONSTRUCTION MANAGEMENT AND ACCOUNTS

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### 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 and accounts.

### DETAILED CONTENTS THEORY

#### CONSTRUCTION MANAGEMENT:

1. Introduction: (06 hrs)
  - 1.1 Significance of construction management
  - 1.2 Main objectives of construction management and overview of the subject
  - 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, architect and contractors, their functions and inter-relationship
2. Construction Planning: (12 hrs)
  - 2.1 Importance of construction planning
  - 2.2 Stages of construction planning
    - Pre-tender stage
    - Contract stage
  - 2.3 Scheduling construction works by bar charts
    - Definition of activity, identification of activities
    - Preparation of bar charts for simple construction work

- Preparation of schedules for labour, materials, machinery and finances for small works
  - Limitations of bar charts
- 2.4 Scheduling by network techniques
- Introduction to network techniques; PERT and CPM, differences between PERT and CPM terminology
3. Organization: (06 hrs)
- 3.1 Types of organizations: Line, line and staff, functional and their characteristics
4. Site Organization: (06 hrs)
- 4.1 Principle of storing and stacking materials at site
- 4.2 Location of equipment
- 4.3 Preparation of actual job layout for a building
- 4.4 Organizing labour at site
5. Construction Labour: (08 hrs)
- 5.1 Conditions of construction workers in India, wages paid to workers
- 5.2 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)
6. Control of Progress: (04 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: (08hrs)
- 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: (10 hrs)
- 8.1 Accidents – causes and remedies
  - 8.2 Safety measures for
    - Excavation work
    - Drilling and blasting
    - Hot bituminous works
    - Scaffolding, ladders, form work
    - Demolitions
  - 8.3 Safety campaign and safety devices

## **ACCOUNTS**

9. Public Work Accounts: (20 hrs)

Introduction, technical sanction, administrative approval, allotment of funds, re-appropriation of funds bill, contractor ledger, measurement book running and final account bills complete, preparation of bill of quantities (BOQ), completion certificate & report, hand receipt, 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, defination of cash, precaution in custody of cash book, imprest account, temporary advance, treasury challan, preparation of final bills. Students must learn to prepare accounts register, stock register.

## **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. Harpal Singh, "Construction Management and Accounts", Tata McGraw Hill Publishing Company., New Delhi
2. Peurifoy, RL, "Construction Planning, Equipment and Methods", McGraw Hill, Tokyo
3. Singh, Harbhajan “ Construction Project Management” Abhishek Publishers, Chandigarh
4. Verma, Mahesh; "Construction Equipment and its Planning and Application
5. Dharwadker, PP; "Management in Construction Industry", , Oxford and IBH Publishing Company, New Delhi
6. Gahlot PS; Dhir, BM; "Construction Planning and Management", Wiley Eastern Limited, New Delhi
7. Softwares :  
(a) MS Project – Microsoft USA  
(b) Primavera

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	09
2	12	14
3	06	09
4	06	08
5	08	12
6	04	06
7	08	09
8	10	11
9	20	22
<b>Total</b>	<b>80</b>	<b>100</b>

(Elective)

### 6.6.1 REPAIR AND MAINTENANCE OF BUILDINGS

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#### 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 (06 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) (06 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. Investigation and Diagnosis of Defects (06 hrs)
  - 3.1 Systematic approach/procedure of investigation
  - 3.2 Sequence of detailed steps for diagnosis of building defects/problems



- 3.3 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
  
- 4. Defects and their root causes (06 hrs)
  - 4.1 Define defects in buildings
  - 4.2 Classification of defects
  - 4.3 Main causes of building defects in various building elements
    - 4.3.1 Foundations, basements and DPC
    - 4.3.2 Walls
    - 4.3.3 Column and Beams
    - 4.3.4 Roof and Terraces
    - 4.3.5 Joinery
    - 4.3.6 Decorative and protective finishes
    - 4.3.7 Services
    - 4.3.8 Defects caused by dampness
  
- 5. Materials for Repair, maintenance and protection (06 hrs)
  - 5.1 Compatibility aspects of repair materials
  - 5.2 State application of following materials in repairs:
    - 5.2.1 Anti corrosion coatings
    - 5.2.2 Adhesives/bonding aids
    - 5.2.3 Repair mortars
    - 5.2.4 Curing compounds
    - 5.2.5 Joints sealants
    - 5.2.6 Waterproofing systems for roofs
    - 5.2.7 Protective coatings
  
- 6. Remedial Measures for Building Defects (18 hrs)
  - 6.1 Preventive maintenance considerations
  - 6.2 Surface preparation techniques for repair
  - 6.3 Crack repair methods
    - 6.3.1 Epoxy injection
    - 6.3.2 Grooving and sealing
    - 6.3.3 Stitching
    - 6.3.4 Adding reinforcement and grouting
    - 6.3.5 Flexible sealing by sealant

- 6.4 Repair of surface defects of concrete
  - 6.4.1 Bug holes
  - 6.4.2 Form tie holes
  - 6.4.3 Honey comb and larger voids
  
- 6.5 Repair of corrosion in RCC elements
  - 6.5.1 Steps in repairing
  - 6.5.2 Prevention of corrosion in reinforcement
  
- 6.6 Material placement techniques with sketches
  - 6.6.1 Pneumatically applied (The gunite techniques)
  - 6.6.2 Open top placement
  - 6.6.3 Pouring from the top to repair bottom face
  - 6.6.4 Birds mouth
  - 6.6.5 Dry packing
  - 6.6.6 Form and pump
  - 6.6.7 Preplaced – aggregate concrete
  - 6.6.8 Trowel applied method
  
- 6.7 Repair of DPC against Rising Dampness
  - 6.7.1 Physical methods
  - 6.7.2 Electrical methods
  - 6.7.3 Chemical methods
  
- 6.8 Repair of walls
  - 6.8.1 Repair of mortar joints against leakage
  - 6.8.2 Efflorescence removal
  
- 6.9 Waterproofing of wet areas and roofs
  - 6.9.1 Water proofing of wet areas
  - 6.9.2 Water proofing of flat RCC roofs
  - 6.9.3 Various water proofing systems and their characteristics
  
- 6.10 Repair of joints in buildings
  - 6.10.1 Types of sealing joints with different types of sealants
  - 6.10.2 Techniques for repair of joints
  - 6.10.3 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. The students will also prepare a project report based upon the available water proofing materials, sealant, special concrete for repair and adhesives and other repair material available in the market.

## RECOMMENDED BOOKS

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

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	13
2	06	13
3	06	13
4	06	13
5	06	13
6	18	35
<b>Total</b>	<b>48</b>	<b>100</b>

**Elective**  
**6.6.2 ENVIRONMENTAL ENGINEERING**

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**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 (02 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 (05 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 (04 hrs)  
  
Causes of pollution in surface and underground water eutrophication of lakes and its preventing measure; BIS standards for water quality.
4. Air Pollution (07 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 (03 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 (02 hrs)  
 Ill effects of mining, blasting and deforestation on the environment human life and wild life.
7. Land Use (06 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 (06 hrs)  
 Definition and requirements, environmental impact assessment. Flow chart of environmental impact assessment methodology. Describe the need and importance of EIA.
9. Legislation to Control Environmental Pollution (idea) (03 hrs)  
 Indian legislative acts for water, land and air pollution control – provisions, scope and implementation
10. Global Issues of Environmental Engineering (05 hrs)  
 Global warming, ozone depletion, acid rain, oil pollution; radiation hazards and their control, concept of clean technology and carbon credits.
11. Renewable Source of Energy (05 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. Deswal DS and Deswal SS “Environmental Engineering” Dhanpat Rai and Company (P) Ltd., Delhi
2. Odum EP, “Fundamentals of Ecology”, Amarind Publication Co., Delhi
3. Dhamija SK “Environmental Engineering and Management ; SK Kataria and Sons, Delhi
4. De AK, “Engineers Chemistry”, New Age Publication, Delhi
5. Kendeigh SC, “Ecology”, Prentice Hall of India, Delhi
6. Khitoliya, RK, “Environmental Pollution’, S Chand & Co. Ltd., New Delhi
7. Bhatia, HS, “A text book of Environmental Pollution and Control”, Galgotia. Publishers, Delhi

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	04
2	05	10
3	04	08
4	07	14
5	03	06
6	02	04
7	06	12
8	06	14
9	03	07
10	05	11
11	05	10
<b>Total</b>	<b>48</b>	<b>100</b>

**(Elective)**  
**6.6.3 PRESTRESSED CONCRETE**

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**RATIONALE**

Now a days, diploma holders in Civil Engineering have 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. N Krishna Raju “Prestressed Concrete” , Tata McGraw Hill, Delhi
2. P Dayaratnam “Prestressed Concrete”, Oxford & IBH Publishing Co. Delhi
3. S Ramamurthum “Prestressed Concrete” , Dhanpat Rai & Sons, Delhi

## 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
<b>Total</b>	<b>48</b>	<b>100</b>



**6.7 MAJOR PROJECT WORK  
(INDUSTRY/FIELD ORIENTED - PRACTICE BASED)**

**L T P  
- - 10**

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 classroom 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:

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 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 by 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
14. Construction of concrete cubes by mixing appropriate quantity of fly ash with fibres
  - (i) the fibres like polypropylene, carbon, steel etc. can be used
  - (ii) students will show the comparison between concrete mixed with fibres verses the quality controlled concrete.
15. Estimation and designing of a State Highway Road
  - (i) Reconnaissance survey of proposed road
  - (ii) To take L - section and cross sections
  - (iii) Fixing of grades
  - (iv) Estimation of cutting and filling of earth mass
  - (v) Plane tabling survey of proposed road
  - (vi) Estimation of proposed road
16. Designing a small height gravity dam
  - (i) Constructing of catchment area
  - (ii) Calculating the reservoir capacity
  - (iii) Designing of gravity dam by taking into account various forces
17. Designing of ferro-cement water tank and toilet. Testing of the ferro-cement products in civil engineering labs.

Note: The projects undertaken should be field oriented