

## 6.1 STEEL STRUCTURES DESIGN

**L T P**  
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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.

### LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Explain structural properties of steel and its designation as per Indian Standards
- Select different types of bolted and welded joints
- Analyze and design single and double angle section struts and I section compression members
- Explain different types of trusses, their different components and usability
- Analyze and design of simply supported steel beams
- Select various types of plate girders
- Supervise fabrication and erection of steel structure like trusses, columns and girders

### 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

2. Bolt Connections: (10 hrs)

Types of bolt, permissible stresses in bolt, types of bolted joints, specifications for bolted joints as per IS 800. Failure of a bolted joint. Assumptions in the theory of bolted joints. Strength and efficiency of a bolted joint. Design of bolted joints for axially loaded members ( No Staggered bolts).

3. Welded connections: (06 hrs)  
Types of welds and welded joints, advantages and disadvantages of welded joints design of fillet and butt weld for axially loaded members
4. Tension Members (16 hrs)  
Analysis and design of single and double section tension members and their rivetted and welded connections with gusset plate as per IS:800-2007
5. Compression Members (16 hrs)  
Analysis and design of single and double angle sections compression members subjected to axial load
6. Roof Trusses (06 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 (no design, only concept)
7. Column Bases: (10 hrs)  
7.1 Types of column bases i.e. slab base, gusseted base  
7.2 Details of grillage foundation
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 (04 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

**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	04	06
<b>Total</b>	<b>80</b>	<b>100</b>

## 6.2 EARTHQUAKE RESISTANT BUILDING CONSTRUCTION

**L T P**  
**3 - -**

### 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

### LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Classify the earthquakes
- Explain seismic behavior of traditionally built constructiona
- Supervise construction of earthquake resistant buildings
- Monitor reinforcement detailing in earthquake resistant structures
- Manage all rescue operation caused due to earthquake

### 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 seismic zone of India and factors related to IS:1893 and IS: 13920 (latest edition) (05 hrs)
5. Seismic provision of strengthening and retrofitting measures for traditionally-built constructions (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. (06 hrs)

### 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: 13827, IS: 13828, IS 1893-2002, IS 4326 (latest edition)
5. Earthquake Engineering by RL Weigel, Prentice Hall Inc.
6. Dynamics of Structure by AK Chopra, Prentice Hall Inc. New Delhi

### 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 STEEL STRUCTURES DRAWINGS

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#### RATIONALE

Diploma holders in Civil Engineering are required to supervise the construction of steel structures. Thus one should be able to read and interpret structural drawings of 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.

#### LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Read and interpret steel structural drawing
- Prepare the detailed drawings of toe joint, ridge joint, details of purlins and roof sheets
- Prepare and draw slab base connection, gusseted base connection grillage base connection for single section steel columns
- Draw column beam connections
- Prepare drawings of plate girder from given design data
- Prepare the drawing and demonstrate steel roof truss
- Draw the structural drawing sheets using CAD Software

#### DETAILED CONTENTS

##### Steel Structures Drawings:

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 (Bolted)

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 “Steel Structures Design and Drawing”, Kaption Publishing House, New Delhi

## 6.4 QUANTITY SURVEYING AND VALUATION

**L T P**  
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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.

### LEARNING OUTCOME

After undergoing the subject, students will be able to:

- Explain different units of measurement for different items
- Calculating quantities of materials and prepare the material chart
- Prepare detailed and abstract of estimates from drawings
- Prepare tender document of different civil engineering items by using C.S.R. rates with premium
- Use principles of valuation for valuation of a building

### 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 content estimate
  - 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 by following CSR rates for: (20 hrs)
  - 4.1 A small residential building with a flat roof 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 10 users septic tank
  
5. Calculation of quantities of materials for (10 hrs)
  - 5.1 Cement mortars of different proportion
  - 5.2 Cement concrete of different proportion
  - 5.3 Brick/stone masonry in cement mortar of different proportion
  - 5.4 Plastering, pointing and painting
  - 5.5 D.P.C. and flooring
  
6. Analysis of Rates (12 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
  - 6.3 Running and maintenance cost of construction equipment
  
7. Contractorship (08 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) (16 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
9. Valuation (06 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	2	3
2	3	4
3	3	4
4	20	19
5	10	12
6	12	17
7	8	12
8	16	19
9	6	10
<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 & safety and accounts.

### LEARNING OUTCOME

After undergoing the subject, students will be able to:

- State functions of various aspects of controlling construction job/project
- Explain pre-tender stage and contract stage
- Prepare bar charts for simple construction work
- Prepare scheduling techniques i.e. PERT and CPM
- Prepare job layout of building
- Comply with various labour laws
- Analyze and support in effective functioning of organization
- Inspect quality at various stages of the construction
- Control accidents and safety concerns
- Prepare measurement books and bill of quantities

### 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  
Stages of construction planning
- Pre-tender stage
  - Contract stage
- 2.2 Scheduling construction works by bar charts
- Definition of activity, identification of activities though
  - Preparation of bar charts for simple construction work
  - Preparation of schedules for labour, materials, machinery and finances for small works
  - Limitations of bar charts
- 2.3 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: (8 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)
  - Acts relating to Labour Safety

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: (08 hrs)
- 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, safety training

### **ACCOUNTS**

9. Public Work Accounts: (20 hrs)
- 9.1 Introduction, technical sanction, 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.
- 9.2 Filling of PWD accounts forms

## 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", East West Press, New Delhi
2. Harpal Singh, "Construction Management and Accounts", Tata McGraw Hill Publishing Company., New Delhi
3. Peurifoy, RL, "Construction Planning, Equipment and Methods", McGraw Hill, Tokyo
4. Wakhlo, ON; "Civil Engineering Management", Light and Life Publishers, New Delhi
5. Verma, Mahesh; "Construction Equipment and its Planning and Application
6. Dharwadker, PP; "Management in Construction Industry", , Oxford and IBH Publishing Company, New Delhi
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	6	9
4	6	8
5	8	12
6	4	6
7	8	9
8	10	11
9	20	22
<b>Total</b>	<b>80</b>	<b>100</b>

(Elective)

**6.6.1 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.

**LEARNING OUTCOMES**

After undergoing the subject, students will be able to:

- State various factors causing deterioration to buildings
- Investigate/diagnose various defects in buildings
- Explain main causes of defects in buildings
- Select the materials for repair and maintenance of buildings
- Carry out repairs for various types of building defects

**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	6	13
2	6	13
3	6	13
4	6	13
5	6	13
6	6	13
7	12	22
<b>Total</b>	<b>48</b>	<b>100</b>

**ELECTIVE**  
**6.6.2    ADVANCED CONSTRUCTION TECHNOLOGY**

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**RATIONALE**

This is an applied technology subject. In this subject, knowledge regarding earth work, construction of high rise buildings and precast and pre stressed concreting operations and piles has been given.

**LEARNING OUTCOME**

After undergoing the subject, student will be able to:

- Use various techniques for earthwork by following safety measures
- Use construction techniques for high rise buildings and chimneys
- Supervise prestressed concrete construction
- Use various methods of pile driving

**DETAILED CONTENTS**

- |    |   |          |
|----|---|----------|
| 1. | Earth Work  | (16 hrs) |
|    | 1.1    Excavation in ordinary and hard soils, excavation in soft and hard rock, blasting techniques excavation in weak soils  |          |
|    | 1.2    Side slopes of excavation; minimum working space at bottom, shoring strutting  |          |
|    | 1.3    Dewatering technique – pumping and well points   |          |
|    | 1.4    Disposal of spoil and balancing  |          |
|    | 1.5    Safety aspects   |          |
|    | 1.6    Embankments, compaction of earth fills, protection and drainage of embankments   |          |
| 2. | High Rise Construction  | (08 hrs) |
|    | 2.1    Construction techniques for high rise buildings  |          |
|    | 2.2    Construction techniques for chimneys and cooling towers  |          |
| 3. | Precast and Prestressed Concrete Construction   | (16 hrs) |
|    | 3.1    Introduction of prestressed concrete, general theory. Linear post tensioning – general, post tensioning advantages to the design engineer and the contractor |          |

- 3.2 Linear post tensioning system, high strength post tensioned stands, parallel lay wire, high strength alloy steel bars
  - 3.3 Techniques of post tensioning – general, special requirements for forming and false work, ducts or tendons, concreting, stressing procedure, grouting, protecting anchorage from corrosion
  - 3.4 Pretensioning - general, pretensioning yards set up, forms for pretensioned structural elements, special techniques of pretensioning
  - 3.5 Materials of prestressing – cement, aggregates concrete, admixtures, vibration, curing, light weight aggregates, high strength steel bars, high strength stand, stress relaxation, galvanization. Codes specifications and inspection, manufacturers of prestressing equipment, specifications, sizes and costs
4. Piles (08 hrs)
- Piles; basic piling methods for various types of piles, methods of pile driving, non – displacement piles, problems in pile construction, pile testing

**Note: To visit high rise buildings and flyovers construction site and their report writing**

### **INSTRUCTIONAL STRATEGY**

The subject shall consist of visits by the students to various construction sites where they shall see the heavy construction works. They shall also contact the representatives of the manufacturers of various construction equipment and collect information from practical demonstration, discussions and technical information received from the firms.

### **RECOMMENDED BOOKS**

1. Gupta, Sushil Kumar, Singla, DR. and Juneja BM, “A Text Book of Building Construction”; Ludhiana Katson Publishing House.
2. Deshpande, RS and Vartak, GV; “A Text Book of Building Construction”; Poona United Book Corporation.
3. Kulkarni, GJ; “A Text Book of Building Construction”; Ahmedabad Book Depot.
4. Arora, SP and Bindra, SP; “A Text Book of Building Construction”; New Delhi Dhanpt Rai and Sons.
5. Sharma, SK and Kaul, BK; “A Text Book of Building Construction”; Delhi, S Chand and Corporation
6. Sushil Kumar; “Building Construction”; Delhi Standard Publishers Distributors.
7. Moorthly, NKR; “A Text Book of Building Construction”; Poona, Engineering Book Publishing Corporation
8. N.Krishna Raju, “Prestressed Concrete”, Tata McGraw Hills, New Delhi
9. P Dayaratnam, “Prestressed Concrete”, Laxmi Publication, New Delhi

**SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	16	30
2	08	20
3	16	30
4	08	20
<b>Total</b>	<b>48</b>	<b>100</b>

**ELECTIVE**  
**6.6.3 GREEN BUILDINGS**

**L T P**  
**3 - -**

**RATIONALE**

Buildings have major impact on the environment and human health during its construction and also lifelong its use. It accounts large amount of land use, water and energy consumption causes air and atmospheric pollution. Green Buildings bring environment friendly construction and utilization, ultimately reduce green house gas emissions and impact on climate change. Hence, Green Building subject is introduced in the curriculum of Diploma in Civil Engineering Course at Polytechnic Level.

**LEARNING OUTCOME**

After undergoing the subject, student will be able to:

- Describe various features of green building and benefits of green buildings
- Explain site selection and site planning
- List out various concepts of design of components of Green Building
- Use eco-friendly green building materials  
Integrate renewable energy systems in the green building construction
- Use energy conservation measures in the buildings by following ECBC
- Identify various water efficient fixtures
- Use rainwater harvesting techniques
- Demonstrate waste water and solid waste management
- Use low VOC materials
- Evaluate different type of Green Building Ratings for certification of building

**DETAILED CONTENTS**

1. Introduction (03 hrs)  
  
Introduction and objectives of Green Buildings, benefits of Green Buildings, features of Green Buildings
2. Green Building Planning and Design Concepts (05 hrs)  
Site selection and planning, Passive Solar design concepts; orientation, building envelope, roof, walls, fenestration, shading and colour

3. Eco-friendly Green Building Materials (08 hrs)

Different types of eco-friendly materials, recycled materials; fly ash bricks, autoclave aerated blocks, hollow concrete blocks, aggregates, sun controlled glass, UPVC windows, wood, steel and sun reflective paints

4. Integration of Renewable Energy Systems (05 hrs)

Solar Thermal Systems; Solar Water Heating System, Solar chimney, Wind mills. Solar Photovoltaic Systems; Rooftop Solar Power Plant, Solar Lights, Net-metering system

5. Energy Efficiency (12 hrs)

Use of Energy Conservation Building Code (ECBC), Energy Efficient Star labeled Appliances, Energy monitoring and evaluation, Energy Auditing and implementation of energy conservation measures

6. Water Efficiency (05 hrs)

Use of Water Efficient fixtures, rainwater harvesting, waste water management, solid waste management

7. Indoor Environment Quality (05 hrs)

Natural air ventilation, day lighting, various type of low VOC materials

8. Green Building Rating and Certification (05 hrs)

Various types of Green Building Ratings; LEED India, GRIHA, BEE; Features and criteria of each rating system and its compliance

**Field Visits :** Field visits for study of green building construction in the region



## INSTRUCTIONAL STRATEGY

Green Building subject involves introduction through lectures-cum-discussions, field work and site visits. The students should be taught this subject through case studies.

## RECOMMENDED BOOKS

1. Energy Conservation Building Code (ECBC) publication of Bureau of Energy Efficiency, Ministry of Power, Government of India
2. Rating Manuals of Indian Green Building Council, Hyderabad
3. Rating Manuals of GRIHA, TERI, New Delhi

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	03	06
2	05	10
3	08	18
4	05	10
5	12	26
6	05	10
7	05	10
8	05	10
<b>Total</b>	<b>48</b>	<b>100</b>

## 6.7 MAJOR PROJECT WORK

L T P  
- - 12

### RATIONALE

Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

### LEARNING OUTCOMES

After undergoing the project work, students will be able to:

Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place the learner for project oriented practical training in actual work situation for the stipulated period with a view to:

- 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
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop first hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.
- Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

### General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training cum project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

**Some of the projects are listed below for the benefit of the students:**

1. Study and detailed estimate of different component of modern residential and commercial building
2. Preparation of detailed estimate for low cost two room set residential building
3. Analysis of green building
4. Design of rain water harvesting for a given building
5. Analysis of accidents prone area in your city and remedial measure for them
6. Case study of safety practices in a multi-storied buildings under constructions
7. Concrete Mix Design
8. Case study of repair and maintenance of a given building
9. Preparation of DNIT of a given building for Civil Engineering works
10. Detailed estimate for installing plumbing fixtures
11. Preparing a standard measurement book of a given building
12. Construction of concrete road by using latest
13. Water supply scheme for a govt approved colony
14. Construction estimates of shopping complex
15. Analysis and design of Effluent Treatment Plant (ETP) for an industry
16. Design of soak pit with septic tank for 100 users
17. Design and estimate of two room set building
18. Design of concrete mix by using flyash
19. Setting up of an interlocking pavers fabrication plant
20. Preparation of different Civil Engineering models e.g. beam, one way, two way slab, column etc.

21. Reinforcement detailing as per IS:4326
22. Design of car parking in your polytechnic
23. Design of acoustics for an auditorium
24. To prepare analysis of rates for non -schedule items e.g. aluminium door, windows, work stations etc.
25. Study of retrofitting of a given Civil Engineering works.
26. Survey of your polytechnic by using total station.
27. Traffic volume study and analysis on different roads in a city
28. Case study of a flyover with regard to its various construction components
29. Study and preparation of detailed project report of ready mix concrete (RMC) unit
30. Study and preparation of detailed project report of prefabricated/prestressed concrete components unit
31. 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
32. Water Supply system for a locality
  - Surveying
  - Design of water requirements and water distribution system
  - Preparation of drawing of overhead tank
  - Material estimating and costing
  - Specifications
  - Technical report writing
33. Construction of shopping complex by detailing of RCC drawings, estimating and costing of material
34. Design and construction of septic tank with soak pit for 100 users

35. 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

There is no binding to take up the above projects as it is only a suggestive list of projects.

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

Sr. No.	Performance Criteria	Max.** Marks	Rating Scale				
			Excellent	Very Good	Good	Fair	Poor
1.	Selection of project assignment	10%	10	8	6	4	2
2.	Planning and execution of considerations	10%	10	8	6	4	2
3.	Quality of performance	20%	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20%	20	16	12	8	4
5.	Sense of responsibility	10%	10	8	6	4	2
6.	Self expression/ communication skills	5%	5	4	3	2	1
7.	Interpersonal skills/human relations	5%	5	4	3	2	1
8.	Report writing skills	10%	10	8	6	4	2
9	Viva voce	10%	10	8	6	4	2
<b>Total marks</b>		<b>100</b>	<b>100</b>	<b>80</b>	<b>60</b>	<b>40</b>	<b>20</b>

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get “Overall Good grade” failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared “not eligible to receive diploma”. It is also important to note that the students must get more than six “goods” or above “good” grade in different performance criteria items in order to get “Overall Good” grade.

	<b>Range of maximum marks</b>	<b>Overall grade</b>
i)	More than 80	Excellent
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

### **Important Notes**

- 1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.**
- 2. The criteria for evaluation of the students have been worked out for 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.**
- 3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.**
- 4. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.**

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work