

**Curriculum for  
Diploma Programme in  
CIVIL ENGINEERING  
For the State of Uttar Pradesh**



Prepared by:  
***Curriculum Development Centre***  
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**Sector 26, Chandigarh - 160 019**

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- x) A small enterprise like precast elements/hume pipes/water proofing chemicals, RCC pipes, hollow blocks, shuttering etc.
- xi) Rain water harvesting system installation
- xii) Sanitary Installation

### 3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN CIVIL ENGINEERING

At the end of the programme, a diploma holder in Civil Engineering will be able to:

1.	Communicate effectively in English with others
2.	Apply basic principles of Mathematics and Science to solve engineering problems
3.	Prepare computerized reports, presentations using IT tools and computer application software
4.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work
5.	Use appropriate procedures for preventing environmental pollution and energy conservation
6.	Use basic concepts and principles of fluid mechanics as applied to civil engineering practices.
7.	Apply concepts of mechanics to solve Engineering problems
8.	Carry out various types of surveying like levelling, plane tabling, theodolite surveying, and tachometry and contouring; and use modern surveying techniques like total station, remote sensing, GIS and GPS.
9.	Select, Use and carry out testing of construction materials including eco friendly and advanced materials as per their suitability and availability
10.	Supervise various building construction works from substructure to superstructure and their finishing operations.
11.	Prepare, read and interpret, component drawing, building drawings and layout
12.	Supervise production, placement and quality control of concrete operations.
13.	Supervise construction of pre cast elements.
14.	Carry out layout plan of water supply, sewerage and sanitary systems and monitor quality of water and waste water
15.	Supervise constructional aspects pertaining to irrigation structures
16.	Prepare, read and interpret public health and irrigation engineering drawings
17.	Analyse and design simple structural elements of R.C.C.

18.	Supervise constructional aspects pertaining to highway engineering
19.	Prepare, read and interpret R.C.C. drawings
20.	Prepare topographical plan of an area
21.	Use various computer softwares in the field of Civil Engineering
22.	Supervise constructional aspects pertaining to railways, bridges and tunnels
23.	Analyse, use and treat various types of soils for foundation purpose
24.	Plan and execute given task/projects as a team member/ leader
25.	Analyse and design simple structural elements of steel
26.	Prepare material estimates as per CSR, Specifications, costing, valuation and tender documents as per given drawings and prepare bill of quantity of construction.
27.	Apply basic principles of construction management techniques and accounts in Civil Engineering
28.	Carry out repair, maintenance and retrofitting of buildings as per requirement
29.	Use various advanced constructional techniques for construction of high rise and earthquake resistant structures keeping safety aspects in mind.
30.	Plan and execute activities related to disaster management.
31.	Apply the knowledge and skills gained through various courses in solving live problems/projects in the field
32.	Demonstrate appropriate values and attitude.

#### 4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum area subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Communicate effectively in English with others	– Communication Skills – Student Centred Activities (SCA)
2.	Apply basic principles of Mathematics and Science to solve engineering problems	– Applied Mathematics – Applied Physics – Applied Chemistry
3.	Prepare computerized reports, presentations using IT tools and computer application software	– Basics of Information Technology
4.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work	– General Workshop Practice – Basics of Mechanical and Electrical Engg.
5.	Use appropriate procedures for preventing environmental pollution and energy conservation	– Environmental Studies – Energy Conservation
6.	Use basic concepts and principles of fluid mechanics as applied to civil engineering practices.	– Hydraulics and Hydraulic Machines
7.	Apply concepts of mechanics to solve Engineering problems	– Applied Mechanics – Structural Mechanics
8.	Carry out various types of surveying like levelling, plane tabling, theodolite surveying, and tachometry and contouring; and use modern surveying techniques like total station, remote sensing, GIS and GPS.	– Quantity Surveying and Valuation
9.	Select, Use and carry out testing of construction materials including eco friendly and advanced materials as per their suitability and availability	– Construction Materials
10.	Supervise various building construction works from substructure to superstructure and their finishing operations.	– Building Construction – Building Drawings
11.	Prepare, read and interpret, component drawing, building drawings and layout	– Engineering Drawing
12.	Supervise production, placement and quality control of concrete operations.	– Concrete Technology

13.	Supervise construction of pre cast elements.	– Reinforced Cement Concrete Structures (RCC Structures)
14.	Carry out layout plan of water supply, sewerage and sanitary systems and monitor quality of water and waste water	– Water and Waste water Engineering
15.	Supervise constructional aspects pertaining to irrigation structures	– Irrigation Engineering
16.	Prepare, read and interpret public health and irrigation engineering drawings	– Waste Water and Irrigation Engineering Drawing
17.	Analyse and design simple structural elements of R.C.C.	– Reinforced Cement Concrete Structures (RCC Structures)
18.	Supervise constructional aspects pertaining to highway engineering	– Highway Engineering
19.	Prepare, read and interpret R.C.C. drawings	– RCC Drawing
20.	Prepare topographical plan of an area	– Surveying
21.	Use various computer softwares in the field of Civil Engineering	– Computer Aided Drawing – Software Application in Civil Engineering
22.	Supervise constructional aspects pertaining to railways, bridges and tunnels	– Railways, Bridges and Tunnels
23.	Analyse, use and treat various types of soils for foundation purpose	– Soil Mechanics and Foundation Engineering
24.	Plan and execute given task/projects as a team member/ leader	– Project Work
25.	Analyse and design simple structural elements of steel	– Design of Steel Structure – Steel Structure Drawing
26.	Prepare material estimates as per CSR, Specifications, costing, valuation and tender documents as per given drawings and prepare bill of quantity of construction.	– Quantity Surveying and Valuation
27.	Apply basic principles of construction management techniques and accounts in Civil Engineering	– Construction Management, Accounts and Entrepreneurship Development
28.	Carry out repair, maintenance and retrofitting of buildings as per requirement	– Repair and Maintenance of Buildings
29.	Use various advanced constructional techniques for construction of high rise and earthquake resistant structures keeping safety aspects in mind.	– Earthquake Engineering

30.	Plan and execute activities related to disaster management.	– Analysis of Structures
31.	Apply the knowledge and skills gained through various courses in solving live problems/projects in the field	– Project Work
32.	Demonstrate appropriate values and attitude.	– Student Centred Activities

## SIXTH SEMESTER (CIVIL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
-	Survey Camp	-	-	-	2	-	40	40	-	-	60	-	60	100	
6.1	Quantity Surveying and Valuation	6	-	-	5	20	-	20	50	2 ½	-	-	50	70	
6.2	Construction Management, Accounts and Entrepreneurship Development	5	-	-	4	20	-	20	50	2 ½	-	-	50	70	
6.3	Design of Steel Structure	6	-	-	5	20	-	20	50	2 ½	-	-	50	70	
6.4	Steel Structure Drawing	-	-	4	2	-	20	20	50	3	-	-	50	70	
6.5	Software Applications in Civil Engineering	-	-	8	3	-	40	40	-	-	60	3	60	100	
6.6	**Elective:	5	-	-	4	20	-	20	50	2 ½	-	-	50	70	
6.7	Project Work	-	-	10	4	-	40	40	-	-	60	-	60	100	
#Student Centred Activities (SCA)		-	-	4	1	-	30	30	-	-	-	-	-	30	
Total		22	-	26	30	80	170	250	250	-	180	-	430	680	

\*\*Elective :- Any one of the following:

- 6.6.1 Repair and Maintenance of Buildings
- 6.6.2 Plumbing Services
- 6.6.3 Analysis of Structures

# Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

## 6.1 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.

### LEARNING OUTCOMES

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 | (04 Periods) |
| 2.  | Types of estimates   | (08 Periods) |
| 2.1 | Preliminary estimates  |              |
|     | - Plinth area estimate   |              |
|     | - Cubic content estimate   |              |
| 2.2 | Detailed estimates   |              |



- Definition, Type of detailed estimate- Detail estimate you new work, Revised Estimate, Supplementary estimate, Maintenance and Repair estimate
- Stages of preparation – details of measurement and calculation of quantities and abstract

3. Measurement (08 Periods)
  - 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: (08 Periods)
  - 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 ( Periods)
  - 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
  - 5.6 Steel in beam, slab, column, foundation
  
6. Analysis of Rates (08 Periods)
  - 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 along with lead diagram
- RCC in roof slab/beam/lintels/columns
- Brick masonry in cement mortar
- Cement Plaster
- White washing, painting- RCC foundation

### 6.3 C.C Flooring

Standard schedule of rates, full rates and labour rates

## 7 Contractorship (08 Periods)

- Meaning of contract
- 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 Periods)

- 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) Preparation of comparative statement for item rate contract.

## 9. Valuation (06 Periods)

- 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.

### MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Viva-voce

### RECOMMENDED BOOKS

1. Estimating, Costing and Valuation (Civil) by Pasrija, HD, Arora, CL and S. Inderjit Singh; New Asian Publishers, Delhi,
2. Estimating and Costing by Rangwala, S.C ;Charotar Book Stall, Anand
3. Estimating and Costing by Dutta, BN
4. Estimating and Costing by Mahajan Sanjay; Satya Parkashan, Delhi
5. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

### Websites for Reference:

<http://swayam.gov.in>

### *SUGGESTED DISTRIBUTION OF MARKS*

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	05
2	08	10
3	08	10
4	20	24
5	08	10
6	08	10
7	08	10
8	12	14
9	06	07
<b>Total</b>	<b>84</b>	<b>100</b>



## 6.2 CONSTRUCTION MANAGEMENT, ACCOUNTS AND ENTREPRENEURSHIP DEVELOPMENT

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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
- Knowledge of scope and benefit of Entrepreneurship
- Know about the various program running in India, state Govt.
- Know about leadership qualities

### DETAILED CONTENTS THEORY

#### CONSTRUCTION MANAGEMENT

- |     |   |              |
|-----|---|--------------|
| 1.  | Introduction  | (06 Periods) |
| 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
- 1.7 Resources for construction industry
  
- 2. Construction Planning (08 Periods)
  - 2.1 Importance of construction planning
    - Stages of construction planning
      - Pre-tender stage
      - Contract stage
    - Contracts and e-tendering
      - Different types of contracts
      - Penalties and Arbitration
  - 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 (02 Periods)
  - 3.1 Types of organizations: Line, line and staff, functional and their characteristics
  
- 4. Site Organization (06 Periods)
  - 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 (06 Periods)
  - 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 (08 Periods)
- 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 (07 Periods)
- 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 (08 Periods)
- 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
- 8.4 Fire safety

### ACCOUNTS

9. Public Work Accounts (10 Periods)
- 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, definition 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

## 10. Entrepreneurship (09 Periods)

Definition and concept, role and significance, risk and awards, Requirement of an entrepreneur development, Programmes Existing in India, Forms of business enterprises, sole proprietorship-partnership-private limited- cooperatives.

Industrial legislation and taxes:

- GST
- Income Tax
- Excise duty
- Labourcess

## 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

## MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Presentations
- Report Writing
- Viva-voce

## RECOMMENDED BOOKS

1. Civil Engineering Management by Wakhlo, ON ; Light and Life Publishers, New Delhi
2. Construction Equipment and its Planning and Application by Verma, Mahesh
3. Management in Construction Industry by Dharwadker, PP; Oxford and IBH Publishing Company, New Delhi
4. Construction Planning and Management by Gahlot PS; Dhir, BM; Wiley Eastern Limited, New Delhi
5. MS Project – Microsoft USA
6. Primavera Manual by Sh. Vinod Kumar; NITTTR, Chandigarh.



7. e-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

**Websites for Reference:**

<http://swayam.gov.in>

***SUGGESTED DISTRIBUTION OF MARKS***

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	06	08
2	08	10
3	02	04
4	06	08
5	06	12
6	08	12
7	07	10
8	08	12
9	10	12
10	09	12
<b>Total</b>	<b>70</b>	<b>100</b>

### 6.3 DESIGN OF STEEL STRUCTURES

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<b>6</b>	<b>-</b>	<b>-</b>

#### 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 OUTCOMES

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

1. Structural Steel and Sections: (06 Periods)
  - 1.1 Properties of structural steel
  - 1.2 Designation and classification of structural steel sections as per IS handbook and IS: 800: 2007
  - 1.3 Tubular Sections
2. Riveted Connections (10 Periods)
 

Types of Rivet, Permissible stresses in rivets, types of riveted joints, specifications as per IS800, Failure of riveted joint, strength and efficiency of riveted joint, Design of Riveted Connection only axially loaded member (No staggered rivetting)
3. Bolt Connections: (10 Periods)
 

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).

4. Welded connections: (10Periods)  
Types of welds and welded joints, advantages and disadvantages of welded joints design of fillet and butt weld for axially loaded members
5. Tension Members (10 Periods)  
Analysis and design of single and double section tension members and their rivetted and welded connections with gusset plate as per IS:800-2007. Introduction to Lug Angle and Tension splice.
6. Compression Members (10 Periods)  
Angle struts, type of section used, effective length, radius of gyration, slenderness ratio and its limits, permissible compressive stress Analysis and design of single and double angle sections compression members subjected to axial load. Introduction to analysis and design of axially loaded column. Introduction to lacing and battening (No numerical problem on lacing and battening)
7. Roof Trusses (08 Periods)  
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)
8. Column Bases (08 Periods)  
Types of column bases i.e. slab base, gusseted base. Design of slais base and concrete block. Introduction to gusseted base (no numerical problems on gusseted base). Introduction to beam columns design of simple built up beams (Symmetrical I section with cover plates only)
9. Beams (08 Periods)  
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
10. Fabrication and erection of steel structures like trusses, columns and girders (04 Periods)

**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

### MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Model Making
- Viva-voce

### RECOMMENDED BOOKS

1. Design of Steel Structures by Duggal SK; Standard Publishers, Delhi
2. Steel Structures Design and Drawing by Birinder Singh; Kaption Publishing House, Ludhiana
3. Design of Steel Structures by Ram Chandra; Standard Publishers, Delhi
4. Design of Steel Structures by S Ramamurthan
5. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

### Websites for Reference:

<http://swayam.gov.in>

### *SUGGESTED DISTRIBUTION OF MARKS*

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	06	70
2	10	12
3	10	12
4	10	12
5	10	12
6	10	12
7	08	10
8	08	10
9	08	10
10	04	03
<b>Total</b>	<b>84</b>	<b>100</b>

## 6.4 STEEL STRUCTURES DRAWINGS

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- - 4  
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 OUTCOMES

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

### MEANS OF ASSESSMENT

- Assignments and quiz/class tests

- Mid-term and end-term written tests
- Model Making
- Drawing sheets
- Software installation and operation
- Viva-voce

### **RECOMMENDED BOOKS**

1. Civil Engineering Drawing by Layal JS; SatyaParkashan, New Delhi
2. Civil Engineering Drawings by Chandel RP
3. Civil Engineering Drawing by Kumar; NS; IPH, New Delhi
4. Civil Engineering Drawing by Malik RS and Meo GA; Asian Publishing House, New Delhi
5. Steel Structures Design and Drawing by SinghBirinder; Kaption Publishing House, New Delhi
6. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

### **Websites for Reference:**

<http://swayam.gov.in>

## 6.5 SOFTWARE APPLICATIONS IN CIVIL ENGINEERING

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### RATIONALE

Computer applications plays a very vital role in present day life, more so, in the professional life of engineer. In order to enable the students use the computers effectively in problem solving, this course offers applications of various computer softwares in Civil Engineering.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Draw 2D drawings on AutoCAD viz. plan, section and elevation of a residential building
- Use various Civil Engineering software

### DETAILED CONTENTS

#### PRACTICAL EXERCISES

1. Introduction and use of AutoCAD for making 2D Drawings and develop plan, section and elevation of a residential building
2. Demonstration of various Civil Engineering softwares like STAAD-Pro/Revit/MS Project Primavera Project Planner, Auto CIVIL or any other equivalent software

#### Note:

- i) Polytechnics may use any other software available with them for performing these exercises
- ii) If the above softwares are not available in the institution, demonstration of the above said software should be arranged outside the institute.

#### MEANS OF ASSESSMENT

- Mid-term and end-term written tests
- Presentations
- Software installation and operation
- Viva-voce

## 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.

### 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 Periods)
  - 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) (10 Periods)
  - 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 (10 Periods)
  - 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 (10 Periods)
  - 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 (12 Periods)
  - 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 (22 Periods)
  - 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 guniting 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.

## MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Presentations
- Report Writing
- Repair work
- Viva-voce

## RECOMMENDED BOOKS

1. Building Defects and Maintenance Management by Gahlot P.S. and Sanjay Sharma; CBS Publishers, New Delhi
2. Maintenance Engineering for Civil Engineers by Nayak, BS; Khanna Publishers, Delhi
3. Building Failures - Diagnosis and Avoidance by Ransom; WH Publishing
4. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

### Websites for Reference:

<http://swayam.gov.in>

### *SUGGESTED DISTRIBUTION OF MARKS*

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	05
2	10	07
3	10	07
4	10	07
5	12	10
6	22	14
<b>Total</b>	<b>70</b>	<b>50</b>