

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
Total	84	100

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

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|-----|---|--------------|
| 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

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
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
Total	70	100

6.3 DESIGN OF STEEL STRUCTURES

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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 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

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
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
Total	84	100

6.4 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 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:

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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:

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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
Total	70	50

6.6.2 PLUMBING SERVICES

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RATIONALE

Plumbing is said to be the system of pipes, tanks, fittings, and other apparatus required for water supply, heating, and sanitation in a building. Plumbers install, repair, and maintain piping systems in residential, commercial and industrial buildings. These systems traditionally included water distribution and wastewater disposal, but because of new technology that combines water and gas pipes, plumbers can work with vent, residential fire, irrigation, and chemical systems as well. The duties of a plumber include: installing, repairing and maintaining pipes, fixtures, and other plumbing equipment; opening walls and floors to accommodate pipes and pipe fittings; welding, connecting, and testing pipes for leaks; preparing cost estimates; interpreting blueprints and designs. Plumbers must also be aware of safety procedures and follow them at all times.

Diploma holders in Civil Engineering who normally work in supervisory positions, must not only be well versed with plumbing procedures, processes, equipment, safety requirements etc. but also be able to demonstrate all practical aspects of plumbing to as to effectively lead team of plumbers and ensure execution of quality work and excellent end results.

This subject is therefore, aimed at instilling theoretical and practical knowledge among students studying civil engineering at diploma level.

LEARNING OUTCOMES

After undergoing this course, the students will be able to:

- Identify and select proper tools and use them for the given plumbing work
- Select appropriate pipes and carry out pipe fitting after carrying out operations like cutting, bending, threading, joining, aligning and other necessary operations
- Erect simple water supply system. Trace leakage and repair water supply system
- Plan, prepare and inspect domestic drainage system
- Select and install sanitary appliances
- Install heating appliances like geyser, etc.

DETAILED CONTENTS

1. Plumber's Tools (10 Periods)

Selection, use and care of tools required for plumbing work, such as threading die, bit brace, ratchet brace, pipe wrench, spanner set, pipe cutter, pipe vice, hacksaw, chisel, files and other common hand tools, bench drilling machine, soldering iron

2. Pipes and Pipe Fitting (15 Periods)

Selection and use of different pipes like GI Pipes, Plastic pipes, PVC pipes, HDPE pipes, Cast iron pipes, Plumbing symbols; Bends, Elbows, Sockets, Tees, Unions, Pipe cutting, Pipe bending, Pipe Threading, Pipe joints, Pipe fitting, Alignment of pipes, Branching of pipes, Safety precautions, relevant IS codes are to be taught.

3. Water Supply System (10 Periods)

Sources of water; Rainwater harvesting; Water supply systems in a town; Water distribution systems; Distribution reservoirs; Pumps; Valves; Fire hydrants; Storage of water in buildings; Types of tanks; Laying water supply pipe lines

4. Domestic Drainage (15 periods)

Drainage system (two pipe, one pipe, single stack and other systems), Trap, Cesspool, Sceptic tank, Cleaning blocked pipes and drains, Laying sanitary and sewer pipes, Manholes, Inspection and testing (pressure & leakage test, testing straightness of pipes, ball test etc.); Fixing accessories, Problems in drainage and their solution

5. Sanitary Appliances (10 Periods)

Flush toilet, Squat toilet, Wash basin, Sink, Floor traps, Urinal, Bathtub, Shower, Bidet, Mixing tap, Popup waste, water efficient appliance.

6. Heating System (10 Periods)

Heat transfer, Water heater, Geyser, Domestic hot water supply system, Central heating, Solar water heater

The teacher will ensure demonstration of following during teaching session:

1. Practice cutting, threading and bending of metal pipes; cutting and shaping of PVC pipes

2. Carry out simple pipe connections requiring use of bends, tees, elbows etc.
3. Test drainage lines by using different testing methods as per IS codes
4. Practice fixing of different valves
5. Install sanitary fittings like washbasin, Sink, Floor traps, Urinal, Bathtub and heating appliance like geyser

INSTRUCTIONAL STRATEGY

During instructions, teacher should explain the use of various plumbing tools and demonstrate how to handle them properly. Liberal use of audio-visual aids may be made. Students may be asked to prepare models of different piping systems. Visit may be arranged for students to see how town water supply is arranged and managed. Detailed explanation with the help of actual sanitary appliances may be given about their use and method of installing them.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and Practical work
- Drawing
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

1. Plumber by G. S. Sethi; Computech Publications Ltd, New Delhi (Available in English and Hindi)
2. 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	10	15
2	15	20
3	10	15
4	15	20
5	10	15
6	10	15

Total	70	100
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6.6.3 ANALYSIS OF STRUCTURES

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RATIONALE

Analysis of structures is the core subject of Civil Engineering knowledge of this subject is essential for a Civil Engineer to understand the behaviour of structure under various forces. Study of subjects will help the students to understand clearly the need of reinforcement in various structural elements made or reinforce concrete. Knowledge of the subject will be very useful while operating structural analysis software.

LEARNING OUTCOME

After understanding the subject student will be able to:

- Calculate various forces and moments used in design of structures
- Calculate shear force and bending moment in redundant beams and frames
- Calculate design moments and shear force in framed structures with different support conditions
- Design of elementary profile of dam by fixing the base width
- Understand the effect of wind force on vertical structures like chimneys
- Use structural analysis softwares

DETAIL CONTENT

1. Fixed and continuous Beams (08 Periods)

Calculation of fixed end moments using moment theorem and to draw bending moment and shear force diagrams. Three moment theorem (no derivation) for continuous beams and to draw shear force and bending moment diagrams.

2. Principal stress and strain (08 Periods)

Stress on inclined planes, principal plane and principal stress in elements subjected to direct and shear stress and their combinations. Mohr Circle for calculation of stress on inclined planes and principal strain for above cases

3. Combined Direct and Bending stress (08 Periods)

Eccentric loading middle third rule columns subjected to uni-axial and bi-axial eccentric loading. Dams- application of middle third rule for fixing the base width calculation of stresses at the base of dam and stability of dam against overturning and sliding vertical structures like chimney subjected to movement due to wind forces.

4. Strain Energy (14 Periods)

Strain energy stored in a member due to axial loading and vinding. Strain energy stored by a beam due to uniform vending moment. Work done by a force on a member law of reciprocal deflection, Betti's law. The first thorem of castigliano. Deflection of truss joints.

5. Redundant frames (10 Periods)

Statically indeterminate structures. The second theorem of castigliano redundant trusses Degree of redundancy. Portal frames further application of principle of least work.

6. Moment Distribution Method (12 Periods)

Basic proposition relative stiffness, continuous beams with and without fixed ends. Sinking of support portal frames with and without sway (simple problem only)

7. Slope Deflection Method (10 Periods)

Basic concepts, stiffness of members with far end fixed or linged. Development of slope deflection equations and their application to beam and frames.

RECOMMENDED BOOKS

- Analysis of structures by Rama murtham
- Analysis of structures by R.S Khurmi
- Analysis of structures by Vazirani&Ratwani Vol I & II

MEANS OF ASSESSMENT

- Assignments
- Subject Quiz
- Presentation
- Viva-voce
- Midterm and Semester exam

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	08	12
2	08	12
3	08	10
4	14	20
5	10	14

6	12	18
7	10	14
Total	70	100

6.7 PROJECT WORK

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RATIONALE

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 firsthand 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. Review/ and existing for various parameters as per green building, Raling system 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 techniques
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. Study of 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:13920
22. Design of car parking in your polytechnic
23. To prepare analysis of rates for non -schedule items e.g. aluminium door, windows, work stations etc.
24. Study of retrofitting of a given Civil Engineering works.
25. Survey of your polytechnic by using total station.
26. Traffic volume study and analysis on different roads in a city
27. Case study of a flyover with regard to its various construction components
28. Study and preparation of detailed project report of ready mix concrete (RMC) unit
29. 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 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:

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.

	Range of maximum marks	Overall grade
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.**