

**Curriculum for**  
**Diploma Programme in**  
**CIVIL ENGINEERING**

CAMPUS



### FIFTH SEMESTER (CIVIL ENGINEERING)

Sr. No	Subject	STUDY SCHEME			Credit	EVALUATION SCHEME						Total Marks
						Internal Assessment		External Assessment (Examination)				
						Theory	Practical	Written Paper		Practical		
						Max. Marks	Max. Marks	Max. Marks	Hrs	Max. Marks	Hrs	
Hrs/week		L	T	P								
Industrial /Field Training					-	-	-	5	-	100	-	-
5.1	Highway Engineering	4	-	2	5	25	25	100	3	50	3	200
5.2	Reinforced Cement Concrete Design & Drawing	5	-	3	7	50*	-	150	6	-	-	200
5.3	Survey Camp <sup>1</sup>	-	-	-	3	-	50	-	-	100	3	150
5.4	Computer Applications in Civil Engineering	-	-	6	3	-	50	-	-	100	3	150
5.5	Railways, Bridges & Tunnels	5	-	-	5	25	-	100	3	-	-	125
5.6	Plumbing Services	3	-	2	4	25	25	100	3	50	3	200
5.7	Elective**	3	-	-	3	25	-	100	3	-	-	125
Soft Skills - III		-	-	2	-	-	25	-	-	-	-	25
<b>Total</b>		<b>20</b>	<b>-</b>	<b>15</b>	<b>35</b>	<b>150</b>	<b>275</b>	<b>550</b>	<b>-</b>	<b>400</b>	<b>-</b>	<b>1375</b>

\*Sessional test including Drawing also with 2 hours duration.

\*\*Elective: To choose any one from the following

5.7.1 Pre-stressed Concrete    5.7.2 Repair and Maintenance of Buildings

Use of the IS: 456-2000 is permissible in the theory exam of Reinforced Cement Concrete Design & Drawing.

## 5.1 HIGHWAY ENGINEERING

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4 - 2

### RATIONALE

Construction of roads is one of the major areas in which diploma holders in Civil Engineering may get very good opportunities for employment. The diploma holders are responsible for construction and maintenance of highways and airports. Basic concepts of road geo-metrics, surveys and plans, elements of traffic engineering, road materials, construction of rigid and flexible pavements, special features of hill roads, road drainage system and various aspects of maintenance find place in above course.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- classify the roads as per IRC types and geometrics
- explain various components of a flexible/rigid pavement
- select various highway materials and test them for different quality parameters
- supervise construction of a highway in plain areas and hilly areas
- supervise repair and maintenance of roads
- supervise preparation of bituminous mix in the hot mix plants
- describe the use various road construction equipment
- Describe basic terminology of various components of an airport.

### DETAILED CONTENTS

#### 1. Introduction

- 1.1 Importance of Highway engineering
- 1.2 Functions of IRC, CRRI, MoRT&H, NHAI
- 1.3 Classification of roads

( 02 Hours)

#### 2. Road Geometrics

- 2.1 Glossary of terms used in road geo-metrics and their importance: Right- of- way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient
- 2.2 Average running speed, stopping and overtaking sight distance
- 2.3 Necessity of curves, horizontal and vertical curves including transition curves. Super elevation and methods of providing super elevation
- 2.4 Sketch of typical cross-sections in cutting and filling on straight alignment and at a curve

( 06 Hours)

**(Note: No design/numerical problem to be taken)**

#### 3. Highway Alignment

- 3.1 Basic considerations governing alignment for a road in plain and hilly area
- 3.2 Highway location, marking of alignment on ground, setting out alignment of road, setting out bench marks, control pegs for embankment and cutting

(04 Hours)

#### 4. Road Materials

- 4.1 Different types of road materials in use; soil, aggregate and binders
- 4.2 Introduction to California Bearing Ratio, method of finding CBR value and its significance. Aggregate : Source and types, important properties, strength, durability
- 4.3 Binders: Common binders; bitumen, properties as per BIS specifications, penetration, softening point, ductility and viscosity test of bitumen, procedures and significance, cut back and emulsion and their uses, Bitumen modifiers (CRMB, PMB)

( 08 Hours)

## 5. Road Pavements

( 14 Hours)

5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components

5.2 Sub-grade preparation:

Borrow pits, making profiles of embankment, construction of embankment, compaction, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation.

5.3 Stabilization of subgrade. Types of stabilization mechanical stabilization, lime stabilization, cement stabilization, fly ash stabilization etc.(introduction only)

5.4 Base Course:

Granular base course:

(a) Water Bound Macadam (WBM)

(b) Wet Mix Macadam (WMM)

Bitumen Courses:

(a) Bituminous Macadam

(b) Dense Bituminous Macadam (DBM)

\*Methods of construction as per MoRT&H

5.5 Surfacing:

\* Types of surfacing

a) Prime coat and tack coat

b) Surface dressing with seal coat

c) Open graded premix carpet

d) Mix seal surfacing

e) Semi dense bituminous concrete

f) Bituminous Concrete

\* Methods of constructions as per MORT&H specifications and quality control; equipments used for above.

5.6 Rigid Pavements:

Construction of concrete roads as per IRC specifications: Form work laying, mixing and placing the concrete, compacting and finishing, curing, joints in concrete pavement, equipment used. Roller compacted concrete.

## 6. Hill Roads:

(06 Hours)

6.1 Introduction: Typical cross-sections showing all details of a typical hill road, partly in cutting and partly in filling

6.2 Special problems of hill areas

6.2.1 Landslides: Causes, prevention and control measures, use of geogrids, geoflexibles, geo synthetics

6.2.2 Drainage

6.2.3 Soil erosion

6.2.4 Snow: Snow clearance, snow avalanches, frost

6.2.5 Land Subsidence

## 7. Road Drainage:

( 04 Hours)

7.1 Necessity of road drainage work, cross drainage works

7.2 Surface and subsurface drains and storm water drains. Location, spacing and typical details of side drains, side ditches for surface drainage. Intercepting drains, pipe drains in hill roads, details of drains in cutting embankment, typical cross sections

### **8. Road Maintenance:**

**( 06 Hours)**

8.1 Common types of road failures of flexible pavements: Pot hole, cracks, rutting, alligator, cracking, upheaval - their causes and remedies (brief description)

8.2 Maintenance of bituminous road such as crack sealing, patch-work and resurfacing.

8.3 Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (berms)

### **9. Road Construction Equipment:**

**( 08 Hours)**

Output and use of the following plant and equipment

9.1 Hot mix plant

9.2 Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline

9.3 Asphalt mixer and tar boilers

9.4 Road pavers

9.5 Paver finisher

### **10 Airport Engineering :-**

**( 06 Hours)**

10.1 Necessity of study of airport engineering, aviation transport scenario in India.

10.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.

10.3 Introduction to Runways, Taxiways, Apron and Hanger

\* An expert may be invited from field/industry for extension lecture on this topic.





## PRACTICAL EXERCISES

1. Determination of penetration value of bitumen
2. Determination of softening point of bitumen
3. Determination of ductility of bitumen
4. Determination of impact value of the road aggregate
5. Determination of abrasion value (Los Angeles') of road aggregate
6. Determination of crushing strength of aggregate
7. Determination of flakiness and elongation index of aggregate
8. Determination of the California bearing ratio (CBR) for the sub-grade soil
9. Demonstration of working of hot mix plant through a field visit
10. Visit to highway construction site for demonstration of operation of:  
Tipper, tractors (wheel and crawler), scraper, bulldozer, dumpers, shovels, grader, roller, dragline, road pavers, JCB
11. Demonstration of working of mixing and spraying equipment through a field visit

## INSTRUCTIONAL STRATEGY

While imparting instructions, it is recommended that emphasis should be laid on constructional details and quality control aspects. Students should be asked to prepare sketches and drawings, clearly indicating specifications and constructional details for various sub components of a highway. It will be also advantageous to organize field visits to show the actual construction of roads at site.

## MEANS OF ASSESSMENT

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

## RECOMMENDED BOOKS

1. "Highway Engineering" by Khanna, SK and Justo, CEG; Nem Chand and Bros., Roorkee
2. "A Text Book on Highway Engineering and Airport" by Sehgal, SB; and Bhanot, KL; S Chand and Co, Delhi
3. "A Course on Highway Engineering" by Bindra, SP; Dhanpat Rai and Sons, New Delhi
4. "Laboratory Manual in Highway Engineering" by Duggal AK, Puri VP; New Age Publishers (P) Ltd, Delhi,
5. "Laboratory Manual in Highway Engineering", by NITTTR, Chandigarh
6. "Maintenance of Highway – a Reader by Duggal AK; NITTTR, Chandigarh
7. "Types of Highway Construction" by Duggal AK; NITTTR Chandigarh
8. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

## Websites for Reference:

<http://swayam.gov.in>

## IRC Publications

- i) MoRTH Specifications for Road and Bridge Works (Fifth Revision)
- ii) MoRTH Pocket book for Highway Engineers, 2001
- iii) MoRTH Manual for Maintenance of Roads, 1983

**SUGGESTED DISTRIBUTION OF MARKS**

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	02	03
2	06	10
3	04	06
4	08	12
5	14	22
6	06	10
7	04	06
8	06	10
9	08	12
10	06	10
<b>Total</b>	<b>64</b>	<b>100</b>





## 5.2 REINFORCED CEMENT CONCRETE DESIGN AND DRAWINGS

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5 - 3

### RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RC Construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials (bars of different diameters). This subject thus deals with elementary design principles as per IS:456-2000 and Thus one should be able to read and interpret drawings of RC 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:

- Explain methods of RCC design i.e.
  - Working stress methods
  - Limit state methods
- Design singly, doubly reinforced rectangular and T&L beams as per IS Code
- Design one way and two way slab
- Design axially loaded column and their isolated footing
- Draw the reinforcement details for various structural elements from the given data
- Calculate reinforcement details from the given drawings
- Draw bar bending schedule from drawing
- Read and interpret R.C.C. drawings

## DETAILED CONTENTS

<b>1. Introduction</b>	<b>( 02 Hours)</b>
1.1 Concept of Reinforced Cement Concrete (RCC)	
1.2 Reinforcement Materials:	
- Suitability of steel as reinforcing material	
- Properties of mild steel and HYSD steel	
1.3. Loading on structures as per IS: 875	
<b>2. Introduction to following methods of RCC design</b>	<b>( 02 Hours)</b>
2.1 Working stress method: Definition and basic assumptions	
2.2 Limit state method: Definition and basic assumptions	
<b>3. Shear and Development Length</b>	<b>( 05 Hours)</b>
Shear as per IS:456-2000 by working stress method	
i) Shear strength of concrete without shear reinforcement	
ii) Maximum shear stress	
iii) Shear reinforcement	
<b>4. Concept of Limit State Method</b>	<b>( 07 Hours)</b>
4.1. Definitions and assumptions made in limit state of collapse (flexure)	
4.2. Partial factor of safety for materials	
4.3. Partial factor of safety for loads	
4.4. Design loads	
4.5. Stress block, parameters	
<b>5. Singly Reinforced beam</b>	<b>( 11Hours)</b>
Theory and design of singly reinforced beam by Limit State Method	
<b>6. Doubly Reinforced Beams</b>	<b>( 11 Hours)</b>
Theory and design of simply supported doubly reinforced rectangular beam by Limit State Method	
<b>7. Behaviour of T beam, inverted T beam, isolated T beam and 'L' beams (No Numericals) ( 05 Hours)</b>	
<b>8. One Way Slab</b>	<b>( 12 Hours)</b>
Theory and design of simply supported one way slab including sketches showing reinforcement details (plan and section) by Limit State Method..	
<b>9. Two Way Slab</b>	<b>( 12 Hours)</b>
Theory and design of two-way simply supported slab with corners free to lift, no provisions for torsional reinforcement by Limit State Method including sketches showing reinforcement details (plan and two sections)	
<b>10. Axially Loaded Column</b>	<b>( 10 Hours)</b>
10.1 Definition and classification of columns	
10.2. Effective length of column,	
10.3. Specifications for longitudinal and lateral reinforcement	
10.4. Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement(sectional elevation	

and plan)

## 11 Pre-stressed Concrete

(03 Hours)

- 11.1 Concept of pre-stressed concrete
- 11.2 Methods of pre-stressing : pre-tensioning and post-tensioning
- 11.3 Advantages and disadvantages of pre-stressing
- 11.4 Losses in pre-stress

### DETAILED CONTENTS

#### 1. RCC Drawing:

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

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

**Important Note: Use of BIS:456-2000 is permitted in the examination.**



## INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various RCC 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 form work for RCC as well as placement of reinforcement in various structural members. Commentary on BIS:456 may be referred along with code for relevant clauses.

## MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Software installation and operation
- Drawing
- Viva-Voce

## RECOMMENDED BOOKS

1. "Reinforced Concrete Structure Vol I" by Punmia, BC; Standard Publishers, Delhi
2. "Design and Testing of Reinforced Structures" by Ramamurtham, S; Dhanpat Rai and Sons, Delhi
3. "RCC Design and Drawing" by Singh, Birinder ; Kaption Publishing House, New Delhi
- 4 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

### RCC DRAWING:

7. "Civil Engineering Drawing" by Loyal JS; Satya Parkashan, New Delhi
8. "Civil Engineering Drawing by Kumar NS; IPH, New Delhi
9. "RCC Design and Drawing" by Singh, Birinder; Kaption Publishing House, New Delhi.
4. "Steel Structures Design and Drawing by Singh, Birinder; Kaption Publishing House, New Delhi
5. e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

### Websites for Reference:

<http://swayam.gov.in>

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2	02	04
3	05	06
4	07	09
5	11	14
6	11	14
7	05	06
8	12	15
9	12	15

10	10	09
11	03	04
	RCC Drawing*	50
Total	80	150

\* Examiner have to set 03 questions from RCC Drawing of 25 marks each and out of which the examinee can attempt any 02 questions.

### 5.3 SURVEY CAMP

10 Days Duration

#### Purpose

- To impart intensive training in the use of surveying instruments
- To train the students to appreciate practical difficulties in surveying on the field
- Making the students conversant with the camp life
- Training the students to communicate with the local population
- Providing an opportunity to the students to develop team spirit
- To train the students for self management

#### LEARNING OUTCOME

After undergoing the survey camp, students will be able to:

- Interpret the contours
- Work in a teamwork
- Mark a road alignment of a given gradient connecting any two stations on the map
- Calculate the earth work
- Prepare a topographical plan of a given area

#### Task:

Preparation of topographical plan of a given area. The survey camp will be organized for a duration of 10 days time span.

The students may be assigned an undulated area of about 1.5 to 2.00 sq.km. with level difference of 15m consisting of good number of physical features such as buildings, roads, bridges, culverts, railway tracks, electric lines etc. They are required to prepare the topographic map of above areas showing various features along with contours using a suitable contour intervals.

They will mark a road alignment of given gradient connecting any two stations on the map consisting some horizontal and vertical curves and will prepare estimate of earthwork and submit the detailed technical report indicating therein practical difficulties faced during surveying for the features like ridge, line, valley lines, saddle cliffs etc.

The students should be divided in the groups consisting of 10-15 in numbers. They are required to submit the Report of work done, during survey camp, which will be dully examined, while awarding the internal assessment.

#### MEANS OF ASSESSMENT

- Practical work
- Report Writing
- Presentation
- Drawing
- Viva-voce



## 5.4 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

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### RATIONALE

Computer applications play 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 software's 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 or Primavera Project Planner, Auto CIVIL & Mx Road, Build Superfast, BIM, ArcGIS 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

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Software installation and operation
- Report Writing
- Drawing
- Viva-voce



## 5.5 RAILWAYS, BRIDGES AND TUNNELS

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### RATIONALE

The subject will cater to the needs of those technicians who would like to find employment in the construction of railway tracks, bridges and tunnels. The subject aims at providing broad based knowledge regarding various components and construction of railway track, bridges and tunnels

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Describe different component parts of permanent way such as rails, sleepers and ballast
- Distinguish different types of rail gauges used in India
- Use of different types of rail fastenings and fixtures
- Classify bridges and select suitable type of bridge for a particular purpose
- Describe essential components of a ROB and RUB
- Supervise construction of a tunnel
- Carry out ventilation, drainage and lightening of tunnels

### DETAILED CONTENTS

#### PART – I:

#### RAILWAYS

**(35 Hours)**

1. Introduction to Indian Railways
- 2 Railway surveys: Factors influencing the railways route, brief description of various types of railway survey
- 3 Classification of permanent way describing its component parts
- 4 Rail Gauge: Definition, types, practice in India
- 5 Rails – types of rails
- 6 Rail Fastenings: Rail joints, types of rail joints, fastenings for rails, fish plates, bearing plates
- 7 Sleepers: Functions of sleepers, types of sleepers, requirements of an ideal material for sleepers.
- 8 Ballast: Function of ballast, requirements of an ideal material for ballast
- 9 Crossings and signalling: Brief description regarding different types of crossings/ signalling
- 10 Maintenance of track: Necessity, maintenance of track, inspection of soil, track and fixtures; maintenance and boxing of ballast maintenance gauges, tools
- 11 Earth work and drainage: Features of rail road, bed level, width of formation, side slopes, drains, methods of construction, requirement of drainage system
- 12 Station and yards: purpose and types of stations and yards

#### PART-II:

#### BRIDGES

**( 35 Hours)**

### 13. Introduction

Bridge – its function and component parts, difference between a bridge and a culvert

### 14. Classification of Bridges

Their structural elements and suitability:

14.1 According to life-permanent and temporary

14.2 According to deck level – Deck, through and semi-through

14.3 According to material –timber, masonry, steel, RCC, pre-stressed

14.4 According to structural form;

- Grade Separators-Railway Road Over Bridges (ROB), Road Under Bridge (RUB)

- Beam type –RCC, T-Beam, steel girder bridges, plate girder and box girder, balanced cantilever, Trussed bridges.

- Arch type – open spandrel and filled spandrel barrel and rib type

- Suspension type – unstiffened and stiffened and table (its description with sketches)

- According to the position of highest flood level submersible and non Submersible

14.5 IRC classification

14.6 Concept of Railway ROB and RUB – Precast components of ROB, drainage problems and solutions of RUB

15. Bridge Foundations: Introduction to open foundation, pile foundation, well foundation

16. Piers, Abutments and Wingwalls

16.1 Piers-definition, parts; types –solid (masonry and RCC), open

16.2 Abutments and wing walls – definition, types of abutments (straight and tee), abutment with wing walls (straight, splayed, return and curved)

17. Bridge bearings

Purpose of bearings; types of bearings – fixed plate, rocker and roller, Elastomeric bearings.

18. Maintenance of Bridges

18.1 Inspection of bridges

18.2 Routine maintenance

## PART - III:

### TUNNELS

( 10 Hours)

19. Definition and necessity of tunnels

20. Typical section of tunnels for a national highway and single and double broad gauge railway track

21. Ventilation –necessity and methods of ventilation, by blowing, exhaust and combination of blowing and exhaust

22. Drainage method of draining water in tunnels

23. Lighting of tunnels

**Notes:** i) Field visits may be organized to Bridge construction site or a Bridge/Tunnel construction site/Railways tracks to explain the various components and a field visit report shall be prepared by the students, as teamwork

ii) Examiners should set questions from all the parts

### INSTRUCTIONAL STRATEGY

This subject is of practical nature. While imparting instructions, teachers are expected to organize demonstrations and field visits to show various components and construction of railway track, bridges and tunnel.

### MEANS OF ASSESSMENT

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

Viva-voce**RECOMMENDED BOOKS**

1. "Railway Engineering" by Vaswani, NK; Publishing House, Roorkee
2. "Railway Engineering" by Rangwala, SC; Anand, Charotar Book Stall
3. "A Text Book of Railway Engineering" by Deshpande, R; Poonam United Book Corporation
4. "Bridge Engineering" by Algia, JS; Charotar Book Stall, Anand
5. "Essentials of Bridge Engineering" by Victor Johnson; Oxford and IBH, Delhi
6. "Bridge Engineering" by Rangwala S.C; Charotar Book Stall, Anand
7. IRC Bridge Codes

8. MoRTH drawings for various types of bridges
9. MoRTH pocket books for bridge Engineers, 2000 (First Revision)
10. "Tunnel Engineering" by Subhash C Saxena; Dhanpat Rai and Sons, Delhi
- 11 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTTR.

**Websites for Reference:**<http://swayam.gov.in>**SUGGESTED DISTRIBUTION OF MARKS**

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	35	44
2	35	44
3	10	12
<b>Total</b>	<b>80</b>	<b>100</b>

## 5.6 PLUMBING SERVICES

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3 - 2

### 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

( 05 Hours)

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

( 10 Hours)

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

### 3. Water Supply System

(09 Hours)

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

(10 Hours)

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

( 08 Hours)

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

### 6. Heating System

( 06 Hours)

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



## LIST OF PRACTICALS

1. Carry out simple job requiring cutting mild steel plate, filing, drilling and tapping holes etc.
2. Practice cutting, threading and bending of metal pipes; cutting and shaping of PVC pipes
3. Carry out simple pipe connections requiring use of bends, tees, elbows etc.
4. Erect simple water supply system
5. Test drainage lines by using different testing methods
6. Practice fixing of different valves
7. 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

- Plumber by G. S. Sethi; Computech Publications Ltd, New Delhi (Available in English and Hindi)
- e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

### Websites for Reference:

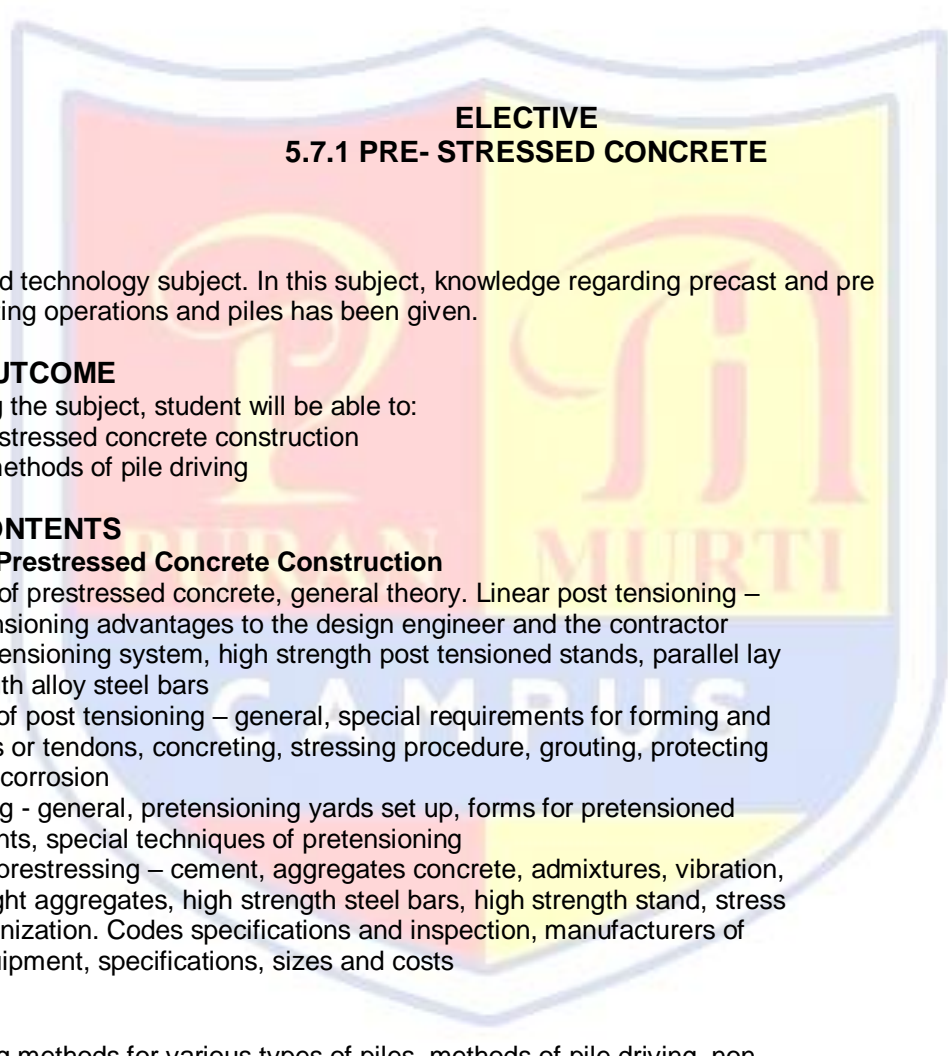
<http://swayam.gov.in>

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hours)	Marks Allotted (%)
1	05	10
2	10	21
3	09	19
4	10	21
5	08	17



6	06	12
<b>Total</b>	<b>48</b>	<b>100</b>



**ELECTIVE**  
**5.7.1 PRE- STRESSED CONCRETE**

L T P  
3 - -

**RATIONALE**

This is an applied technology subject. In this subject, knowledge regarding precast and prestressed concreting operations and piles has been given.

**LEARNING OUTCOME**

After undergoing the subject, student will be able to:

- Supervise prestressed concrete construction
- Use various methods of pile driving

**DETAILED CONTENTS****1. Precast and Prestressed Concrete Construction**

- 1.1 Introduction of prestressed concrete, general theory. Linear post tensioning – general, post tensioning advantages to the design engineer and the contractor
- 1.2 Linear post tensioning system, high strength post tensioned stands, parallel lay wire, high strength alloy steel bars
- 1.3 Techniques of post tensioning – general, special requirements for forming and false work, ducts or tendons, concreting, stressing procedure, grouting, protecting anchorage from corrosion
- 1.4 Pretensioning - general, pretensioning yards set up, forms for pretensioned structural elements, special techniques of pretensioning
- 1.5 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

**(32 Hours)**

**2. Piles**

Piles; basic piling methods for various types of piles, methods of pile driving, non – displacement piles, problems in pile construction, pile testing

**(16 hours)**

**INSTRUCTIONAL STRATEGY**

The subject shall consist of visits by the students to various construction sites. 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.

**MEANS OF ASSESSMENT**

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

### RECOMMENDED BOOKS

1. "A Text Book of Building Construction" by Gupta, Sushil Kumar, Singla, DR. and Juneja BM; Katson Publishing House, Ludhiana
2. "A Text Book of Building Construction" by Deshpande, RS and Vartak, GV; United Book Corporation, Poona.
3. "A Text Book of Building Construction" by Kulkarni, GJ; Ahmedabad Book Depot.
4. "A Text Book of Building Construction" by Arora, SP and Bindra, SP; Dhanpat Rai and Son, Delhi.
5. "A Text Book of Building Construction" by Sharma, SK and Kaul, BK; S. Chand and Corporation, Delhi
6. "Building Construction" by Sushil Kumar; Standard Publishers Distributors. Delhi.
- 7 e-books/e-tools/relevant software to be used as recommended by AICTE/HSBTE/NITTTR.

#### Websites for Reference:

<http://swayam.gov.in>

### SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	32	65
2	16	35
<b>Total</b>	<b>48</b>	<b>100</b>



**ELECTIVE**  
**5.7.2 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 Hours)

- 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 Hours)

- 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 Hours)

- 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 Hours)

- 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 Hours)

- 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 Hours)**

- 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.



**MEANS OF ASSESSMENT**

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Report Writing
- 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/HSBTE/NITTTR.


**Websites for Reference:**

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**SUGGESTED DISTRIBUTION OF MARKS**

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





## SOFT SKILLS – III

L T P  
- - 2

### RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. The diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject is to prepare students for employability in job market.

### LEARNING OUTCOMES

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

- Develop communication skills.
- Learn how to speak without fear and get rid of hesitation
- Use effective presentation techniques
- Understand entrepreneurial traits
- Exhibit attitudinal changes

### DETAILED CONTENTS

- Communication Skills – Handling fear and phobia
- Resume Writing
- Applying for job through email/job portal
- Interview preparation : Mock Interview, Group Discussions and Extempore
- Presentation Techniques
- Developing attitude towards safety. Disaster management.

In addition, the students must participate in the following activities to be organized in the institute

- Sports
- NCC/NSS
- Camp – Entrepreneurial awareness
- Cultural Event

Note : Extension Lectures by experts may be organized. There will be no examination for this subject.