

## TEACHING & EVALUATION SCHEME

**DISCIPLINE: CIVIL ENGINEERING**

**FIFTH SEMESTER**

Sl.No.	SUBJECT	Evaluation Scheme						Total Marks	
		L	P	THEORY			PRACTICAL		
				END EXAM	INTERNAL ASSESSMENT		End Examination		Sessional
Class Test	Assignment								
	<b>THEORY</b>								
1.	Structural Design-I	5	--	80	15	5	--	--	100
2.	Public Health Engineering	5	--	80	15	5	--	--	100
3.	Survey-II	4	--	80	15	5	--	--	100
4.	Transportation Engineering-II	5	--	80	15	5	--	--	100
5.	Construction Management	4	--	80	15	5	--	--	100

### **PRACTICAL/SESSIONAL**

1.	Structural Detailing Practice-I	--	3	--	--	--	--	50	50
2.	Survey Practical-II	--	7	--	--	--	50	50	100
3.	Civil Engineering Lab. -II	--	6	--	--	--	50	50	100
		23	16	400	75	25	100	150	<b>750</b>

NOTE: Evaluation for I.A.(Theory)& Sessional /Practical to be made as per guidelines of SCTE&VT.

## STRUCTURAL DESIGN – I (Th-1)

Period/Week: 05  
Total Periods: 75

Total Marks: 100 Evaluation Scheme;  
Theory End Exam: 80;IA(15)+Assignment(05)

(IS:456-2000,SP-16 and SP-34 Codes published by BIS are allowed in the end examination)

### **Topic wise Distribution of Periods:**

<b>Sl. No.</b>	<b>Topics</b>	<b>No. of Periods</b>
01.	<b>Introduction to design and detailing</b>	02
02.	<b>Working Stress Method of Design</b>	08
03.	<b>Limit State Method (LSM) of Design</b>	08
04.	<b>Limit States Of Collapse of Singly Reinforced Members in Bending</b>	10
05.	<b>Limit States Of Collapse in Shear (Design of Shear by LSM)</b>	02
06.	<b>Bond, Anchorage, Development lengths &amp; Splicing (LSM)</b>	04
07.	<b>Beams (LSM)</b>	16
08.	<b>Two-way slabs (LSM)</b>	10
09.	<b>Axially Loaded short columns (LSM)</b>	07
10	<b>Ductile detailing of reinforced concrete structures subjected to seismic forces</b>	08

### **RATIONALE :**

Safety and durability of a structure depend on appropriate design, proper detailing and construction as per detailed drawing and specification. For this reason, 'Design and Detailing' is an important subject for Civil Engineering Diploma Holders. They are most often asked to act as a supervisor in construction projects, in addition to this they may also require to work as a draftsman responsible for preparing detailed drawing for construction sites. Diploma holders are also called upon to assist designers, suggest modifications for repair and renovation work and also to design simple structural elements. The subject attempts to cover the above aspects to civil engineering profession.

### **OBJECTIVES:**

On completion of the subject a student will be able to –

- i) Design of simple R.C. structural elements
- ii) Draw structural details for construction

### **COURSE CONTENTS:**

- 1.1 Introduction to design and detailing
- 1.2 State and explain the objectives of design and detailing
- 1.3 Explain the advantages of Reinforced Concrete

1.4 State the different methods of design

### **1.5 Working Stress Method of Design**

1.6 Explain briefly the general concept, assumption of old Working Stress Method (WSM) of design, moment of resistance of a rectangular section through WSM, concept of under-reinforced, balanced and over reinforced sections

1.7 Basic concept of design of single reinforced members, double reinforced beam sections by working stress method. Design of T-beam (single reinforced and doubly reinforced)

### **1.8 Limit State Method (LSM) of Design**

1.9 Define Limit States

1.10 State and explain limit states of collapse, serviceability and durability

1.11 State and explain the factors responsible for (i) durability of structure, (ii) serviceability of a structure and how they are taken into account in design

1.12 Define and explain characteristic strength of materials, such as steel and concrete (IS:456-2000)

1.13 Define and explain briefly different characteristic loads for structures (IS 875 Parts I to V)

1.14 Explain the partial safety factors for loads and material strengths under different load combinations of different limit of states

1.15 Draw and explain the assumed actual and design stress-strain diagrams of Mild Steel, HYSD bars and concrete as per IS 456

### **1.16 Limit States Of Collapse of Singly Reinforced Members in Bending**

1.17 Explain Ultimate Strength of R.C beams (Limit States Of Collapse by flexure), balanced under reinforced and over reinforced sections, compression stress block in concrete

1.18 Evaluate the depth of neutral axis of a given beam, solve problems

1.19 Calculate moment of resistance by strain Compatibility and equilibrium, solve problems

1.20 Evaluate the minimum depth for a given design bending moment, solve problems

1.21 Explain basic considerations, behavior of doubly reinforced beams, simplified and approximate analysis of doubly reinforced beams

1.22 Explain the differences in the behaviors of 'T' and 'L' beams with rectangular beams

### **1.23 Limit States Of Collapse in Shear (Design of Shear by LSM)**

1.24 Explain shear cracks and shear failure with or without shear reinforcement

1.25 Explain contribution of concrete in resisting design shear, types of shear reinforcement, design of stirrups, minimum shear reinforcement, step-by-step procedure for design of links, shear in slabs, detailing of steel.

### **1.26 Bond, Anchorage, Development lengths & Splicing (LSM)**

1.27 Explain and differentiate between bond & anchorage

6.2 Explain and calculate development length for HYSD bars for M20 & M25 grade concrete

6.3 Explain and anchorage of bars (refer to SP 24 and IS 456: clause 25.2.3.1)

6.4 Check the development length at support of a beam

6.5 Explain the conditions for termination of tension reinforcement in flexural members

6.6 Explain the equivalent development lengths of bonds, IS code provision for anchorage, splicing of bars, laps and importance of laps and anchorage length

### **1.28 Beams (LSM)**

1.29 Design of singly reinforced rectangular beams, Design doubly reinforced beams as per IS 456 for bending and shear

1.30 Design of T beams as per IS 456 for bending and shear

## **2.0 Two-way slabs (LSM)**

2.1 One way slab and two way slab.

2.2 one-way & cantilever slabs as per IS 456 for bending and shear

2.3 Explain the action of two-way slabs with deflected shape,

2.4 Provision for two-way slab as per I.S. 456-2000

8.3.1 Middle strip and edge strip

8.3.2 B.M. coefficient

8.3.3 Torsion reinforcement

8.4 Design of two-way slab as per I.S. 456-2000 and SP: 16 handbook.

8.5 Check for deflection, development length and cracking as per SP:16 and I.S. 456-2000

### **2.5 Axially Loaded short columns (LSM)**

2.6 Explain short column and long column, state the types of failures that may be observed in columns with sketches, braced and un-braced columns, effective length of columns, design formula for short columns, check for minimum

eccentricity, minimum longitudinal reinforcements and transverse reinforcement, detailing at junctions with beams and footing

2.7 Design of axially loaded short columns using IS: 456 & SP-16

## 10.0 **Ductile detailing of reinforced concrete structures subjected to seismic forces**

### 10.1 Ductility

10.1.1 Definition

10.1.2 Terminology

10.1.2.1 Cross tie

10.1.2.2 Hoop

10.1.2.3 Shear wall

10.1.2.4 Space frame

10.1.3 Necessity in structure

10.1.4 Scope of Ductility

10.1.5 Methods of improving ductility

10.2 Force displacement response of ductile and brittle material

10.3 Detailing of beam as per I.S. –13920 (clause no. 6.1,6.2,6.3)

10.4 Detailing of column as per I.S. –13920 (clause no.7.1,7.2,7.3,7.4)

10.5 Detailing of beam column joint

## **REFERENCE BOOKS:**

- |  |                                 |
|--|---------------------------------|
| 1. Reinforced Concrete Structures            | -I.C.Syal &A.K. Goel.           |
| 2. Reinforced Concrete                       | -HJ Saha.                       |
| 3. Fundamentals of Reinforced Concrete       | -N.C.Sinha,S.K.Roy.             |
| 4. Earthquake Resistant Design Of Structures | -Pankaj Agarwal & M. Shrikhande |
| 5. IS:456-2000                               |                                 |
| 6. SP-16                                     | -BIS Publication                |
| 7. SP-34                                     | -BIS Publication                |
| 8. IS: 13920                                 | -BIS Publication                |

## **PUBLIC HEALTH ENGINEERING (Th-2)**

Period/Week: 05  
Total Periods: 75

Evaluation Scheme; Total Marks: 100  
Theory: End Exam: 80;  
IA (15)+Assignment(05)

Topic wise Distribution of Periods:

Sl. No.	Topic (A:WATER SUPPLY)	No. of Periods
01.	Introduction	01
02.	Quantity of water	01
03.	Sources of water	01
04.	Conveyance of water	01
05.	Quality of water	04
06.	Treatment of water	12
07.	Distribution system	07
08.	Appurtenance in distribution system	05
09.	w/s plumbing in building	08
	<b>(B:SANITARY ENGINEERING)</b>	
10.	Introduction	01
11.	Quantity of sewage	01
12.	Sewerage system	02
13.	Sewer appurtenances	02
14.	Sewage characteristics	02
15.	Sewage disposal	02
16.	Sewage treatment	10
17.	Sanitary plumbing for building	12
18.	Rural water supply & sanitation	03

### **COURSE CONTENT:**

#### **WATER SUPPLY ENGINEERING**

##### **1.0 INTRODUCTION:**

- 1.1 Necessity of treated water supply
- 1.2 Historical development

##### **2.0 QUANTITY OF WATER**

- 2.1 Water requirements for different uses
- 2.2 Per capita demand, variation in demand and factors affecting demand
- 2.3 Methods of forecasting population, Numerical problems using different methods

##### **3.0 SOURCES OF WATER ;**

- 3.1 Surface sources – Lake, stream, river and impounded reservoir
- 3.2 Underground sources – aquifer type & occurrence – Infiltration gallery, infiltration well, springs, well – types, suitability

- 3.3 Yield from well- methods of determination, Numerical problems using yield formulae ( deduction excluded)
- 3.4 Sinking of wells, Well components, Well development
- 3.5 Sanitary protection of wells and maintenance of well
- 3.6 Well pumps – type, selection, installation
- 4.0 CONVEYANCE OF WATER :**
- 4.1 Intakes – types, description of river intake, reservoir intake, canal intake
- 4.2 Pumps for conveyance & distribution – types, selection, installation, most economic diameter of pumping main
- 4.3 Pipe materials – necessity, suitability, merits & demerits of each type, selection of pipe material
- 4.4 Pipe joints – necessity, types of joints, suitability, methods of jointing  
[Note : Detailed study covered under practical, hence students may be asked to prepare detailed sketches as home assignment ]
- 1.1 Laying of pipes – method, testing
- 1.2 Pipe corrosion – cause and remedies
- 5.0 QUALITY OF WATER :**
- 5.0 Impurities in water – organic and inorganic, classification
- 5.1 Harmful effects of impurities
- 5.2 Analysis of water – sampling and tests for physical, chemical and bacteriological quality, significance of tests (detailed methods of tests will be discussed in laboratory class )
- 5.3 Water quality standards for different uses
- 6.0 TREATMENT OF WATER :**
1. Design of treatment units excluded.
  2. Students may be asked to prepare detailed sketches of units, preferably from working drawing as home assignment
  3. Field visit to treatment plant, under practical should arranged after covering this unit.
- 6.1 Flow diagram of conventional water treatment system
- 6.2 Treatment process / units :
- 6.2.1 Aeration ; Necessity, types of aerators, essential features
- 6.2.2 Plain Sedimentation : Necessity, working principles, Sedimentation tanks – types, essential features, operation & maintenance
- 6.2.3 Sedimentation with coagulation: Necessity, principles of coagulation, types of coagulants, determination of coagulant dose (procedure of jar test to be covered under practical)
- Flash Mixer – types, essential features, operation
  - Flocculators - types, essential features, operation & maintenance
  - Clarifier - types, essential features, operation & maintenance
- 6.2.4 Filtration : Necessity, principles, types of filters
- Slow Sand Filter - essential features, operation, clearing & maintenance
  - Rapid Sand Filter - essential features, operation, clearing & maintenance, comparison with slow sand filter, description & working of operating accessories – rate controller, head – loss gauge etc., Filter operational troubles & remedies
  - Pressure Filter - essential features, operation, & maintenance, suitability of use
- 6.2.5 Disinfection : Necessity, methods of disinfection, types of chemical disinfectants criterion for ideal disinfectants

- Chlorination – free and combined chlorine demand, available chlorine, residual chlorine, pre-chlorination, break point chlorination, super-chlorination, determination of chlorine dose (testing procedure to be covered under practical), chlorinators – types, feeding

#### 6.2.6 Miscellaneous treatment methods :

- Removal of iron & manganese – Necessity, working principles
- Softening of water – Necessity, Methods of softening – Lime soda process, Ion exchange method, working principles
- Removal of arsenic & fluoride – Necessity, working principles

1.1 Chemicals required in various treatment units, their uses and feeding devices

1.2 Determination of dosage of chemical requirement for coagulation, chlorination, (jar test, Residual chlorine test to be discussed in laboratory), softening, numerical problems on dosage calculation.

### **7.0 DISTRIBUTION SYSTEM :**

7.0 General requirements, types of distribution system-gravity, direct and combined

7.1 Methods of supply – intermittent and continuous

7.2 Maintenance of required pressure in distribution system head loss in system, calculation of size of pipes – application of Hazen – William's formula, numerical problems on determination of size of pipes

7.3 Storage – necessity, types – underground, ground level, overhead reservoirs, suitability, accessories

7.4 Distribution system layout – types, comparison, suitability

7.5 Loss and wastage – cause, detection, remedial measures

### **8.0 APPURTENANCE IN DISTRIBUTION SYSTEM :**

8.0 Valves-types, features, uses, purpose-slucce valves, check valves, air valves, scour valves

8.1 Fire hydrants

8.2 Water meters – types, uses, fixing

[Note: detailed study covered under practical. Students may be asked to prepare sketches as home assignment]

### **9.0 W/S PLUMBING IN BUILDING :**

9.0 Method of connection from water mains to building supply

9.1 General layout of plumbing arrangement for water supply in single storied and multi-storied building as per I.S. code.

9.2 Water supply fittings-features, uses, purpose, fixing and jointing

9.3 Hot water supply – Electric water supply, Solar water heater features, fittings and fixing



# **SANITARY ENGINEERING**

## **10.0 INTRODUCTION**

- 10.0 Aims and objectives of sanitary engineering
- 10.1 Definition of terms related to sanitary engineering
- 10.2 Systems of collection of waste – Conservancy and Water Carriage System – features, comparison, suitability

## **11.0 QUANTITY OF SEWAGE :**

- 11.0 Quantity of sanitary sewage – domestic & industrial sewage, variation in sewage flow, numerical problem on computation quantity of sanitary sewage, Storm water flow-rational method of computation of flow
- 11.1 Computation of size of sewer, application of Chazy's formula, Limiting velocities of flow – self – cleaning and scouring

## **12.0 SEWAGE SYSTEM :**

- 12.0 Types of system-separate, combined, partially separate , features, comparison between the types, suitability
- 12.1 Shapes of sewer – rectangular, circular, avoid-features, suitability
- 12.2 Sewer materials-features, suitability, handling & maintenance – stoneware, cast iron, cement concrete, asbestos cement, precast & cast in situ sewer
- 12.3 Laying of sewer-setting out sewer alignment, excavation and supporting, checking the gradient, preparation of bedding, handling, lowering, laying and jointing, testing of sewer, backfilling, ventilation of sewer, cleaning

## **13.0 SEWER APPURTENANCES ;**

- 13.0 Manholes and Lamp holes – types, features, location, function, construction
- 13.1 Inlets, Grease & oil trap – features, location, function, construction
- 13.2 Storm regulator, inverted siphon - features, location, function, construction
- 13.3 Sewage Pumping – necessity, ejectors, location, components of pumping station, types of pumps and selection.

## **14.0 SEWAGE CHARACTERISTICS :**

- 14.0 General importance, strength of sewage, Characteristics of sewage-physical, chemical & biological
- 14.1 Analysis of sewage-sampling, tests for – solids, pH, dissolved oxygen, BOD, COD, Nitrogen(Detailed methods of tests to be discussed in laboratory)
- 14.2 Significance of parameters
- 14.3 Bacteriology of sewage-decomposition cycles of sewage – aerobic & an-aerobic – C, N, S cycle

## **15.0 SEWAGE DISPOSAL :**

- 15.0 Disposal on land – sewage farming, sewage application and dosing, sewage sickness-causes and remedies
- 15.1 Disposal by dilution – standards for disposal in different types of water bodies, self purification of stream

## **16.0 SEWAGE TREATMENT :**

- 16.0 Principles of treatment, flow diagram of conventional treatment

- 16.1 Primary treatment – necessity, principles, essential features, functions, operation and maintenance of different units – Screens and racks, Grit chamber, primary sedimentation tank
- 16.2 Secondary treatment – necessity, principles, essential features, functions, operation and maintenance of different units – contact bed, tricking filter, activated sludge process, aerated lagoon, oxidation ditch, rotating biological disc
- 16.3 Sludge disposal – sludge digestion - necessity, principles, essential features, operation, construction of sludge digesters, disposal of digested sludge
- 16.4 Isolated treatment units – features, principles, operation, construction, maintenance of septic tank and soak pit/soak trench, design of septic tank according to I.S. code; oxidation pond – principles & essential features

**17.0 SANITARY PLUMBING FOR BUILDING :**

- 17.0 Requirements of building drainage, layout of lavatory blocks in residential buildings, layout of building drainage
- 17.1 Plumbing arrangement of single storied & multi storied building as per I.S. code practice
- 17.2 Sanitary fixtures – features, function, and maintenance and fixing of the fixtures – water closets, flushing cisterns, urinals, inspection chambers, traps, anti-syphonage pipe
- 17.3 Inspection, testing and maintenance of sanitary fixtures

**18.0 RURAL WATER SUPPLY & SANITATION :**

- 18.0 Spring water source – development, sanitary protection, Maintenance
- 18.1 Roof top rain water harvesting – techniques, elementary Treatment, storage, maintenance
- 18.2 Single pit & two pit latrine – features, construction, Maintenance, disposal of sludge

**REFERENCE BOOKS:**

- |  |                     |
|--|---------------------|
| 1.Basic Environmental Technology                           | -Jerry A.Nathanson. |
| 2.Elements of Environmental Engineering                    | -K.N.Duggal,        |
| 3.Unit Operations and Process in Environmental engineering | -Reynolds,CENGAGE   |
| 4.Solid Waste Enginnering                                  | -Vesilind           |
| 5.Water Supply and Sanitary Engineering                    | -S. K.Garg          |

## **SURVEYING – II**

Period/Week: 05  
Total Periods: 75

Total Marks: 100 Evaluation Scheme;  
Theory End Exam: 80;IA(15)+Assignment(05)

### **TOPIC WISE DISTRIBUTION OF PERIODS**

<b>Sl. No.</b>	<b>Topics</b>	<b>Periods</b>
<b>01</b>	<b>Levelling</b>	<b>8</b>
<b>02</b>	<b>Contouring</b>	<b>4</b>
<b>03</b>	<b>Principles of theodolite surveying</b>	<b>10</b>
<b>04</b>	<b>Theodolite traversing</b>	<b>12</b>
<b>05</b>	<b>Tacheometry</b>	<b>10</b>
<b>06</b>	<b>Curves</b>	<b>06</b>
<b>07</b>	<b>Setting out works</b>	<b>05</b>
<b>08</b>	<b>Modern surveying methods</b>	<b>20</b>
	<b>Total</b>	<b>75</b>

### **RATIONALE :**

Surveying – II is the essential course following Surveying – I. The course covers the technique of Levelling and contouring; preparing plotting to know the ground profile. It also covers the technique of handling and use of theodolite, a versatile instrument in surveying for horizontal and vertical angular measurement, traversing, horizontal linear measurement, setting out curves and layout of different types of structures in the site. The course also gives an exposure to the students about the modern surveying instruments. The theory course is supplemented with practical course in Surveying Practice - II

### **OBJECTIVES :**

On completion of the subject a student will be able to

1. Conduct plane table survey work in the field using horizontal linear measurements.
2. Plot the profile map and contour map from the recorded data
3. Interpret the plotted contour map and compute data from it.
4. Prepare survey map by conducting traverse survey with theodolite
5. Measure height of objects with the help of theodolite
6. Determine horizontal distance by tacheometry
7. Set out circular curve in the field
8. Lay out the construction plan of different types of structures at the site

## 9. Use modern electronic surveying instruments

### **COURSE CONTENTS :**

#### **(Theory)**

#### **1.0 LEVELLING :**

- 1.1 Purpose of leveling
- 1.2 Definition of terms used in leveling – concepts of level surface, Horizontal surface, vertical surface, datum, R. L., B.M.
- 1.3 Description of essential features and uses of different types of leveling instruments
- 1.4 Concepts of line of collimation, axis of bubble tube, axis of telescope, Vertical axis
- 1.5 Levelling staff – types, features and use
- 1.6 Temporary adjustments of level, taking reading with level
- 1.7 Concept of bench mark, BS, IS, FS, CP, HI
- 1.8 Principles of leveling – Simple leveling, Differential leveling
- 1.9 Field data entry – level Book – height of collimation method and Rise & Fall method, comparison, Numerical problems on reduction of levels applying both methods, Arithmetic checks
- 1.10 Different types of leveling, uses and methods – Fly leveling, check leveling, Profile leveling – longitudinal sections and cross-sections
- 1.11 Plotting of profiles
- 1.12 Effects of curvature and refraction, numerical problems on application of correction
- 1.13 Reciprocal leveling – principles, methods, numerical problems, precise leveling
- 1.14 Difficulties in leveling, errors in leveling and precautions
- 1.15 Sensitiveness of bubble tube, determination of sensitiveness
- 1.16 Permanent adjustments of different types of levels
- 1.17 Setting grades and stakes, setting out grades of sewers and related problems

#### **2.0 CONTOURING :**

- 2.1 Definitions of related terms, concepts of contours, characteristics of contours
- 2.2 Methods of contouring, plotting contour maps
- 2.3 Interpretation of contour maps, toposheets
- 2.4 Use of contour maps on civil engineering projects – drawing cross-sections from contour maps, locating proposal routes of roads / railway / canal on a contour map, computation of volume of earthwork from contour map for simple structure.

#### **3.0 PRINCIPLES OF THEODOLITE SURVEYING :**

- 3.1 Purpose, definition of terms
- 3.2 Description of features, component parts of a transit theodolite
- 3.3 Fundamental axes of a theodolite, concept of vernier, reading a vernier
- 3.4 Temporary adjustment of theodolite
- 3.5 Concept of transiting – swinging, faceleft, face right, changing face
- 3.6 Measurement of horizontal angles with theodolite by repetition and reiteration method

3.7 Measurement of vertical angles with theodolite

3.8 Determination of magnetic bearings with theodolite

3.9 Measurement of deflection angle, direct angle, setting out angles, prolonging a straight line with theodolite

3.10 Errors in theodolite observations

#### **4.0 THEODOLITE TRANSVERSING :**

4.1 Methods of traversing with theodolite – inclined angle method, deflection angle method, bearing method

4.2 Plotting the traverse by coordinate method

4.3 Checks for open and closed traverse

4.4 Traverse computation – consecutive coordinates, latitude and departure, Gale's traverse table, Numerical problems on omitted measurement of lengths & bearings

4.5 Closing error – adjustment of angular errors, adjustment of bearings, numerical problems

4.6 Balancing of traverse – Bowditch's method, transit method, graphical method, axis method

4.7 Calculation of area of closed traverse

#### **5.0 TACHEOMETRY (Only concepts; applications without derivation)**

5.1 Principles, stadia constants determination

5.2 Stadia tacheometry with staff held vertical and with line of collimation horizontal or inclined, numerical problems

5.3 Elevations and distances of staff stations – numerical problems

#### **6.0 CURVES :**

6.1 compound, reverse and transition curve, Purpose & use of different types of curves in field

6.2 Elements of circular curves, numerical problems

6.3 Preparation of curve table for setting out

6.4 Setting out of circular curve by chain and tape and by instrument angular methods (i) offsets from long chord, (ii) successive bisection of arc, (iii) offsets from tangents, (iv) offsets from chord produced, (v) Rankine's method of tangent angles

6.5 Obstacles in curve ranging – point of intersection inaccessible

6.6 Transition curves – description and their characteristics (numerical problems not required)

## **7.0 SETTING OUT WORKS :**

7.1 Methods of setting out layouts of structures from construction plans of (i) buildings, (ii) culverts, (iii) bridge piers

## **8.0 MODERN SURVEYING METHODS :**

8.1 Principles, features and use of (i) Micro optic theodolite, digital theodolite,  
(ii) Electronic Distance Meter

8.2 Working principles of a Total Station (Set up and use of total station to measure angles, distances of points under survey from total station and the co-ordinates (X, Y & Z or northing, easting, and elevation) of surveyed points relative to Total Station position using trigonometry and triangulation.

8.3 Principles of aerial surveying, uses, interpretation of aerial photographs, stereoscopes – principles and uses

8.4 Principles of remote sensing, systems (passive and active system) uses (land use/land cover, natural hazards and environmental systems) interpretation of remote sensing images

## **REFERENCE BOOKS :**

1. Plane Surveying – by Alak. De; S. Chand & Co
2. Surveying Vol. I, II, III – by B. C. Punmia; Laxmi Publication, Delhi – 06
3. A text book of surveying and leveling – by R. Tagor; Khanna Publishers, Delhi-6
4. Surveying and Levelling – by Hussain and Nagraj; S. Chand & Co., Delhi
5. Surveying and Levelling – by S. C. Rangwala; Charotar Book Stall, Pune
6. Surveying and Levelling – by N. N. Basak; Tata McGraw Hill
7. Higher Surveying – A.M. Chandra

## TRANSPORTATION ENGINEERING – II (Th-4)

Period/Week: 05 Total Marks: 100 Evaluation Scheme;  
Total Periods: 75 Theory End Exam: 80;IA(15)+Assignment(05)

### TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topics	Section – A : RAILWAYS	Periods
01		Introduction	01
02		Permanent way	03
03		Track materials	04
04		Geometric for Broad gauge	08
05		Points and crossings	05
06		Laying & maintenance of track	06
07		<b>Section – B ; BRIDGES</b> Introductions	01
08		Bridge Site investigation, hydrology & planning	07
09		Bridge foundation	06
10.		Bridge substructure and approaches	04
11.		Permanent bridges	03
12.		Culvert & cause ways	04
13.		<b>Section : C : DOCKS &amp; HARBOURS</b> Introduction	04
14.		Break waters	03
15.		Docks	04
16.		<b>SECTION-D, AIR PORT ENGINEERING</b> Introduction to Airport Engineering	01
17.		Components of an airport	05
18		<b>SECTION-E TUNNEL ENGINEERING</b>	06

#### **RATIONALE ;**

Railways, Bridges and Harbour constitute important specialized components of Transportation of our country. Many-a times diploma holders are involved in the construction and maintenance of these vital transportation facilities. Knowledge in the subjects is a very necessary for civil engineering diploma holder.

#### **OBJECTIVES :**

On completion of the subject a student will be able to –

- i) Understand the various components of bridges.
- ii) Understand the method of selection of site for a bridge by hydrological investigations
- iii) Know the necessity functions and depth of bridge foundations
- iv) Know the different aspects of culverts, causeways and bridge bearing.
- v) Know the different types of Railway tracks fastenings method of laying and track maintenance

- vi) State the difference types of gauges advantage of uniform gauge and component parts of permanent way.
- vii) Understand the necessity of railway signals and interlocking list the factors to be considered for selection of site for different types of harbours.
- viii) Know the types and functions of the components like break-water, jetties, docks.

## **COURSE CONTENT**

### **Section – A : RAILWAYS**

#### **1.0 Introduction :**

- 8.1 Railway terminology
- 8.2 Advantages of railways
- 8.3 Classification of Indian Railways

#### **9.0 Permanent way**

- 9.1 Definition and components of a permanent way
- 9.2 Concept of gauge, different gauges prevalent in India, suitability of these gauges under different conditions

#### **10.0 Track materials**

- 10.1 Rails
  - 10.1.1 Functions and requirement of rails
  - 10.1.2 Types of rail sections, length of rails
  - 10.1.3 Rail joints – types, requirement of an ideal joint
  - 10.1.4 Purpose of welding of rails & its advantages
  - 10.1.5 Sreep definition, cause & prevention
- 10.2 Sleepers
  - 10.2.1 Definition, function & requirements of sleepers
  - 10.2.2 Classification of sleepers
  - 10.2.3 Advantages & disadvantages of different type s of sleepers
- 10.3 Ballast
  - 10.3.1 Functions & requirements of ballast
  - 10.3.2 Materials for ballast
- 10.4 Fixtures for Broad gauge
  - 10.4.1 Connection of rails to rail-fishplate, fish bolts
  - 10.4.2 Connection of rails to sleepers

#### **11.0 Geometric for Broad gauge**

- 11.1 Typical cross – sections of single & double broad gauge railway track in cutting and embankment
- 11.2 Permanent & temporary land width
- 11.3 Gradients for drainage
- 11.4 Super elevation – necessity & limiting valued

#### **12.0 Points and crossings**

- 12.1 Definition, necessity of Points and crossings
- 12.2 Types of points & crossings with tie diagrams

#### **13.0 Laying & maintenance of track**

- 13.1 Methods of Laying & maintenance of track
- 13.2 Details of a permanent way inspector

### **Section – B ; BRIDGES**

#### **1.0 Introductions**

- 1.1 Definitions



- 1.2 Components of a bridge
- 1.3 Classification of bridges
- 1.4 Requirements of an ideal bridge
- 2.0 Bridge Site investigation, hydrology & planning**
  - 2.1 Selection of bridge site
  - 2.2 Bridge alignments
  - 2.3 Determination of flood discharge
  - 2.4 Waterway & economic span
  - 2.5 Afflux, clearance & free board
  - 2.6 Collection of bridge design data & sub surface investigation
- 3.0 Bridge foundation**
  - 3.1 Scour depth minimum depth of foundation
  - 3.2 Types of bridge, foundations – spread foundation, pile foundation- pile driving, well foundation – sinking of wells, caisson foundation
  - 3.3 Cofferdams
- 4.0 Bridge substructure and approaches**
  - 4.1 Types of piers
  - 4.2 Types of abutments
  - 4.3 Types of wing walls
  - 4.4 Approaches
- 5.0 Permanent bridges**
  - 5.1 Masonry bridges
  - 5.2 Steel bridges – classification with sketches
  - 5.3 Concrete bridges – classification, brief description with sketches
  - 5.4 IRC bridge loading
- 6.0 Culvert & cause ways**
  - 6.1 Types of culvers - brief description
  - 6.2 Types of causeways - brief description

## **Section : C : DOCKS & HARBOURS**

### **1.0 Introduction**

- 1.1 Definition
- 1.2 Necessity of harbours
- 1.3 Types of harbours
- 1.4 Components of harbours
- 1.5 Layout of harbor – sketches, description
- 1.6 Criterion for selection of site for a good harbor

### **2.0 Break waters**

- 2.1 Definition
- 2.2 Function of break waters
- 2.3 Types of breakwaters - sketches, description

### **3.0 Docks**

- 3.1 Definition
- 3.2 Necessity of docks
- 3.3 Function of docks - sketches, description
- 3.4 Comparison between dry and wet dock

## SECTION-D

### 7.0 AIR PORT ENGINEERING

- 7.1 Introduction to Airport Engineering
  - a Types of Airport, Location and orientation of an airport
  - b Airport Terminology
- 7.2 Components of an airport
  - a Runways, brief description
  - b Taxiways, brief description
  - Aprons, brief description
  - Airport layout

## SECTION- E

### 8.0 TUNNEL ENGINEERING

- 8.1 Definition, classification, shape and size
- 8.2 Tunnel cross section for highways and railways
- 8.3 Shaft-its purpose and construction

### REFERENCE BOOKS:

1.	A text book of transportation engineering	- N.L. Arora
2.	Atextbookoftransportationengineering	-S.P.Chandola,
3	Highway engineering	- S.K. Khanna, C.E.G. Justo
4	Roads, railways, bridges and tunnel engineering	-B.L. Gupta and Amit Gupta
5	Roads, railways, bridges and tunnel engineering	- Ahuja and Birdi
6	Highway Engineering	-T.D. Ahuja
7	Highway Engineering	- Gurucharan Singh
8.	Bridge Engineering - S.P. Bindra	
9.	A Text book of Railway Engineering	- S.C.Sexena&S.P.Arora,
10.	Principles and practice of Bridge engineering	- S.P.Bindra,
	Tunnel Engineering	-SC Saxena

## **CONSTRUCTION WORKS MANAGEMENT (Th-5)**

Period/Week: 05  
Total Periods: 75

Total Marks: 100 Evaluation Scheme;  
Theory End Exam: 80;IA(15)+Assignment(05)

One of the important activities of Civil Engineering technician is that he should learn the managerial processes involved in construction industries like management of labour, material and equipment to minimize the project cost and project duration and also to optimize the quality of works.

In this course, the student will learn the application of available software used in the management of construction industries for the purpose stated above. Disaster management, an important aspect of present day requirement is treated to face the effects of natural calamities.

### **SCHEME OF TEACHING AND ASSESSMENT**

Topic No.	Name of Topic	Periods
1.	<b>Introduction</b>	<b>1</b>
2.	<b>Construction team</b>	<b>2</b>
3.	<b>Scientific management &amp; its functions.</b>	<b>4</b>
4.	<b>Construction planning, scheduling &amp; controlling</b>	<b>12</b>
5.	<b>Organizations</b>	<b>6</b>
6.	<b>Material management</b>	<b>6</b>
7.	<b>Labour management</b>	<b>6</b>
8.	<b>Equipment</b>	<b>10</b>
9.	<b>Quality management</b>	<b>6</b>
10.	<b>Safety management in construction work</b>	<b>5</b>
11.	<b>Management Information</b>	<b>7</b>
	<b>Total</b>	<b>75</b>

### **OBJECTIVES:**

The student should be able to:

- Know the history of management
- Know structures of various organizations
- Know the safety measures to be adopted at construction sites under different situations.
- Understand the meaning of construction management.
- Understand the scientific construction management.
- Understand quality management & its applications.
- Understand management information system(MIS)
- Understand "disaster management"
- Work with construction team
- Execute functions of management in construction works
- Apply CPM & PERT effectively.
- Prepare labour, material and equipment schedule.
- Manage material, labour and equipment at the construction site efficiently.

- Execute leadership characteristics/qualities on construction site.

## **TOPICS AND SUB TOPICS**

### **TOPIC 1 INTRODUCTION**

- 1.1 Definition of management, construction & construction management.
- 1.2 Objects & types of management
- 1.3 Different management schools.
  - Classical sChool
  - Behavioral sChool
- 1.4 Modern behavioral management science.

### **TOPIC 2 CONSTRUCTION TEAM**

- 2.1 The Engineers
- 2.2 Contractors and Owner
- 2.3 Their role in construction management process
- 2.4 Construction works manager & skills required for managers at different management level
  - 2.4.1 Essential qualities in a construction manager.
    - Character, integrity, devotion to duty, hardworking, leadership knowledge, good vision, sharp & proper assessment of situation, foresightedness, decision maker, problem solver, absence of parochialism etc.
  - 2.4.2 Skills required for managers:
    - technical, intellectual, communication, presentation, motivating, analytical, behavioral, experimental & managerial skills.

### **TOPIC 3 SCIENTIFIC MANAGEMENT & ITS FUNCTIONS**

- 3.0 Definition:
- 3.1 Planning of projects like Dams, Highways, Bridges, Railways etc.
- 3.2 Organizing
- 3.3 Directing and motivating
- 3.4 Controlling and feedback study

### **TOPIC 4 CONSTRUCTION PLANNING, SCHEDULING AND CONTROLLING**

- 4.1 Definition of Planning
- 4.2 Pre and Post tender planning
- 4.3 Planning process, survey, collection and analysis of data
- 4.4 Technical, Economical and environmental feasibility of projects
- 4.5 Interpretation of plans, maps, drawings & specifications
- 4.6 Identification of activities, their hierarchy of execution & resources requirements
- 4.7 Study of availability of resources at sites
- 4.8 CPM and introduction to **PERT**
- 4.9 Introduction to :
  - Network compression
  - Time cost trade off

- Cost optimization

## **TOPIC 5 ORGANISATIONS :**

- 5.1 Definition & functions
- 5.2 Principles of organizations
- 5.3 Basic components of organizing process
- 5.4 Primary means of departmental responsibility, authority and accountability
- 5.5 Situational approach to organization

## **TOPIC 6 MATERIAL MANAGEMENT:**

- 6.1 Preparing material schedule
- 6.2 Identification of scarce materials
- 6.3 Cost index job layout
- 6.4 Material handling
- 6.5 Storage and safety precautions :IS - 7969 : 1975
- 6.6 IS - 4082 - 1977 for stacking and storage of construction material at site.
- 6.7 Purchase procedure
- 6.8 Economic order quantity
- 6.9 Inspection & testing the quality of material

## **TOPIC 7 LABOUR MANAGEMENT:**

- 7.1 Preparing labour schedule
- 7.2 Essential steps for optimum labour output
- 7.3 Labour characteristics
- 7.4 Wages & their payment
- 7.5 Labour incentives
- 7.6 Motivation
- 7.7 Morale
- 7.8 Relevant labour laws and case studies related to labour disputes

## **TOPIC 8 EQUIPMENT MANAGEMENT:**

- 8.1 Preparing the equipment schedule
- 8.2 Identification of different alternative equipment
- 8.3 Importance of Owning & operating costs in making decisions for hiring & purchase of equipment
  - 8.3.1 Job layout for different construction sites ego  
 Dam site, multistoried buildings,  
 bridge construction site etc.
- 8.4 Inspection and testing of equipment
- 8.5 Equipment maintenance and minor repairs
- 8.6 Safety considerations

## **TOPIC 9 QUALITY MANAGEMENT:**

- 9.1 Quality control Qy statistical methods
  - 9.1.1 Control charts, X - chart, R - chart, C - chart and P - chart
- 9.2 Sampling plan

## **TOPIC 10 SAFETY MANAGEMENT IN CONSTRUCTION WORKS:**

### **Study of the following BIS codes:**

10.1 IS - 3696 (I) -1966	for Scaffolds
10.2 IS - 3696 (II) -1966	for Ladders
10.3 IS - 3764 -1966	for Execution
10.4 IS - 4130 -1976	for Demolition of buildings
10.5 IS -7205 -1974	for Erection of steel structures
10.6 IS - 5121 -1969	for Piling & other deep foundation
10.7 IS - 5916 -1970	for construction involving hot bituminous materials
10.8 IS - 8969 -1978	for Erection of concrete framed structures

## **TOPIC 11 MANAGEMENT INFORMATION SYSTEM**

11.1 Purpose and needs

11.2 System of Management Information techniques

11.3 Format of Management Information technique

11.4 Implementation of Management Information Systems

### **REFERENCES :**

1. Professional construction Management Donald S Berry
2. Construction planning and management PS Gahlot & BM Dhir
3. Construction Management and accounts Harpalsingh Tata McGraw Hill
4. A management guide to PERT/ CPM Jerome D Weist  
Ferdinand K Levy  
SC Sharma Khanna Publishers
5. Construction equipment and its management PP Dharwadker
6. Management in Construction Industry Robert L Peurifoy &
7. Construction Planning equipment and methods William B Ledbetter VK Raina Tata McGraw Hill
8. Construction Management Practice Roy Pilcher
9. Construction Management Sengupta & Guha Tata McGraw Hill
10. Construction Management and Planning S.C. Rangwala
11. Construction of Structures Management & works Gurucharan Singh
12. Building, planning, designing and scheduling B.C. Punmia & Khandelwal
13. Project planning by CPM & PERT

## **PRACTICALS**

Evaluation scheme:

Period per week: 6P  
Total periods (Practical):90

End term examination:50marks  
Sessional:50marks  
Total :100marks

### **Structural Detailing Practice-I (Pr-1)**

Evaluation scheme:

Period per week: 3P  
Sessional:50marks

Total periods (Practical):45  
Total :50marks

1.0 Draw the following with necessity details and schedule of bars from supplied hand sketches or given references such as SP 34

- (a) Slab, beam and lintel with chaja as in a simple building (Help from Sections 8&9 of SP 34 may be taken ) Plate I
- (b) Columns, column-beam connections with & without splicing, isolated footing, staircase (Help from sections 6, 7, 10 of SP 34 may be taken) Plate 2
- (c) Cantilever and a Counter fort retaining walls : deflected shapes of sections at different locations and details of reinforcement (Help from Section 11 and sheet 20 of SP 34 may be taken ) – Plate 3

#### **REFERENCE BOOKS:**

1. Reinforced Concrete Structures -I.C.Syal &A.K. Goel.
2. Reinforced Concrete -HJ Saha.
3. Fundamentals of Reinforced Concrete -N.C.Sinha,S.K.Roy.
4. Earthquake Resistant Design Of Structures -Pankaj Agarwal & M. Shrikhande
5. IS:456-2000
6. SP-16 -BIS Publication
7. SP-34 -BIS Publication
8. IS: 13920 -BIS Publication

# **SURVEYING - II ( PRACTICAL ) Pr-2**

Evaluation scheme:

Period per week: 6P

Total periods (Practical):90

End term examination:50marks

Sessional:50marks

Total :100marks

## **COURSE CONTENTS :**

Field exercise on :

### **1.0 LEVELLING :**

- 1.1 Study of essential features and parts of different types of levels
- 1.2 Study of essential features of different types of leveling staffs
- 1.3 Making temporary adjustments of Levels
- 1.4 Determining Reduced Levels of five given points taking staff readings with Levels.
- 1.5 Determining the difference of levels between two points (3 pairs of points / group) by taking staff readings form single set up of level, recording the readings in level book and application of Arithmetic check. (At least 3 change points must be covered)
- 1.6 Conduct Fly Levelling (Compound) between two distant points with respect to R.L. of a given B.M. and reduction of levels by both height of collimation and rise & fall method and applying Arithmetic check. (At least 3 change points must be covered)
- 1.7 Finding R. L. of (1) roof, (2) chaja or canopy with reference to the R.L. of given B.M. by taking inverted staff reading.
- 1.8 Conduct profile leveling along the given alignment for a road / canal for 150m length, taking L. S. at every 15m and C. S. at 1m & 3m apart on both sides at every 30m interval and recording the data in level book and applying arithmetical check.
- 1.9 Plotting the profile of the alignment surveyed in Exercise 6.8 and drawing the grade of alignment desired (To be drawn during the class hours )
- 1.10 Setting out the given grades for a sewer along a given alignment

### **2.0 CONTOURING :**

- 2.1 Locating contour points in the given area by direct method / indirect method
- 2.2 Conducting block level survey inn the given area
- 2.3 Plotting and drawing contour map of a given area by radial method.

### **3.0 THEODOLITE :**

- 3.1 Study of essential features and parts of transit thodolite, to describe the theodolite with neat sketches
- 3.2 Carry out temporary adjustment of a tansit theodolite and read horizontal and certicla angles to 5 objects
- 3.3 Measurement of horizontal angles (3nos.) by repetition and reiteration method and compare two methods
- 3.4 Prolonging a given straight line with the help of a theodolite



3.5 Determination of magnetic bearing of 3 given straight lines

#### **4.0 THEODOLITE TRAVERSING ;**

4.1 Setting out a closed traverse with 6 sides and entering the field data

4.2 Plotting the traverse from exercise 4.1 and checking the error of closure

4.3 Setting out an open traverse with 5 sides and entering the field data

4.4 Plotting the traverse from exercise 4.3 and checking the error of closure

#### **5.0 TRIGONOMETRICAL SURVEYING & TACHEOMETRY :**

5.1 Determination of height of 3 objects whose bases are accessible

5.2 Determination of stadia constants

5.3 Determination of horizontal distance and elevation with Staff vertical , by stadia method

#### **6.0 SETTING OUT CURVES :**

6.1 Setting out a simple circular curve by offsets from long chord

6.2 Setting out a simple circular curve by offsets from the tangent

6.3 Setting out a simple circular curve by offsets from chords produces

6.4 Setting out a simple circular curve by Rankine's method of tangent angle (Deflection angles)

#### **7.0 SITE SURVEYING :**

7.1 Setting out a site the center line and foundation width of a building from the given plan

7.2 Setting out the foundation line for a culvert

7.3 Dividing an area into plots of given size

#### **8.0 MODERN SURVEYING INSTRUMENTS :**

8.1 Study of essential features of

(i) Microphonic theodolite / digital theodolite.

ii) Measure distance, elevation, horizontal and vertical angle of an object with modern theodolite. between two points with electronic distance meter

8.2 Total Station and Electronic Distance Meter

(I) Set up and use of Total Station/EDM for establishing control, detailing surveying, setting out and coordinate check

(II) Extract and relate coordinate information from drawings.

(III) Record angle and distance observations in the field.

(IV) Calculate rectangular coordinate information from the field observation.

- (V) Calculate polar coordinate setting out information from drawings.
  - (VI) Mainain clear records of calculations.
  - (VII) Check for sources of errors with Total Station.
- 8.3 Meaure distance between two points with Electronic Distance Meter

**REFERENCE BOOKS :**

1. Plane Surveying – by Alak. De; S. Chand & Co
2. Surveying Vol. I, II, III – by B. C. Punmia; Laxmi Publication, Delhi – 06
3. A text book of surveying and leveling – by R. Tagor; Khanna Publishers, Delhi-6
4. Surveying and Levelling – by Hussain and Nagraj; S. Chand & Co., Delhi
5. Surveying and Levelling – by S. C. Rangwala; Charotar Book Stall, Pune
6. Surveying and Levelling – by N. N. Basak; Tata Mcgrew Hill

## **CIVIL ENGINEERING LABORATORY-II (Pr-3)**

Fifth Semester Civil Engineering.

Evaluation scheme:

Period per week: 6P

Total periods (Practical):90

End term examination:50marks

Sessional:50marks

Total :100marks

### **1.0 TESTS ON SOIL:**

1.1 Determination of Water content of Soil by Oven drying method.

1.2 Determination of Specific gravity of Soil by Pycnometer/Density bottle.

1.3 Determination of Field Density of Soil by Core Cutter Method.

1.4 Determination of Particle Size gradation of sand/Gravel by sieve analysis.

1.5 Wet mechanical analysis using pipette method for clay and silt.

1.6 Determination of Liquid Limit by soil by Casagrande's apparatus.

1.7 Determination of Plastic limit of soil.

1.8 Determination of Shrinkage limit of soil.

1.9 Determination of Coefficient of permeability of coarse grained soils under constant head method.

1.10 Determination of MDD & OMC of soil by using modified Proctor Test.

1.11 Determination of  $C$  and  $\phi$  of Soil sample by Triaxial Test device.

1.12 Determination of Coefficient of Consolidation of soil with Consolidation apparatus.

1.13 Determination of CBR value using Laboratory CBR Testing device.

1.14 Demonstration of Plate load Test for determination of SBC.

1.15 Demonstration of SPT for determination of SBC.

1.16 Demonstration of methods of Sampling by using different samplers.

1.17 Demonstration of SCPT and DCPT.

1.18 Determination of Swelling Index, Swelling factor & Swelling pressure of expansion.

### **2.0 TRANSPORTATION LABORATORY:**

2.1 Penetration Test of Bitumen.

2.2 Ductility Test of Bitumen.

2.3 Viscosity Test of Bitumen.

2.4 Flash point & Fire Point Test of Bitumen.

2.5 Softening point Test of Bitumen.

2.6 Determination of Bitumen content by centrifuge extractor.

2.7 Determination of stripping value of road aggregates .

### **3.0 PUBLIC HEALTH ENGINEERING LABORATORY:**

3.1 Determination of Turbidity of water Sample using Turbidimeter/Nephelometer/Jackson's Candle Turbidimeter.

3.2 Determination of pH of Water sample using (a) pH – meter (b) colour Comparator.

3.3 Determination of sulphate content of Water sample.

3.4 Determination of Acidity/ Alkalinity of Water sample using method of titration.

- 3.5 Determination of Iron content of Water sample using colorimetric method using Nessler's tube.
- 3.6 Determination of Chloride content of a Water sample using method of titration.
- 3.7 Determination of Bacteriological quality of water sample by Coliform Test.
- 3.8 Determination of Coagulant (Alum) dose requirement for a turbid water sample by Jar Test.
- 3.9 Determination of dissolved Oxygen of water sample collected from the field using Winkler's method.
- 3.10 Determination of total solids, suspended solids and dissolved solids of waste water sample by Gravimetric method.
- 3.11 Determination of Biochemical Oxygen demand (BOD) of waste water sample collected from the field. Determination of residual chlorine in a water sample.

#### **4.0 Construction Workshop:**

- 4.1 Study of tools required for construction of masonry.
- 4.2 Setting out centre line for a building.
- 4.3 Construction of 1 & 1 ½ Brick thick walls in English Bond in Mud mortar including a corner.
- 4.3 Construction of 1 & 1 ½ Brick thick Pillar in Mud mortar .
- 4.4 Fabrication of timber or steel formwork for a beam.
- 4.5 Fabrication of timber or steel formwork for a slab.
- 4.6 Fabrication of timber or steel formwork for a Column.
- 4.7 Bar bending and fabrication of reinforcements for a beam.
- 4.8 Bar bending and fabrication of reinforcements for a slab.
- 4.9 Bar bending and fabrication of reinforcements for a lintel with chajja & column.
- 4.10 Bar bending and fabrication of reinforcements for a column.
- 4.11 Conducting a Non destructive compressive strength test on concrete beam using rebound Hammer as per I.S:1311(Part-2)-1992.
- 4.12 Casting of a prestressed concrete beam using a prestressing unit.
- 4.13 Field visits.

Visit to a construction site of a building where the following works are in progress.

- a) Excavation of foundation
- b) Masonry works
- c) White washing
- d) Painting (interior & exterior)
- e) Wood works
- f) Fabrication & concreting works.
- g) Flooring.

#### **Reference Books:**

- |   |                              |
|---|------------------------------|
| 1. Concrete Laboratory Manual                       | -Gambhir. Danpat rai & Sons. |
| 2. Cement, Aggregate and concrete Laboratory Manual | -Dr. M. Chakraborty          |
| 3. Highway material testing Laboratory manual       | -S.K. Khanna & C.E.G. Justo. |
| 4. Laboratory manual in Highway material testing    | -Ajay K. Duggal, Vijaya p.   |
| 5. Laboratory work in Hydraulic Engineering         | -G.L. Asawa.                 |
| 6. Experimental Hydraulics                          | -S.N. Ghosh & S.C Talapatra. |
| 7. Laboratory manual in Environmental Engineering   | -Prof. P.D. Kulkarni.        |
| 1. A text book of Building Construction             | -Bindra & Arora              |
| 2. A text book of Building Construction             | -Sushil Kumar                |
| 3. S.P-34   |                              |