

## **Foreword**

Technical Teachers' Training Institute (ER), Calcutta has been awarded Academic Consultancy by the Govt. of Mizoram for the 3rd phase of World Bank Project For Quality improvement of Polytechnic Education system in the State.

The quality improvement of the system largely depends on the quality of curriculum and its implementation. It's a common experience that even the best-designed curriculum could not yield desired result due to lack of proper implementation. Again an excellent curriculum, designed at a particular time becomes obsolete after laps of a period depending on the life-span of the technology. Periodic revision of curriculum, is therefore, an essential condition for dynamically responding to the changing needs of the world of work. The three year diploma curriculum in Civil, Electrical, Mechanical and Electronics & Telecommunication Engineering has been revised with due emphasis on the

- Present needs of the world of work
- Flexibility in the entry and exit from the system and
- Assessment system

A model of Multi-Point Entry and Credit System (MPECS) has been developed to introduce the above flexibility. It will be observed that the entire curriculum has been divided into broad category of courses viz.

- Foundation
- Hard Core
- Soft Core
- Basic Technology
- Applied Technology &
- Elective courses

It is suggested that appropriate resources in terms of faculty, support staff, laboratory and workshop etc. along with appropriate learning resources and evaluation system be developed for implementation of the curriculum.

I sincerely thank Mrs. B. Sangkhumi, Project Director, Govt. of Mizoram, and her faculty members for their active support and contribution in the revision of the curriculum. My special thanks are due to the external experts, and the faculty members and the support staff of TTTI, Calcutta who have contributed in the revision process.

**(Dr. S, K. Bhattacharya)**

Principal

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**MULTI POINT ENTRY AND CREDIT SYSTEM (MPECS)**

<b>Category of Courses</b>	<b>Reference to First Digit of Course Code</b>	<b>Credits to be acquired</b>	<b>No. of Courses</b>
Foundation Course	1	22	06
Hard Core Course	2	17	06
Soft Core Course	3	06	02
Basic Technology Course	4	31	09
Applied Technology Course	5	39	12
Elective Course	6	06	02
<b>TOTAL :</b>		<b>121</b>	<b>37</b>

**Scheme of Studies and Evaluation (MPECS)**  
**Diploma in Electrical Engineering**

**1. FOUNDATION COURSES:**

Sl. No	Code	Course	Study Scheme			Evaluation Scheme						Total Marks	Credit	
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Internal Assessment		End Exam	Internal Assessment			
								Class Test	Assignment		Sessio nal			Viva
1	101	Communication in English-1		2	1	0	70	15	15	0	0	0	100	3
2	102	Communication in English-11	101	2	1	0	70	15	15	0	0	0	100	3
3	103	Applied Mathematics-I		3	0	0	70	15	15	0	0	0	100	3
4	104	Applied Mathematics-II		3	0	0	70	15	15	0	0	0	100	3
5	105	Engineering Science-1		3	0	4	70	15	15	25	25	0	150	5
6	106	Engineering Science-11	105	3	0	4	70	15	15	25	25	0	150	5
<b>TOTAL</b>				<b>16</b>	<b>2</b>	<b>8</b>	<b>420</b>	<b>90</b>	<b>90</b>	<b>50</b>	<b>50</b>		<b>700</b>	<b>22</b>

## 2. HARD CORE COURSES:

Sl. No	Code	Course	Study Scheme			Evaluation Scheme						Total Marks	Credit	
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Internal Assessment		End Exam	Internal Assessment			
								Class Test	Assignment		Sessional			Viva
1	201	Engineering Drawing –I		0	0	6	0	0	0	50	50	0	100	3
2	202	Engineering Drawing –II	201	0	0	6	0	0	0	50	50	0	100	3
3	203	Workshop Practice – I		0	0	4	0	0	0	0	25	25	50	2
4	204	Workshop Practice – II		0	0	4	0	0	0	0	25	25	50	2
5	205	Mechanics Engineering		3	0	0	70	15	15	0	0	0	100	3
6	206	Introduction to Information Technology	203	2	0	3	50	0	0	25	25	0	100	4
<b>TOTAL</b>				<b>5</b>	<b>0</b>	<b>23</b>	<b>10</b>	<b>15</b>	<b>15</b>	<b>125</b>	<b>175</b>	<b>50</b>	<b>500</b>	<b>17</b>

3. SOFT CORE COURSE : (Any two to be taken)

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Mark	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Internal Assessment		End Exam	Internal Assessment			
								Class Test	Assignment		Sessional	Viva		
13	301	Engineering Economics & Accountancy		3	0	0	70	15	15	0	0	0	100	3
14	302	Element of Management and Industrial Legislation		3	0	0	70	15	15	0	0	0	100	3
15	303	Entrepreneurship Development		3	0	0	70	15	15	0	0	0	100	3
16	304	Element of Electronics	105,106	3	0	0	70	15	15	0	0	0	100	3
17	305	Materials Science	105,106	3	0	0	70	15	15	0	0	0	100	3
18	306	Environmental Education		3	0	0	70	15	15	0	0	0	100	3
<b>TOTAL</b>				<b>6</b>	<b>0</b>	<b>0</b>	<b>140</b>	<b>30</b>	<b>30</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>200</b>	<b>6</b>

#### 4. BASIC TECHNOLOGY COURSES FOR MECHANICAL ENGINEERING:

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Mark	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Internal Assessment		End Exam	Internal Assessment			
								Class Test	Assignment		Sessional	Viva		
19	401	Mechanics of materials	205	3		2	70	15	15		25	25	150	4
20	M402	Thermal Engineering	105,106	3	0	0	70	15	15				100	3
21	M403	Fluid Mechanics	205	3	0	2	70	15	15		25	25	150	4
22	M404	Element of Electrical Engineering		3	0	2	70	15	15		25	25	150	4
23	M405	Mechanical Drawing	202	0	0	6				100	50	50	200	3
24	M406	Theory of Machine	205	3	0	0	70	15	15				100	3
25	M407	Workshop Practice –III		0	0	4					100	50	150	2
26	M408	Manufacturing Process – I		3	0	0	70	15	15				100	3
27	M409	Workshop Practice - IV		0	0	4					100	50	150	2
<b>TOTAL</b>				<b>18</b>	<b>0</b>	<b>20</b>							<b>1250</b>	<b>28</b>

**5. APPLIED TECHNOLOGY COURSES FOR MECHANICAL ENGINEERING:**

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Mark	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Internal Assessment		End Exam	Internal Assessment			
								Class Test	Assignment		Sessional	Viva		
28	M501	Fluid Machines	M403	3	0	2	70	15	15		25	25	150	4
29	M502	Thermal Engineering – II	M402	3	0	0	70	15	15				100	3
30	M503	Manufacturing Process-II		3	0	0	70	15	15				100	3
31	M504	Machine Tools – I	204,205	3	0	0	70	15	15				100	3
32	M505	Machine Design & Drawing	M405	2	0	4	50			100	50		200	4
33	M506	Production Management		3	0	0	70	15	15				100	3
34	M507	Mechanical Measurement	M408	4	0	0	70	15	15				100	4
35	M508	Machine Tools – II	M504	3	0	0	70	15	15				100	3
36	M509	Workshop Practice –V		0	0	4					100	50	150	2
37	M510	Mechanical Estimation	M405	2	0	2	50				50	50	150	3
38	M511	Projects		0	0	6					100	50	150	3
39	M512	Plant Maintenance Engineering		3	0	0	70	15	15				100	3
40	M513	Seminar, Tech. & Industrial Tour		0	0	6					100	50	150	3
<b>TOTAL</b>				<b>28</b>	<b>0</b>	<b>26</b>							<b>1650</b>	<b>41</b>



6. ELECTIVE COURSES FOR MECHANICAL ENGINEERING (*Any two to be taken*)

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Mark	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Internal Assessment		End Exam	Internal Assessment			
								Class Test	Assignment		Sessional	Viva		
41	M601	Foundry Technology	M408	3	0	0	70	15	15				100	3
42	M602	Automobile Engineering	M502	3	0	0	70	15	15				100	3
43	M603	Refrigerator & Air Conditioning	M502	3	0	0	70	15	15				100	3
44	M604	Production Technology	M408, M503	3	0	0	70	15	15				100	3
45	M605	Welding Technology	M408	3	0	0	70	15	15				100	3
<b>Total of Two Courses</b>				<b>6</b>	<b>0</b>	<b>0</b>							<b>200</b>	<b>6</b>



## MECHANICS OF MATERIALS

L      T      P  
3      2/2    2/2

Total Contact hrs.:

Total marks:150

Theory: 45

Tutorial: 15

Practical: 15

Theory Class duration:

45 classes of 1 hr. or

60 classes of 45 minutes

Pre requisite: 205

Credit: 4

Curri. Ref. No.: 401

Theory:

End Term Exam: 70

I.A: 30

Practical:

End Term Exam: 25

I.A:25

### RATIONALE:

Mechanics of Materials deals with the internal behaviour of variously loaded solid bodies, such as; shafts, bars, beams, plates, and columns, as well as structures and machines that are assemblies of these components. Mechanics of materials focuses primarily on mechanical properties of materials, analysis of stress, strain and evaluation of deformations. The subjects like structural analysis, design of structures as well as machines are based on adequate knowledge and understanding of Mechanics of Materials. Therefore, it is an important basic subject for Diploma students in Civil and Mechanical Engineering.

### AIM:

The aim of the subject Mechanics of Materials is to develop background preparation of students for taking up Engineering subjects like Theory and Design of Structures, Design of Machines mostly through the followings:

- Describe the Mechanical properties of important Engineering materials
- Determine stresses, strains and deformations in elastic bodies of different shapes under different loading conditions for engineering applications.
- Determine load carrying capacity of different types of members.

THEORY: 45 Hours

### UNIT TOPIC/SUB-TOPIC

### Hrs. Total hrs.

1.0	Introduction:	2
	1.1 Scope of the subject: Uses of structures, Importance of knowledge of: stress, strain, and deformation in a structure, permissible stresses in a material. Safety and Economy. Contents and importance of the subject.	
	1.2 Engineering Materials : Elastic material, linearly elastic material, ductile material, brittle material, composite material, isotropic material, orthotropic material (Definition, examples, and application).	
	• Identify different engineering materials in specific application.	
2.0	Stress and Strain:	12
	2.1 Introduction:Definitions of stress; types of stress-tensile, compressive and shear.	
	2.2 Stress-strain Diagram : Principle of tensile testing in Universal Testing Machine, Dimensions of a tensile test specimen, tensile test, elastic limit, elastic range, proportional limit, point of fracture, plastic range, strain hardening, ultimate stress, necking, ductility, yield strength, 0.2% proof stress, allowable stress of ductile and brittle materials, factor of safety.	
	• Identify the different parts of universal Testing Machine.	
	• Draw the sketch of a tensile test specimen.	
	• Draw the stress strain diagram for mild steel and indicate the different parts of the curve.	

### 2.3 Stress-strain Relations :

Hooke's law, Young's modulus, Shear modulus of rigidity, Poisson's ratio, generalized Hooke's law for two dimensional stress, relation among the elastic constants for an isotropic material.

- Distinguish among different elastic constants for a material

### 2.4 Riveted or Bolted Joints :

Single riveted/bolted lap joint, double riveted/bolted lap joint, triple riveted/bolted lap joint, single riveted/bolted double cover butt joint, double riveted/bolted double cover butt joint (no design).

- Determine stresses in rivets/bolts and plates.
- Determine size of rivet/bolt: for given load.

### 2.5 Stresses in Welded Joints : butt weld, fillet weld.

- Determine stresses in butt weld and fillet weld.

### 2.6 Stresses, strains, and Deformations of Axially Loaded Members :

Bars of varying section, taper rod, bars of composite section, rod and tube connected by bolted joint, temperature stresses.

- Solve simple problems on determination of stresses and shortening of axially loaded members.

### 2.7 Principal Stresses and Strains :

Plane stress - definition and expressions; stresses on inclined planes; Principal Stresses (no theoretical derivation) - principal planes, maximum or major principal stress, minimum or minor principal stress, maximum shear stress; Mohr's Circle — construction and interpretation.

- Determine principal stresses in an element with given stresses or at a point of a loaded member using standard formulae and indicate the same with the help of a Mohr's Circle (sketch only).

### 3.0 Analysis of beams:

10

3.1 Beam : definition, types of beams — Simply supported and cantilever beams, propped cantilever, fixed-ended and continuous beams.

- Identify different types of beams and loading conditions.
- Determine the support reactions and draw the free body diagram of a determinate beam.

### 3.2 Shearing force and Bending Moment in Beams :

Sign conventions and relationships among load, shearing force and bending moment.

### 3.3 Shear Force and Bending Moment Diagrams :

Cantilever beam with concentrated and uniformly distributed load, simply supported beam with uniformly distributed and varying loads.

- Draw the shear force and bending moment diagrams of a beam with given loads on it.

### 4.0 Simple Bending of Beams :

5

4.1 Centroid of an area, moment of inertia of beam cross- sections, parallel axis theorem, principal moments of inertia

4.2 Assumptions in simple bending, neutral surface, neutral axis determination of bending stresses in beams with simple cross sections and standard sections used in industry.

- Determine the moment of inertia, section modulus and moment of resistance of a beam cross-section.
- Determine the bending stresses in a beam under pure bending.

### 5.0 Torsion

4

5.1 Basic assumptions for pure torsion, torsion of circular shafts (hollow and solid, no proof) — polar moment of inertia, torsional shearing stress, angle of twist, torsional rigidity.

- Determine the maximum shear stress and angle of twist in shafts transmitting given torque.

5.2 Applications: Horse power transmitted by a shaft, Torque transmitted by a flange coupling and corresponding forces acting on coupling bolts, formula for stiffness of closed coil helical spring (no proof).

- Apply the torsion formula in determination of (a) safe power transmitted by a flange coupling (b) stiffness of helical springs.

- 6.0 Columns and Struts: 5
- 6.1 Definition of columns and struts; Buckling load (critical or crippling load); Slenderness ratio, Classification of columns as long and short columns.
- 6.2 Euler's Theory — Basic assumptions made in Euler's theory for column buckling, Effective lengths for different end conditions— both ends pinned, one end fixed and the other end free, both ends fixed, one end fixed and other end pinned.
- 6.3 Other Formulae — Practical deviations from ideal column, Rankine's formula, factor of safety for different column materials, IS - 800-codc formula for column design.
- Determine die critical budding load for a given column as per known formulae.
  - Determine factor of safety for a given column with known end conditions and loading
- 7.0 Slope and Deflection of Beams: 4
- 7.1 Introduction : Shape and nature of elastic curve (deflection curve). Importance of slope and deflection.
- 7.2 Expressions for slope and deflection of cantilever and simply supported beams under concentrated and uniformly distributed load. Principle of superposition for deflection and rotation.
- Determine the slope and deflection at a point of beams under given loads and supports conditions.
  - Solve problems of propped cantilevers from superposition of deflection at the prop.

### Class Test 3

PRACTICAL: 15 Hours

UNIT TOPIC/SUB-TOPIC hrs.	Hrs.	Total
8.0 SHEAR TEST:		2
8.1 Determination of Shear Modulus (Modulus of Rigidity ) of a soft material (with the apparatus similar to that in C.E Dept of TTTI, Calcutta)		
9.0 TENSILE TEST		2
9.1 Determination of Young's Modulus of a material in a tensile testing machine.		
10.0 HARDNESS TEST:		2
10.1 Determination of hardness of a material by a Brinell or Rockwell testing machine.		
11.0 IMPACT TEST:		2
11.1 Testing of Cast Iron (C.I.) and Mild Steel (M. S.) test pieces by Impact testing machine.		
12.0 FATIGUE TEST:		2
12.1 Testing of a Mild Steel (M. S.) test piece for fatigue.		
13.0 DEFLECTION OF BEAMS		2
13.1 Central Deflections (with the help of a dial gauge) of simple supported beam models (e.g., M. S. flat) with concentrated loads at the middle.		
13.2 Determination of Young's Modulus (E) for the material of a beam model by load deflection mediod.		
14.0 VIVA-VOCE:		3

**REFERENCE BOOKS :**

1. Elements of Strength of materials - by S. P. Timoshenko, D. H. Young; Affiliated East - West Press Private Limited.
2. Engineering Mechanics and Strength of materials - by R. K. Bansal; Laxmi Publications, New Delhi
3. Strength of Materials - by Surendra Singh; Vikas Publishing House Pvt. Ltd.
4. Strength of materials - by Ferdinand L. Singer; Harper & Row and John Weatherbill.
5. Theory and Problems of Strength of Materials - by William A. Nash; Shaum's outline of – Shaum's Outline Series, Me. Graw Hill. Inc.
6. Engineering Mechanics of Solids - by Egor P. Popov; Prentice Hall of India Private Limited, New Delhi.
7. Strength of Materials - by R.S. Khurmi
8. Strength of Materials - by Dr. Sadhu Singh; Khanna Publishers, Delhi-110 006.
9. Engineering Mechanics & Strength of Materials - by S. Ramamrutham; Dhanpat Rai Publishing Co., Delhi - 110 006.
10. Mechanics of Materials - by A. C. Ugural; Me. Graw Hill. Inc
11. Strength of Materials - by D.R. Malhotra and H.C. Gupta; Satya Prakashan, New Delhi-110 005.
12. Strength of Materials Through Problems - by B. K. Sarkar; Allied Publishers Limited, New Delhi - 110 002.0'

**BUILDING MATERIALS**

L      T      P  
3      0      2

Curri. Ref. No.: 402

Total Contact hrs.:

Total marks:150

Theory: 45

Theory:  
End Term Exam: 70

Practical: 30

I.A: 30

Theory Class duration:

Practical:

45 classes of 1 hr. or

End Term Exam: 25

60 classes of 45 minutes

I.A:25

Pre requisite: Nil

Credit: 4

**RATIONALE:**

The subject of building material is very important for the diploma holders in Civil Engineering. The course material has been designed for the students to know the properties of the building materials as well as the strength of the material as per IS code of practice. Further, practical input has been given for augmenting the learning by the students.

**AIM:**

To know the properties of different materials for use and quality control in construction works.

THEORY: 45 hrs.

<b>UNIT TOPIC/SUB-TOPIC</b>	<b>Hrs. Total hrs.</b>
1.0 Bricks	6
1.1 Brick earth — its composition & selection	
1.2 Brick making - preparation of brick earth moulding, drying, burning in kiln	
1.3 Classification of bricks, size of traditional and modular bricks, qualities of good building bricks	
1.4 Uses of brick bats and surkis, uses of hollow bricks	
2.0 Lime	1
2.1 Types of lime	
2.2 Uses of lime	
2.3 Testing of quality of lime	
3.0 Cement	3
3.1 Types of cements	
3.2 Properties of cements	
3.3 Testing of quality of cement	
4.0 Sand	2
4.1 Sources and classification of sand	
4.2 Bulking factor and fineness of sand	
4.3 Qualities and grading of sand for plaster and for masonry work as per BIS specifications (18:1542.2116,383)	
5.0 Stone	3
5.1 Classification of rock, uses of stone, natural bed of stone, qualities of good building stone	
5.2 Stone quarrying- tools for blasting, process of blasting, precautions in blasting, machines for quarrying, dressing of stone	
5.3 Characteristics of different types of stone and their uses	
6.0 Refractory material and clay products	2
6.1 Definition, classification of refractory	
6.2 Properties and uses of refractory like tiles, terracotta, porcelain , glazing	
7.0 Mortar and Concrete	10
7.1 Composition and properties of ingredients in both cement & lime mortar and concrete	
7.2 Properties and uses of cement & lime mortar and concrete	
7.3 Grading of aggregates in concrete	
7.4 Water- cement ratio	
7.5 Concreting- mechanical properties of aggregates, mixing of ingredients, placing, compacting and curing of concrete.	
7.6 Introduction to R.C.C	
7.7 Factors responsible for deterioration of concrete	
8.0 Timber	6
8.1 Classification and structures of timber	
8.2 Defects in timber	
8.3 Disease and decay of timber	
8.4 Seasoning and preservation of timber	
8.5 Manufacturing and uses of plywood	
8.6 Special characteristics of Assam type timber	
8.7 Substitute building materials of timber	
9.0 Paint, Varnish and Distemper	5
9.1 Purpose of painting a surface	
9.2 Characteristics of ideal paint and varnish	
9.3 Ingredients of paint and varnish	
9.4 Process of painting and varnishing	
9.5 Repainting of old surfaces	

9.6	Purpose of applying distemper, properties, ingredients, process of distemporing	
9.7	Application of white washing and colour washing	
10.0	Iron and steel	2
10.1	Uses of cast iron , wrought iron, mild steel and tor steel	
10.2	Classification and uses of steel	
11.0	Bituminous material	2
11.1	Distinction among tar, bitumen and asphalt	
11.2	Different types of asphalt and tar and their uses	

**Class Test 3**

TOTAL: 45

**12.0 PRACTICAL: 30hrs.**

**UNIT TOPIC/SUB-TOPIC**

**Hrs. Total hrs.**

12.1	Determination of normal consistency of cement	
12.2	Determination of Initial & Final Setting time of cement (sample of hardened ring marks after final setting to be shown to the students)	
12.3	Determination of fineness of cement by sieving and soundness of cement by Le Chatelicer apparatus	
12.4	Determination of compressive strength of cement	
12.5	Grading analysis of fine and coarse aggregates by sieving	
12.6	Determination of bulking of sand	
12.7	Determination of bulk density of coarse aggregate	
12.8	Determination of water absorption of brick	
12.9	Determination of compressive strength of brick	
12.10	Determination of Air content, Slump , Ve-bee and compaction factor of fresh concrete	
12.11	Determination of compressive strength of concrete	
12.12	Tensile testing of reinforcing rod	
12.13	Testing of timber beam for flexural and shear strengths	
12.14	Demonstration of the following non-destructive tests on concrete:	
(i)	Ultrasonic testing	
(ii)	Rebound hammer testing	

**REFERENCE OF BOOKS:**

1. Materials of Construction- by D.N.Ghoh, :Tata Mc-Grew Hills
2. Text book of materials- by Rangawala. :
3. Building Materials - by Shu S.K. Basu and Shri A.K. Ray;; S.K. Lahiri & Co. (P) Ltd
4. Civil Engineering Materials- T.T.T.I,Chandigarh, Tata McGraw Hills

**HYDRAULICS**

L T P  
3 0 2

Curri. Ref. No.: 403

Total Contact hrs.: Total marks:150

Theory: 45

Theory:  
End Term Exam: 70

Practical: 30

I.A: 30

Theory Class duration:

Practical:

45 classes of 1 hr. or

End Term Exam: 25

60 classes of 45 minutes

I.A:25

Pre requisite: Nil

Credit: 4



## RATIONALE:

The subject of Hydraulics deals with behaviour of fluid at rest and in motion. The Civil Engineering profession is much concerned with subjects like water supply, Sanitary Engineering and Irrigation Engineering, which need a sound knowledge of Hydraulics. Therefore, hydraulics is a very important basic subject for students of civil engineering.

## AIM:

To aim of the subject Hydraulics is to develop basic concepts regarding behaviour of fluid, specially water, at rest and in motion.

## THEORY

### UNIT TOPIC/SUB-TOPIC

Hrs. Total

hrs.

1.0	Hydrostatics:	11
	1.1 Properties of fluids, density, specific gravity, surface tension, capillarity, viscosity and their uses	
	1.2 Pressure and its measurements : Definitions-intensity of pressure, atmospheric pressure, gauge pressure, absolute pressure and vacuum pressure; Relation between atmospheric pressure, absolute pressure and gauge pressure, pressure head, pressure gauges	
	1.3 Pressure exerted on an immersed surface; Definitions- total pressure, resultant pressure, expression of equation for total pressure exerted on horizontal, vertical and inclined immersed surface (No deduction); Center of pressure and its expression.	
	1.4 Floatation and buoyancy: Archimedes principle- buoyancy & center of buoyancy, center of pressure, metacenter, metacentric height, determination of metacentric height by experimental method, equilibrium of floating bodies- stable, unstable & neutral equilibrium	
2.0	Kinematics of fluid flow	25
	2.1 Basic equations of fluid flow and their application (No deduction): rate of discharge, equation of continuity of a liquid flow, total energy of a liquid in motion-potential, kinetic & pressure, Bernoulli's theorem and its limitations. Practical applications of Bernoulli's equation.	
	2.2 Flow through Orifices: orifices, types of orifices, venacontracta, hydraulic coefficients and their relations, determination of hydraulic coefficients, discharge formulae for different types of orifices and their application (No deduction)	
	2.3 Flow through mouthpieces: mouthpieces, types of mouthpieces, discharge formulae for different types of mouthpieces and their application (No deduction)	
	2.4 Flow over Notches: notch, types of notches, discharge formulae for different: types of notches and their application (No deduction);	
	2.5 Flow over Weirs; weir and its difference with notches, types of weirs, discharge formulae for different types of weirs and their application (No deduction)	
	2.6 Types of Flow through pipes: uniform & non-uniform; laminar & turbulent; steady & unsteady; Reynold's number and its implication.	
	2.7 Losses of head of a liquid flowing through pipes: due to friction (statement of Darcy's equation), sudden enlargement, sudden contraction, change of direction of flow, loss at inlet & exit (No deduction, only statement of formulae and their application), total energy lines and hydraulic gradient lines.	
	2.8 Flow through Open Channels: types of channel sections- rectangular, trapezoidal & circular, Discharge formulae- Chazy's and Manning's equation, best economical section, phenomenon of hydraulic jump ( only description and no deduction)	
3.0	Pumps	3
	3.1 Types of pumps	

- 3.2 Centrifugal pumps - basic principles, discharge, horse power of pump, efficiency of centrifugal pump, simple numerical problems
- 3.3 Reciprocating pumps: types, operation, discharge, calculation of horse power, efficiency, simple numerical problems
- 4.0 Turbines 3
  - 4.1 Types of water wheels
  - 4.2 Impulse turbine - Basic principles of operation of impulse turbine
  - 4.3 Reaction turbine - Basic principles of operation of reaction turbine
  - 4.4 Layout sketch of a Hydropower Generating Station

**Class Test 3**

**TOTAL: 45**

**PRACTICAL**

**UNIT TOPIC/SUB-TOPIC**

**Hrs. Total hrs.**

- 5.0 Hydraulic Lab Practical 30
  - 5.1 Determination of metacentric height of a floating body
  - 5.2 Verification of Bernoulli's theorem
  - 5.3 Determination of the co-efficients of discharge, contraction and velocity of an orifice
  - 5.4 Determination of coefficient of discharge of a rectangular notch fitted in an open channel
  - 5.5 Determination of coefficient of discharge of a V- notch fitted in an open channel
  - 5.6 Determination of coefficient of discharge of a venturimeter, orificemeter fitted in a pipe
  - 5.7 Determination of head loss due to friction and coefficient of friction for flow through pipes.
  - 5.8 Study of the parts of a centrifugal pump
  - 5.9 Study of the parts of a reciprocating pump
  - 5.10 Study of the parts of a Pelton wheel
  - 5.11 Study of the parts of a Francis Turbine
  - 5.12 Demonstration of discharge measurement by a currentmeter

**TOTAL: 30**

**REFERENCE BOOKS:**

- 1.. Hydraulics - by Jagdish Lal; Metro Publishing Books Limited
- 2.. Hydraulics, Fluid Mechanics and Fluid Machines - by S. Ramamrutham; Dhanpat Rai & Sons, Delhi
3. Hydraulics - By R.S.Khurmi
4. Hydraulics - By Priyany
5. Hydraulics - By S.K-Lakhi
6. Hydraulics - By Dr.P.N.Modi & S.M.Seth
7. Hydraulics and Hydraulic Machinery - V. Thamkachalam, Tata McGraw-Hill Publishing Company Limited

**THEORY OF STRUCTURES**

L     T     P  
3     0     2

Curri. Ref. No.: 403

Total Contact hrs.:

Total marks:150

Theory: 45

Theory:  
End Term Exam: 70

Practical: 30

I.A: 30

Theory Class duration:

Practical:

45 classes of 1 hr. or

End Term Exam: 25

60 classes of 45 minutes  
Pre requisite: Nil  
Credit: 4

I.A:25

**RATIONALE:**

Theory of structures is a very important subject for diploma holders in Civil Engineering. Many of them are entrusted with the responsibility to supervise constructions, make minor remedial changes in maintenance work, analyze simple structures etc. An adequate knowledge of behavior of structures is very essential for developing self-confidence among the diplomats for delivering quality service of work. An understanding of 'why' part of structural behavior and failures enables them to give adequate comparative weightage of their attention to different components of construction supervision jobs. The course content has been designed with a view to enabling students to solve problems of beams related to permissible stresses in bending and shear, check the stability of dams and retaining walls, explain and apply the principle of superposition, analyze the determinate trusses, apply the formulae for deflection to solve the problems of propped cantilever, understand and draw qualitatively the deflected shapes of beams and frames to identify the positions of main reinforcements and apply the concept of principal stresses and strains to explain and identify different types of cracks in reinforced concrete beams. While teaching the deformation of indeterminate structures without going into theory and analysis, a teacher of the subject is advised to make use of indigenous flexible elastic models\*.

**AIM:**

The course content of 'Theory of Structures' aims at knowledge, concepts, and understanding of principles and behaviour of Civil Engineering Structures with related assumptions but without going into much theoretical derivation. In complicated cases, qualitative understanding is emphasized instead of quantitative analysis and evaluation rather than disregarding them as in die past.

<b>UNIT TOPIC/SUB-TOPIC hrs.</b>	<b>Hrs.</b>	<b>Total</b>
<b>1.0 BENDING AND SHEAR STRESSES IN BEAMS:</b>		<b>12</b>
1.1 Loads, beams, shearing forces, and bending moment — Explain types of loads, shearing force and bending moment, distinguish between simply supported and cantilever beams.		
1.2 Exercise — Calculate shearing forces and bending moments and draw the diagrams.		
1.3 Application to steel and timber beams — Calculate bending stresses in steel & timber beams, evaluate moment of resistance, solve numerical problems by applying the equations of bending, draw distribution of bending stress.		
1.4 Flitched beams — solve numerical problems on finding safe load of flitched beams, draw distribution of stresses, and find die moment of resistance given sections.		
1.5 Shear stress in beams—calculate shear stresses at different layers of a given beam, draw the distribution of shear stress for different structural sections (only application of formula).		

**Class Test: 1**

<b>2.0 DAMS AND RETAINING WALLS:</b>		<b>16</b>
2.1 Introduction - distinguish between dams and retaining walls, uses of dams and retaining walls.		
2.2 Stability of Concrete and masonry dams — Distinguish between concrete & masonry dams, check the stability of rectangular and trapezoidal dams with water face vertical, solve numerical problems.		

- 2.3 Detailed applications — Solve numerical problems on stability of cantilever retaining walls having vertical face to the earth with level earth and (b) surcharged earth, draw deflected shapes & positions of main reinforcements in different components of reinforced concrete cantilever retaining walls.
- 2.4 Superposition of stresses and its applications— Explain the principal of superposition of bending and axial stresses, state and explain the middle-third rule. Solve problems to calculate maximum and minimum pressures /stresses at die base of dams & retaining walls.

**Class Test 1**

- 3.0 FRAMED STRUCTURES: 11
- 3.1 Introduction — Define and explain statically determinate frames, distinguish between beams and determinate framed structures, state the important uses of determinate frames.
- 3.2 Methods of analysis — Explain the method of joints, method of sections and graphical method to solve determinate frames.
- 3.3 Applications — Find the forces in the members of simple trusses by methods of joint, section and graphical methods.
- 4.0\* DEFLECTION OF BEAMS: 18
- 4.1 Introduction — Explain why the beams deflect. Explain why the knowledge of beam deflection is important from the structural point of view.
- 4.2 Formulae and their applications — State and explain the formulae for deflection and rotation of simply supported beams and cantilevers under concentrated and uniformly distributed loads and end moments. Sketch die deflected shapes of determinate beams, apply the principal of superposition to solve propped cantilever beams for reactions, bending moment and shearing force diagrams.
- 4.3 Application to continuous beams — Explain and sketch the deflected shape of two and three-span continuous beams under symmetrical vertical loads (no theoretical proof or formula), indicate the positions of main reinforcements in reinforced concrete continuous beams.
- 4.4 Application to portal frames under horizontal loads — Sketch of deflected shape & nature of bending moment diagram in a symmetrical rectangular portal frame fixed at base due to horizontal nodal load (help of portal method may be taken to explain the nature). Explain concept of nodal load due to wind & seismic loads in multistoricd buildings. Explain the effect of reversal of loads, indicate die positions of main reinforcements in beams and columns due to horizontal load.
- 4.5 Application to portal frames under vertical loads — Sketch the deflected shape & nature of B.M. in a symmetrical rectangular portal frame due to symmetrical uniformly distributed vertical load. Indicate die positions of main reinforcements in R. C. portal frames.
- 4.6 Application to portal frames under horizontal and vertical loads — Explain me concept of superposition of loads for total deformations, combined actions and due process of internal resistance through reinforcements of members. Indicate the positions of main reinforcements for a symmetrical portal frame under combined horizontal and vertical loads.

**Class Test: 1**

- 5.0\* COMPLEX STRESSES AND STRAINS : 15
- 5.1 Principal stresses and Principal planes— Explain the occurrence and concept of normal and tangential stresses, define & explain the concept of principal stresses and principal planes and their orientation. State and explain the formulae with

assumptions (no proof) for major and minor principal stresses and their orientation. Solve numerical problems on complex stresses.

5.2 Stresses on a given plane — State and explain formulae (with no proof) for shear and normal stress components on any inclined plane. Solve numerical problems.

5.3 Use of Mohr's circle — Explain with assumptions the alternative graphical solution procedure (sketch only) by using Mohr's circle without proof. Supplement the solution of numerical problems by Mohr's circle method.

5.4 Application to reinforced concrete beams — Give explanation to cracking of concrete beams from the concept of principal tensile stress and strain, explain the orientation of shear cracks, flexural cracks and cracks due to combined bending and shear stresses in R.C. beams.

Class Test: 1

\*A short course should be conducted by TTTI, Calcutta, to explain how the subject, specially items 4.3 to 4.6 and all items 5.1 to 5.4 under Complex Stresses and Strains, be taught to the students of Polytechnic.

#### REFERENCE BOOKS:

1. Theory of Structure - by S. Ramamrutham
2. Theory of Structure - by R. S. Khurmi & J. K. Gui
3. Theory of Structure - by V. Rajaraman
4. Programmed Text in Strength of Materials -by TTTI, Chandigarh.
5. Analysis of structures, Vol. I - by V.N.Vazirani and M.M.Ratwani
6. Introduction to Mechanics of Solids -by E. P. Popov
7. Reinforced Concrete - by H. J. Shah
8. Strength of Materials - by R. S. Khurmi
9. Elements of Strength of Materials - by S. P. Timoshenko and D. .H. Young
10. Strength of Materials - by Surendra Singh

### CONSTRUCTION TECHNOLOGY

L      T      P  
4      0      0

Curri. Ref. No.: 405

Total Contact hrs.:

Total marks:100

Theory: 60

Theory:

End Tern Exam: 70

Theory Class duration:

IA: 30

60 classes of 1 hr. or

90 classes of 45 minutes

Pre requisite: Nil

Credit: 4

#### RATIONALE:

Many diploma holders in Civil Engineering are expected to supervise construction of buildings and other structures. To perform the above task, it is essential that students should have knowledge of various components of buildings like foundations, walls, roofs, staircases, floors etc., and their constructional details. Therefore, the subject of construction technology is very important for Civil Engineering diploma holders.

AIM:

The aim of the subject Construction Technology is mostly to impart knowledge of different components of a building and their construction details to the diploma students of Civil Engineering.

<b>UNIT TOPIC/SUB-TOPIC</b>	<b>Hrs. Total hrs.</b>
1.0 Introduction:	2
1.1 Definition of a building, classification of buildings based on occupancy	
1.2 Different parts of a building	
2.0 Site Investigation	3
2.1 Objectives of site investigation	
2.2 Site reconnaissance	
2.3 Site explorations - methods and sampling	
2.4 Field and laboratory tests.	
3 Site layout and control	3
3.1 Site layout & layout of storage materials	
3.2 Construction of temporary site structures and provision of temporary services, fencing and hoarding.	
4.0 Foundations:	5
4.1 Concept of foundation and its purpose	
4.2 Types of foundations -shallow and deep	
4.2.1 Shallow foundation-constructural details of:	
-Spread foundations for walls, thumb rules for depth and width of foundation and thickness of concrete block, stepped foundation, masonry pillars and concrete columns, raft foundation, combined footing	
4.2.2 Deep foundations; Pile foundations; their suitability, classification of piles according to function, material and installation of concrete piles (under-earned, bored, compacted)	
4.2.3 Construction: Preparing foundation plans, setting out, excavation, timbering and dewatering.	
5.0 Walls:	6
5.1 Purpose of walls	
5.2 Classification of walls - load bearing, non-load bearing walls, retaining	
5.3 Classification of walls as per materials of construction: brick, stone, reinforced brick, reinforced concrete, precast, hollow and solid concrete block and composite masonry walls.	
5.4 Brick masonry - Definition of terms: mortar, bond, facing, backing, hearting, column, pillar, jambs, reveals, soffit, plindi, plinth masonry, header, stretcher, bed of brick, bat, queen closer, king closer, frog and quoin	
5.4.1 Bond—meaning and necessity; English bond; Bond only 1, 1-1/2 and 2 Brick thick walls in English Bond. T, X and right angled corner junctions. Thickness for 1,1-1/2 and 2 bricksquare pillars in English Bond	
5.4.2 Construction of Brick walls - Method of laying bricks in walls, precautions observed in the construction of walls, method of bonding new brick work with old (Toothing, raking back and block bonding)	
5.4.3 Construction, expansion and contraction joints; purpose and constructural details	
5.5 Stone Masonry:	
5.5.1 Glossary of terms - Natural bed, bedding planes, string course, corbel, cornice, block-in- course, grouting, mouldings, templates, throating, through stones, parapet, coping, pilaster and buttress	
5.5.2 Types of Stone Masonry: Rubble Masonry: random and coarsed. Ashlar Masonry: Ashlar fine, Ashlar rough, Ashler facing, specifications for coarsed rubble masonry, principles to be observed in construction of stone masonry walls	

5.6	Partition walls: Constructional details, suitability and uses of brick and wooden partition walls	
5.7	Mortars - Preparation, use, average strength and suitability of cement, lime, lime cement, lime surkhi and mud mortar	
5.8	Scaffolding; Constructional details and suitability of mason's brick layers and tubular scaffolding	
5.9	Shoring and under pining: Types and uses	
5.10	Safety in construction of low rise and high rise buildings	
6.0	Arches and Lintels:	3
6.1	Meaning and use of arches and lintels:	
6.2	Glossary of terms used in arches and lintels - abutment, pier, arch ring, intrados, soffit, extrados, voussoiers, springer, springing line, crown, key stone, skew back, span, rise, depth of an arch, haunch, spandril, jambs, bearing, thickness of lintel, effective span	
6.3	Arches:	
6.3.1	Types of arches. - Semi circular, segmental, elliptical and parabolic, flat, inverted and relieving	
6.3.2	Stone arches and their construction	
6.3.3	Brick arches and their construction	
7.0	Doors and Windows:	4
7.1	Glossary of terms used in doors and windows	
7.2	Door - name, uses and sketches of metal doors, laced and battened doors, framed and paneled doors, glazed and paneled doors, flush doors, collapsible doors, rolling steel shutters, side sliding doors, door frames, PVC shutters and metal doors	
7.3	Windows - names, uses and sketches of metal windows, fully paneled windows, fully glazed windows, casement windows, fanlight windows and ventilators, sky light window frames, lowered shutters (emphasis shall be given for using metals and plastics etc. in place of timber)	
8.0	Damp Proofing:	4
8.1	Dampness and its ill effects on bricks, plaster, wooden fixtures, metal fixtures and reinforcement, damage to aesthetic appearance, damage to heat insulating materials, damage to stored articles and health, sources and causes of dampness	
8.2	Types of dampness - moisture penetrating the building from outside e.g., rainwater, surface water, ground moisture	
8.3	Moisture entrapped during construction i.e., moisture in concrete, masonry construction and plastering work etc.	
8.4	Moisture which originates in the building itself i.e., water in kitchen and bath rooms etc.	
8.5	Damp proofing materials and their specifications: rich concrete and mortar, bitumen, bitumen mastic	
8.6	Methods of damp proofing basement, ground floors plinth and walls, special damp proofing arrangements in bathrooms, WC and kitchen, damp proofing for roofs and window sills	
8.7	Plinth protection and aprons	
9.0	Floors:	4
9.1	Ground floors	
9.1.1	Glossary of terms-floor finish, topping, under layer, base course, rubble filling and their purpose	
9.1.2	Types of floor finishes - cast-in-situ, concrete flooring (monolithic, bonded) Terrazzo die flooring, cast-in-situ, Terrazzo flooring, Timber flooring, description with sketches of the methods of construction of the floors and their specifications, floor polishing equipment	
9.1.3	PVC floor, ceramic floor	
9.2	Upper floors	
9.2.1	Flooring on RCC slab	

9.2.2	Flooring on RB slab	
10.0	Roofs:	3
10.1	Types of roofs, concept of flat, pitched, hiped, arched and cell roofs	
10.2	Glossary of terms for pitched roofs - batten, eaves, barge, facia board, gable hip, lap, purlin, rafter, rag bolt, valley, ridge	
10.3	Drainage arrangement for pitched roofs	
10.4	Drainage arrangements for flat roofs	
11.0	Stairs:	4
11.1	Glossary of terms: Stair case, winders, landing, stringer, newel, baluster, riser, tread, width of staircase, hand rail, nosing	
11.2	Planning and layout of staircase: Relations between rise and tread, determination of width of stair, landing etc.	
11.3	Various types of layout - straight flight, dog legged, open well, quarter turn, half turn (newel and geometrical stairs), bifurcated stair, spiral stair	
12.0	Surface Finishes:	4
12.1	Plastering - classification according to use and finishes like grit finish, rough cast, pebble dashed, plain plaster etc., dubbing, proportion of mortars used for different plasters, preparation of mortars, techniques of plastering and curing	
12.2	Pointing - different types of pointing, mortar used and method of pointing	
12.3	Painting - preparation and application of paints on wooden, steel and plastered wall surfaces	
12.4	White washing, colour washing and distempering, application of cement and plastic paints	
12.5	Commonly used water repellent for exterior surfaces, their names and application	
13.0	Concept of Sesmics in Planning and Design of Buildings:	2
13.1	Introduction to earthquakes	
13.2	Magnitude and intensity, seismic zoning, seismograph	
13.3	Precautions to be observed in the design of earthquake prone buildings	
14.0	Building Planning:	3
14.1	Site selection: Factors to be considered for selection of site for residential, commercial, industrial and public building	
14.2	Basic principles of building planning, arrangement of doors, windows, cupboards etc., for residential building	
14.3	Orientation of building as oer BIS:766? in relation to sun and wind direction, rains, internal circulation and placement of towers within the available area	
15.0	Earthworks	7
15.1	Excavation	
15.2	Earth moving plant and equipment crawler and wheel tractors: Their functions, types, specifications and gradability	
15.3	Bull dozers and tractor pulled scrapers: — their uses, sizes and output, effect of grade and rolling resistance on the output of tractor pulled scrapes	
15.4	Earth loaders, placing and compacting earth tills	
15.5	Power shovels: —Functions, selection, sizes, shovel dimensions and clearances, output	
15.6	Draglines:- functions, types, sizes, output	
15.7	Safe lifting capacities and working ranges of cranes; hobs and trenching machines.	
	Class Tests	3
	<b>TOTAL: 60</b>	

**REFERENCE BOOKS:**

1. "A text Book of Building Construction" - by Gupta, Sushil Kumar, Singia, D.R., and Juneja



- BM; Ludhiana, Katsea Publishing Mouse.
2. "A Text Book of Building Construction" - by Deshpande, RS and Vartak, GV; Poona, United Book Corporation.
  3. "Building Construction" - by Rangwala, SC; Anand, Charotar Book Stall
  4. "A Text Book of Building Coonstruction" - by Kulkarm, GJ; Ahmedabad Book Depot
  5. "A Text Book of Building cøonstruction" - by Arora, SP and Bindra, SP; New Delhi Dhanpt Rai and Sons
  6. "A Text Book of Building Construction" - by Sharma, SK and Kaul, BK; Delhi, S Chand and Co.
  7. "Building Construction" - by Sushil Kumar; Delhi Standard Publishers Distributors.
  8. "A Text Book of Building Construction" - by Moorthy, NKR; Poona, Engineering Book Publishing Co.
  9. "Construction Equipment its Planning and Application" - by Verma, Mahesh
  10. "Construction Technology for Civil Engineering Technicians" – by Monckton P.L: Longman, London and New York, 1983
  11. "Construction Technology" – by Chudly, R; L.P Edition, Elbs, Vol 1-4 Elbs and Longman Group Ltd. London

### SURVEYING-I (Theory)

L     T     P  
3     0     4

Curri. Ref. No.: 406

Total Contact hrs.:

Total marks:200

Theory: 45

Theory:  
End Term Exam: 70

Practical: 60

I.A: 30

Theory Class duration:

Practical:

45 classes of 1 hr. or

End Term Exam: 50

60 classes of 45 minutes

I.A:50

Pre requisite: Nil

Credit: 5

#### RATIONALE:

Surveying is an essential component of the day to day work of a Civil Engineering Technician. The job includes conducting detailed surveying, plotting of survey data, preparation of survey maps etc. In view of its importance the course content has been divided into 2 parts and introduced sequentially as Surveying-I. Each theory course is accompanied by practical course work to provide hands on experience. The course content of Surveying-I includes the basic concept of surveying, horizontal linear and angular measurements and conducting surveys involving horizontal linear and angular measurements with stress on familiarization with various equipment used. It also includes vertical linear measurements to indicate the profile of the land surface by levelling has also been covered in details

#### AIM:

The course content of Surveying -I has been designed to provide adequate information to develop competency in a learner to-

1. Comprehend the concepts of surveying,
2. Carry out horizontal linear and angular measurements using appropriate equipment,
3. Conduct survey work in field using horizontal linear and angular measurements,
4. Record the data observed during the survey work,
5. Plot the survey map from the recorded data,
6. Compute the data required for plotting,
7. Interpret the plotted survey map and compute data from it.
8. Determination of elevations of points on the earth surface, using appropriate equipment,
9. Record the data observed during levelling,
10. Compute the data required for plotting,

**COURSE CONTENT:**

**UNIT TOPIC/SUB-TOPIC**

**Hrs. Total hrs.**

1.0 INTRODUCTION:		02
1.1 Definition of surveying and related terms		
1.2 Aims and objectives of surveying		
1.3 Primary division of surveying with their purposes		
1.4 Classification of surveying		
1.5 Principles of surveying		
1.6 Field work-essential features and organisation		
1.7 Office work-features, plotting, scales, effect of erroneous scale		
1.8 Maintenance and adjustments of instruments		
1.9 Precision and accuracy of measurements		
2.0 LINEAR MEASUREMENT:		04
2.1 Methods of measuring distance, their merits and demerits, Suitability :		
2.2 Instruments for measuring distance: a. Tapes- types, description (demonstration in class/lab), purposes, suitability, merits and demerits. b. Chains - types, description (demonstration in class/lab), purposes, suitability, merits and demerits.		
3.0 CHAINING:		06
3.1 Equipment and accessories for chaining- description(demonstration in class/lab), purpose		
3.2 Use of chain- unfolding & folding, use of arrows, reading a chain, testing and adjustment of chain (demonstration in class/lab).		
3.3 Ranging- Purpose, signaling, direct and indirect ranging, Line ranger-features and use, error due to incorrect ranging.		
3.4 Method of chaining- Role of leader and follower, Chaining on flat ground, Chaining on sloping ground- stepping method, Clinometer-features and use, slope correction, (demonstration in field)		
3.5 Field problems- Setting perpendicular with chain & tape, Chaining across different types of obstacles -		
(a) Chaining around obstacle possible: Vision free but chaining obstructed, both vision and chaining obstructed.		
(b) Chaining around obstacle not possible: Vision free but chaining obstructed, chaining free but vision obstructed. Numerical problems on chaining across obstacles		
3.6 Errors and mistakes in linear measurement classification, Sources of errors and remedies.		
3.7 Correction to measured lengths due to-incorrect length, temperature variation, pull, sag, numerical problem applying corrections		
3.8 Precautions during chaining, maintenance of equipment.		
4.0 CHAIN SURVEYING:		06
4.1 Purpose of chain surveying, Principles of chain surveying-well conditioned and ill conditioned triangles		

4.2	Accessories in chain surveying- features and use (detailed description to be covered in practical)	
4.3	Field books- single line & double line entry, field book recording (detailed description to be covered in practical)	
4.4	Reconnaissance survey- method, index map, reference sketch	
4.5	Selection of survey stations. Base line, Tie lines. Check lines	
4.6	Offsets- Necessity, Perpendicular and Oblique offsets, Setting offset with chain & tape, Instruments for setting offset- Cross Staff, Optical Square, features, use & handling(demonstration in field ), merits & demerits, suitability, sources of error & remedies, limiting length of offsets.	
4.7	Method of chain surveying, locating objects, recording entry in field book.	
4.8	Plotting- selection of scale, conventional signs, plotting on drawing sheet from field book data.	
4.9	Errors in chain surveying- causes & remedies, Precautions during chain surveying.	
5.0	ANGULAR MEASUREMENT:	08
5.1	Measurement of angles with chain & tape, with compass	
5.2	Compass- types- Surveyors' compass, Prismatic compass, features, parts, (detailed description to be covered in practical), merits & demerits, suitability of different types, testing & adjustment of compass	
5.3	Designation of angles- concept of meridians- Magnetic, True, Arbitrary Concept of bearings-Whole circle bearing, Quadrantal bearing, Reduced bearing, suitability of application, numerical problems on conversion of bearings.	
5.4	Use of compasses -setting in field-centering, leveling, taking readings (demonstration in field), concepts of Forebearing, Back bearing, Numerical problems on computation of interior & exterior angles from bearings.	
5.5	Effect of earth's magnetism- dip of needle, magnetic declination, variation in declination, numerical problems on application of correction for declination.	
5.6	Errors in angle measurement with compass- sources & remedies, precaution during use of compass, maintenance of compass.	
6.0	CHAIN AND COMPASS SURVEYING:	06
6.1	Principles of traversing- open & closed traverse, advantages & disadvantages over chain surveying.	
6.2	Methods of traversing- locating objects, field book entry.	
6.3	Local attraction -causes, detection, errors, corrections, Numerical problems on application of correction due to local attraction.	
6.4	Plotting of traverse- check of closing error in closed & open traverse, Bowditch's correction.	
6.5	Errors in chain & compass surveying-sources & remedies, precautions during chain & compass surveying.	
6.6	Computation of area from plotted survey map- planimeter, features, use of mensuration techniques - average ordinate rule, trapezoidal rule, simpson's rule.	
7.0	LEVELLING:	10
7.1	Purpose of levelling	
7.2	Definition of terms used in levelling- concepts of level surface. Horizontal surface, vertical surface, datum, R.L., B.M.	
7.3	Description of essential features and uses of different types of levelling instruments	
7.4	Concepts of line of collimat'on, axis of bubble tube, axis of telescope, Vertical axis	
7.5	Levelling staff- types, features and use	
7.6	Temporary adjustments of level-1, taking reading with level	
7.7	Concept of bench mark, BS, IS, FS, CP, HI	

- 7.8 Principles of levelling-Simple levelling. Differential levelling
- 7.9 Field data entry- level Book-Height of CoUimation method and Rise & Fall method, comparison. Numerical problems on reduction of levels applying both methods, Arithmetic check
- 7.10 Different types of levelling, uses and methods – Fly levelling, Check levelling. Profile levelling- longitudinal sections and cross-sections
- 7.11 Plotting of profiles
- 7.12 Effects of curvature and refraction, numerical problems on application of correction
- 7.13 Reciprocal levelling-principles, methods, numerical problems, Precise levelling
- 7.14 Difficulties in levelling, errors in levelling and precautions
- 7.15 Sensitiveness of bubble tube, determination of sensitiveness
- 7.16 Permanent adjustments of different types of levels
- 7.17 Setting grades and stakes, setting out grades of sewers and related problems

### **CLASS TEST & REVISION 03**

**TOTAL: 45**

#### **Reference:**

1. Surveying and Levelling Vol-1 by T.P Kanetkar& S.V Kulkarni, Grihi Prakash, Pune
2. Surveying Vol-1 by B.C Punmia; Lakshmi Publication, Delhi
3. A text book of surveying and leveling by Ragor, Khanna Publishers, Delhi
4. Surveying & Leveling by Hussain and Nagraj; S.Chand & Co. Delhi.
5. Surveying & Levelling by S.C Ragawala, Charotar Book Stall, Pune.
6. Surveying & leveling by N.N Basak, Tata Mac. Graw Hill
7. Plane Surveying by A.De; S.Chand & Co.

### **SURVEYING- I (Practical)**

#### **RATIONALE:**

Surveying being a practice oriented subject, the theoretical instruction has to be supplemented with practical instructions in the field. This course will give the students the opportunity for intensive hands-on -experience in the handling and use of various equipment and accessories used in surveying. The course will also lead to development of skills in the students of making appropriate recording of data in the field and of plotting the observed data.

The course content of surveying-I practical includes the use and handling of various equipment for horizontal linear and angular measurements and conducting surveys to prepare maps from horizontal linear and angular measurements and for determination of elevation of various points with the help of vertical measurements

#### **AIM:**

The course content of surveying-I practical has been designed to provide adequate hands-on -experience to develop the competency in a learner to-

1. Prepare survey map of a given plot of area by chain surveying using only horizontal linear measurements.
2. Prepare survey maps of a given plot of area by chain & compass traverse surveying using horizontal linear and angular measurements
3. Determine the reduced levels of various points using the dumpy level and tilting level
4. Prepare longitudinal sections and cross sections profile of road/canal
5. Find the difference of level between two points using the method of reciprocal levelling
6. Carry out permanent adjustments of dumpy level/ tilting level
7. Establish grades for sewer/ canal in the field

**COURSE CONTENT:**

Field exercises on:

**UNIT TOPIC/SUB-TOPIC****Hrs. Total hrs.**

1.0 LINEAR MEASUREMENTS:	
1.1 Study of the essential features of different types of chains and tapes, to describe the chains & tapes with neat sketches.	02
2.0 CHAINING;	
2.1 Testing and adjusting of a metric chain	
2.2 Measurement of distance between two points (more than 2 chain lengths apart) with chain including direct ranging	02
2.3 Setting out different types of triangles , given the lengths of sides with chain & tape	
2.4 Measurement of distance between two points by chaining across a sloping ground using- stepping method & a clinometer	02
2.5 Measurement of distance by chaining across obstacles on the chain line- (1) a pond (2) a building (3) a stream/ river (in the event of non-availability of stream/river, a pond or lake may be taken, considering that chaining around the same is not possible	04
3.0 CHAIN SURVEYING:	
3.1 Setting perpendicular offsets to various objects(at least 3) from a chain line using-(1) tape,(2) cross-staff,(3) optical square and comparing the accuracy of the 3 methods	02
3.2 Setting oblique offsets to objects (at least 3) from a chain line using tape	02
4.0 ANGULAR MEASUREMENT	
4.1 Study of features and parts of a Prismatic compass and a Surveyor's compass to describe the compasses by drawing neat sketches.	02
4.2 Testing and adjustment of Prismatic compass and Surveyor's compass	
4.3 Measurement of bearings of lines (at least 3 lines) and determination of included angles using Prismatic compass and Surveyor's compass.	02
4.4 Setting out triangles (at least 2) with compass, given the length and bearing of one side and included angles.	
5.0 CHAIN AND COMPASS SURVEYING:	
5.1 Setting out a closed traverse of 5 sides, using prismatic compass, given bearing of one line and included angles and lengths of sides.	02
5.2 Conducting chain & compass traverse surveying in a given plot of area (2 plots) and recording data in die field book.	04
(5 to 6 students/group)	04
5.3 Preparation of survey map by plotting, individually, the field book data from exercise and computation of the plotted area.	04
(Plotting should be done during class hours)	04
6.0 LEVELLING:	
6.1 Study of essential features and parts of different types of levels	02
6.2 Study of essential features of different types of levelling staves	02
6.3 Making temporary adjustments of Levels	02
6.4 Determining Reduced levels of five given points taking staff readings with Levels	
6.5 Determining die difference of levels between two points (3 pairs of points/ group) by taking staff readings from a single set up of level, recording the readings in level book and application of Arithmetic check	02

	6.6	Conduct Fly levelling (Compound) between two distant points with respect to the 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)	02
	6.7	Finding R.L of (1) roof, (2) chajja or canopy with reference to the R.L. of given B.M. by taking inverted staff reading	02
	6.8	Conduct profile levelling along the given alignment for a road/ canal for 150m lengdi, 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	04
	6.9	Plotting die profile of the a lignment surveyed in Exercise 6.8 and drawing the grade of alignment desired ( To be drawn during the class hours)	04
04	6.10	Computation of volume of earthwork, cutting and filling, required to obtain the desired grade from the plotting in Exercise 6.9	02
	6.11	Testing and conducting permanent adjustments of a dumpy level	02
	6.12	Setting out the given grades for a sewer along a given alignment	02

**TOTAL: 60**

**Note:** Grouping for each exercise will be Two students per group unless mentioned otherwise.

### CIVIL ENGINEERING DRAWING - I

L	T	P		Curri. Ref. No.: 407
0	0	4		
Total Contact hrs.:		Total marks:150		Practical
Practical: 60				End Term Exam: 100
Pre requisite: 202				IA: 50
Credit: 4				

**RATIONALE:**

This subject is very important for diploma holders in Civil Engineering as tills subject provides an input to the students to dr;iw the different structural elements accurately to a chosen scale as required for construcion. The students are required to make working drawings showing all different components of a structure so that the same may be easily read and the construction of different units of structures can be done once the working drawings are made available to the constructors.

**AIM:**

The subject aims to introduce the various parameters, which are required for drawing the geometric figures as well as components of different types of structures.

UNIT TOPIC/SUB-TOPIC	Hrs. Total hrs.
1.0 INTRODUCTION:	3
1.1 Introduction of civil engineering drawing – foundation plinth, conventional signs of brick masonry, stone masonry, concrete, use of scales (Plate No. 1)	
2.0 DOORS AND WINDOWS:	9
2.1 Different types of doors and windows with their parts (Plate No. 2)	
3.0 ROOF TRUSSES:	12

3.1	Different types of roof trusses such as king post trusses, queen post trusses (Plate No. 3)	
4.0	STAIRCASE:	09
4.1	Conventional sign of staircase, introduction of quarter turn, newel, dog legged, open well newel, open well geometrical, bifurcated, half turn geometrical staircases - only plan (Plate No. 4) Plan and elevation of newel & dog-legged staircase (Plate No. 5)	
5.0	BUILDING DRAWING:	24
5.1	Plan, elevation and section of simple single storeyed building with masonry wall with:	
	• Sloped roof with steel trusses	
	• RCC roof slabs with lintel	
	• Assam type building (Plate No. 6, 7, 8)	
5.2	Development of two storeyed building from line plans and specifications with details	
	• Site Plan	
	• Plan	
	• Elevation	
	• Foundation plan	
	• Sectional elevations (Plate No. 9)	

Class Test:

3

**TOTAL: 60**

**REFERENCE BOOKS:**

1. IS: 696-1972 - Bureau of Indian Standards
2. N.D. Bhatt - Elementary Engineering Drawing - Charotar Publishing House
3. S.C. Sharma - Engineering Drawing
4. Dharam Gupta - Engineering Drawing
5. R.B. Gupta - Machine drawing
6. Fraderik Egnisecks and other - Engineering Graphics
7. WarrenJ. Luzaddcr - Graphics for Engineers - Prentice Hall of India (Pvt.) Ltd.
8. KL. Narang - A Text Book of Engineering Drawing
9. G.R. Nagpal - Geometrical Drawing - Khanna Publishers
10. W. Abbott - Practical Geometry and Engineering Graphics - Blackie & Son (India) Ltd.
11. I.H. Morris - Geometrical Drawing for Art Students - Orient Longman
12. A.C. Parkinson - General Engineering Drawing - Sir Isaac Pitman and Sons Ltd., London
13. Succeeding with Auto CAD - a full course on 2D drafting and 3D modeling – by Berry Hawkes; Me. Graw Hill Inc., New York
14. Civil Engg. Drawing - by D.N. Ghosh
15. Civil Engg. Drawing - by Shah Kale
16. Civil Engg. Drawing - by TTTI, Bhopal, Work Book

**CIVIL ENGINEERING DRAWING - II**

L     T     P  
0     0     4

Curri. Ref. No.: 408

Total Contact hrs.:

Total marks:150

Practical: 60

Practical  
End Term Exam: 100

Pre requisite: C407

I.A: 50

Credit: 2

#### RATIONALE:

This subject deals with drawing to be made for different components of sanitary engineering, bridges & culverts, roads & railways and blue prints to be made of the drawings. It also relates to preparation of working drawing as required for actual drawing.

#### AIM:

To prepare the students to draw working drawing for different items pertaining to sanitary & water supply, bridges & culverts, roads & railways, plan, elevation & sections of RCC building etc. and to introduce the skill of computer aided drafting.

<b>UNIT TOPIC/SUB-TOPIC</b>	<b>Hrs. Total hrs.</b>
1.0 SANITARY ENGINEERING	08
1.1 Plan, Sectional elevation of sanitary latrine with septic tanks, inspection chambers; manholes, soak pits, showing soil pipe connection. (Plate No. 1)	
2.0 BRIDGE AND CULVERTS:	10
2.1 Plan, elevation, section of simple (i) timber bridge (ii) RCC bridge either freely supported hollow circular type(single span) or RC balanced cantilever (single span) as constructed by the local PWD. Drawings may be shown(from the existing blue-print) (Plate No. 2)	
2.2 Plan, elevation, section of a box culvert and hume pipe, culvert, RCC slab culvert. Drawing and Models may be shown (Plate No. 3)	
3.0 ROADS AND RAILWAYS:	06
3.1 Cross Section of (i) National highway/ state highway (ii) Major district road (iii) Minor district road (Plate NO. 4)	
3.2 Cross-section of Railway for B.G., M.G. and N.G. (Plate No. 5)	
4.0 COMPUTER AIDED DRAFTING:	24
(To use the Auto-CAD or any other similar drafting package to produce Civil engineering drawings such as. Plan Elevation, Section, etc. The use of commands will enable the students to perform different activities as listed below.)	
4.1 Making of , RC or masonry building and Culvert drawings.	
4.2 Editing /modifying of existing drawing.	
4.3 Dimensioning, drawing section lines and hashed section lines.	
4.4 Writing texts on Drawings.	
4.5 Display of drawings on Computer screens	
4.6 Making use of different settings of drawings related to scale unit, co-ordinate system.	
5.0 TRACING PAPER DRAWING AND BLUE PRINTING	09
5.1 Plan, elevation, and section of a single storied RCC Building on tracing paper from a given plan. Details of chajja, lintel and beams should be shown (Plate No, 6)	
Class Test:	03
TOTAL:	60

#### REFERENCE BOOKS:

1. IS: 696-1972 - Bureau of Indian Standards
2. N.D. Bhatt. - Elementary Engineering Drawing - Charotar Publishing House
3. S.C. Sharma - Engineering Drawing
4. Dharam Gupta - Engineering Drawing
5. Fradcrik Egnisecks and other - Engineering Graphics
6. Warren J. Luzadder - Graphics for Engineers - Prentice Hall of India (Pvt.) Ltd.
7. K.L. Narang - A Text Book of Engineering Drawing
8. G.R. Nagpal - Geometrical Drawing - Khanna Publishers
9. W. Abbott - Practical Geometry and Engineering Graphics - Blackie & Son (India) Ltd.
10. I.H. Morris - Geometrical Drawing for Art Students - Orient Longman



11. A.C. Parldnson - General Engineering Drawing - Sir Isaac Pitman and Sons Ltd.,
12. Auto CAD-14 for Windows Bible- By Shyam Tickoo.Santosh Tickoo and Renu Muthoo-galgotia Publications Pvt. Ltd.
13. A Text book Of Bridge Construction by Prof. C. H. Khadilkar- Allied Publishers, Bombay, New Delhi and Calcutta.

### **WORKSHOP (CIVIL ENGINEERING CONSTRUCTION)**

L	T	P		Curri. Ref. No.: 409
0	0	4		
Total Contact hrs.:		Total marks:100		Practical
Practical: 60				I.A: 50
Pre requisite: 203,204				
Credit: 4				

#### **UNIT TOPIC/SUB-TOPIC**

**Hrs. Total hrs.**

#### **WELDING SHOP**

- |  |   |
|--|---|
| 1.0 Shop talk:   | 2 |
| 1.1 What is welding and its engineering importance   |   |
| 1.2 Safety precautions to be observed during welding   |   |
| 1.3 Types of welding — Gas and Arc.  |   |
| 1.4 Equipment and accessories required for high and low pressure gas welding, their functions with demonstration. Adjustment of flame and their characteristics, use of flux, filler rod and their specifications. |   |
| 1.5 Arc welding tools and equipment, their functions with demonstrations, selection and specification of electrodes.   |   |
| 1.6 Common welding joints and their edge preparation   |   |
| 1.7 Welding defects and maintenance of arc and gas welding equipment   |   |
| 1.8 Demonstration of cutting by Gas.   |   |
| 2.0 Shop Practice:   | 3 |
| 2.1 Practice on gas welding, setting of flame carbonizing, neutral and oxidizing, metal depositing using filler rod on 4 mm. Thick flat or sheet and running a single bead.  |   |
| 2.2 Practice on are welding fusion run on M.S. flat bar 6mm. thick botii left ward and right ward for hand balancing.  |   |
| 2.3 Single Vee-Belt joint on M.S. flat 4 to 6 mm. thick with at least two runs.  |   |

#### **PLUMBING SHOP**

- |  |    |
|--|----|
| 3.0 Shop talk:   | 3  |
| 3.1 Role of plumbing in our day to day life  |    |
| 3.2 Description and use of plumbing tools and equipment  |    |
| 3.3 Plumbing materials and fitting e.g. various types of valves, taps etc. with demonstrations.  |    |
| 3.4 Pipe threading with die set  |    |
| 3.5 G. I. Pipe joints (flange, union, nipple sockets) C.I.A.C. and polyethylene pipe joints (with practical demonstration of at least two pipe joints) |    |
| 3.6 Study and demonstration of various types of water supply and sanitary fittings with layout.  |    |
| 3.7 Study of simple hand pumps and centrifugal pumps   |    |
| 3.8 Estimation of water supply and sanitary fittings for a domestic Building.  |    |
| 4.0 Shop Practice:   | 15 |

- 4.1 Practice of thread cutting on G. I. Pipes with adjustable click (making a short nipple)
- 4.2 Practice of thread cutting on both ends and bending of G.I. pipe pieces (making a G.I. bend)
- 4.3 Practice on cast iron to cast iron pipe joint using lead.
- 4.4 Practice on joining two A.C. Pipes with cement mortar
- 4.5 Practice on water pipe line connection for water tap, shower, wash basin and water closet (group task)

### **R.C.C AND MASONRY SHOP**

- 5.0 Shop talk: 4
  - 5.1 Role of R.C.C. and Masonry work in the field of construction
  - 5.2 Demonstration of various tools and equipment used in various R.C.C. and masonry work.
  - 5.3 Common materials used for R.C.C. and Masonry works
  - 5.4 Various brick bonds and use of closer, plastering, flooring
  - 5.5 Bending and binding M.S. rods for RCC structure (Lap, hook, crank-up bar)
  - 5.6 Lay-out of building plinth in die field
  - 5.7 White washing and distempering preparation and demonstration
  - 5.8 Form work of RCC structure-column, beam and slab.
  - 5.9 Method of inspection of a job.
- 6.0 Shop Practice: 15
  - 6.1 Preparation of cement Mortar at a given proportion for plastering
  - 6.2 Practice on brick bond - (i) .LlEnglish bond (ii) Flemish bond for a corner wall and a Tee-joint
  - 6.3 Casting of Reinforced cement concrete beam/slab with given proportion (;i) preparation of M.S. reinforcement including stirrups (b) study and provision of cover and form work (c) preparation of dry mixture and its calculation (d) mcd-iods of mixing and casting of the beam/slab (e) curing.
  - 6.4 Lay-out of a simple building (single storeyed)
  - 6.5 Making of mosaic tiles (size about 150 mm. x 150 mm. x 20 mm. thick)

### **ELECTRICAL SHOP**

- 7.0 Shop talk: 2
  - 7.1 Electrical shop work and their utility in day to day life
  - 7.2 Safety precautions to be observed during handling and operating electrical equipment, electrical shock treatment procedure.
  - 7.3 Common conductors and insulators (with display)
  - 7.4 Various types of cable and materials for earthing
  - 7.5 Common types of house wiring surface and concealed wiring
  - 7.6 Various types of domestic wiring, fitting and their positions
  - 7.7 Testing of installations (demonstration)
- 8.0 Shop Practice: 9
  - 8.1 Wiring with single and twin core cable connecting main switch and D.F.B., pendent lamp, bracket lamp, socket oudet, switch, installation of earth wire.
  - 8.2 Testing of electrical installation as per IE Rules, Trouble shooting of minor faults house or workshop wiring with some fault.
  - 8.3 Study of drawing for wiring of a two-storied building. Test and Viva Voce 6 (Jointly with all Workshops)

### **REFERENCE BOOKS :**

1. Elements of workshop Technology - by S. K. Hazra Chowdhury, Vol. I & II
2. A Text Book of Engg. Workshop -by C. G. Dixit
3. Engg. Workshop Manual - by E. Paul
4. Engg. Workshop Experiments - by H.W. Reece

## SURVEYING-II (Theory)

L     T     P  
3     0     4

Curri. Ref. No.: 501

Total Contact hrs.:                      Total marks:200  
Theory: 45  
Practical: 60  
Theory Class duration:  
45 classes of 1 hr. or  
60 classes of 45 minutes  
Pre requisite: C406  
Credit: 5

Theory:  
End Term Exam: 70  
I.A: 30  
Practical:  
End Term Exam: 50  
I.A:50

### RATIONALE:

Surveying- II is the sequential course following Surveying-I. The course covers die technique of preparing survey map by plotting the observed data on the map at the field itself, using the method of Plane Table Surveying. 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-11.

### AIM:

The course content of Surveying -II has been designed to provide adequate information to develop competency in a learner to- comprehend die concepts of plane table surveying,

1. Conduct plane table survey work in 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 CONTENT:

UNIT TOPIC/SUB-TOPIC	Hrs. Total hrs.
1.0 PLANE TABLE SURVEYING:	5
1.1 Objectives of plane table surveying, comparison with chain & compass surveying, use of plane table surveying	
1.2 Principles of plane table surveying	
1.3 Instruments & accessories in plane table surveying- features and uses	
1.4 Setting up plane table-centering, leveling, orientation	
1.5 Methods of plane table surveying- (1) Radiation, (2) Intersection, (3) Traversing, (4) Resection.	
1.6 Statements of TWO POINT and THREE POINT PROBLEM and their applications	
1.7 Errors in plane table surveying and their corrections, precautions in plane table surveying.	
1.8 Plane table surveying in a developed area like town.	
2.0 CONTOURING:	4

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, topographic maps	
2.4	Use of contour maps in engineering projects - drawing cross-sections from contour maps, locating proposed routes of roads/railway/canal on a contour map, computation of volume of earthwork from contour map for simple structures	
3.0	PRINCIPLES OF THEODOLITE SURVEYING:	4
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 adjustments of theodolite	
3.5	Concept of transiting-swinging, face left, 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 TRAVERSING:	6
4.1	Methods of traversing with theodolite- included 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 measurements 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	TRIGONOMETRICAL SURVEYING & TACHEOMETRY:	6
5.1	Determination of elevation and distances of objects whose base is accessible, numerical problems	
5.2	Determination of elevation and distances of objects whose base is inaccessible and the object and the instrument station (i) are in the same plane, (ii) are not in the same plane numerical problems	
5.3	Principles, stadia constants determination	
5.4	Stadia tacheometry with staff held vertical and with line of collimation horizontal or inclined, numerical problems	
5.5	Elevations and distances of staff stations-numerical problems use of tacheometry tables, numerical problems	
6.0	CURVES:	6
6.1	Definitions, degree and radius of curve, types of curves - simple, 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 instrumental angular methods (i) offsets from long chord; (ii) successive bisection of arc (iii) offsets from tangents (iv) offsets from chords produced (v) Rankine's method of tangential 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	PERMANENT ADJUSTMENT OF THEODOLITE:	2

7.1	Permanent adjustment of a transit theodolite for (i) plate level, (ii) line of sight, (iii) horizontal axis, (iv) altitude bubble, (v) vertical index frame	
8.0	SETTING OUTWORKS:	2
8.1	Methods of setting out layouts of structures from construction plans of (i) buildings, (ii) culverts, (iii) bridge piers	
9.0	MINOR SURVEYING INSTRUMENTS:	2
9.1	Essential features and use of - (i) Hand Level, (ii) Abney's Level, (iii) Pantograph, (iv) Ceylone Ghat Tracer, (v) Box Sextant	
10.0	MODERN SURVEYING METHODS:	5
10.1	Principles, features and use of (i) Microoptic theodolite/ digital theodolite, (ii) Electronic Distance Meter	
10.2	Working principles of a Total Station	
10.3	Principles, of aerial surveying, uses, interpretation of aerial photographs, stereoscopes-principles and uses	
10.4	Principles of remote sensing, uses, interpretation of remote sensing images	

### REVISION and CLASS TEST 3

**TOTAL 45**

### REFERENCE BOOKS:

1. Surveying & Levelling Vol.1, 11 - by T.P.Kanetkar & S.V.Kulkarni; Griha Prakash, Pune
2. Surveying Vol.1, II, III - by B.C.Punmia; Laxmi Publications, Delhi-6
3. A text book of surveying and levelling - by R.agor; Khanna Publishers, Delhi-6
4. Surveying and Levelling - by Hussain and Nagraj; S.Chand & Co, Delhi-
5. Surveying & Levelling - by S.C.Rangawala; Charotar Book Stall, Pune
6. Surveying and Levelling - by N.N.Basak; Tata Mcgrew Hill
7. Plane Surveying - by A.De; S.Chand & Co

## SURVEYING -II (Practical)

### RATIONALE:

Surveying being a practice oriented subject, the theoretical instruction has to be supplemented with practical instructions in the field. This course will give the students the opportunity for intensive hands-on-experience in the handling and use of various equipment and accessories used in surveying. The course will also lead to development of skills in the students of making appropriate recording of data in the field and of plotting the observed data.

The course content of surveying-II practical includes the handling and use of theodolite in traversing, trigonometrical surveying, application of tacheometry, setting out of curves and civil engineering works at the site. The course also gives an exposure to modern surveying techniques including the instruments used.

### AIM:

The course content of surveying-II practical has been designed to provide adequate hands-on-experience to develop the competency in a learner to-

1. Prepare survey map using plane table surveying
2. Use the transit theodolite for measurement of horizontal and vertical angles
3. Use the transit theodolite to carry out open and closed traverse survey
4. Determine with theodolite horizontal distances and heights of accessible and inaccessible objects
5. Use tacheometry to determine distances and differences of levels
6. Prepare curve tables for setting out curves
7. Set out simple circular curve using chain & tape and theodolite

8. Perform permanent adjustment of Transit theodolite
9. Setout center line and width of foundation for civil engineering works
10. Divide an area into plots of lands
11. Use modern surveying instruments

## **COURSE CONTENT**

### **Field exercises on:**

#### **UNIT TOPIC/SUB-TOPIC**

#### **Hrs. Total hrs.**

1.0 PLANE TABLE SURVEYING:	
1.1 Setting up of Plane Table and plotting five points by radiation method and five inaccessible points by intersection method	02
1.2 Conducting Plane Table surveying in a given plot of area by traversing ( at least a 5-sided traverse and locating the objects	04
2.0 CONTOURING:	
2.1 Locating contour points in the given area by direct - method/ indirect method	02
2.2 Conducting block level survey in the given area	02
2.3 Plotting and drawing contour lines of the block level survey in Exercise 2.2	02
2.4 Preparing the contour map of a given area by radial method	02
3.0 THEODOLITE:	
3.1 Study of essential features and parts of transit theodolite, to describe the theodolite with neat sketches	02
3.2 Carry out temporary adjustment of a transit theodolite and read horizontal and vertical 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	02
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	02
4.2 Plotting the traverse from exercise 4.1 and checking the error of closure	02
4.3 Setting out an open traverse with 5 sides and entering the field data	02
4.4 Plotting the traverse from exercise 4.3 and checking the error of closure	02
5.0 TRIGONOMETRICAL SURVEYING & TACHEOMETRY:	
5.1 Determination of height of 3 objects whose bases are accessible	02
5.2 Determination of stadia constants	02
5.3 Determination of horizontal distance and elevation with Staff vertical, by stadia method	04
6.0 SETTING OUT CURVES:	
6.1 Setting out a simple circular curve by offsets from long chord	02
6.2 Setting out a simple circular curve by offsets from the tangent	02
6.3 Setting out a simple circular curve by offsets from chords produced	02
6.4 Setting out a simple circular curve by Rankinc's method of tangential angle (Deflection angles)	
7.0 PERMANENT ADJUSTMENT OF THEODOLITE:	04
7.1 Adjustment of plate level	
7.2 Adjustment of line of sight	
7.3 Adjustment of die horizontal axis	
7.4 Adjustment of altitude bubble and vertical index frame	
8.0 SITE SURVEYING:	

- 8.1 Setting out at site the center line and foundation width of a building from the given plan  
02
- 8.2 Setting out the foundation line for a culvert 02
- 8.3 Dividing an area into plots of given size 02
- 9.0 MODERN SURVEYING INSTRUMENTS:
- 9.1 Study of essential features of (i) Microoptic theodolite/ digital theodolite, (ii) Electronic Distance Meter (iii) Total Station with EDM 02
- 9.2 Measure distance between two points with electronic distance meter 02
- 9.3 Measure distance, elevation, horizontal and vertical angle of an object with modern theodolite  
02

**TOTAL: 60**

### ESTIMATING -1

L	T	P		Curri. Ref. No.: 502
2	0	4		
Total Contact hrs.:			Total marks:150	Theory:
Theory: 30				End Term Exam: 70
Practical: 60				I.A: 30
Theory Class duration:				Practical:
30 classes of 1 hr. or				End Term Exam: 25
40 classes of 45 minutes				I.A:25
Pre requisite: Nil				
Credit: 4				

#### RATIONALE:

The subject of estimating is very important for the diploma holders in Civil Engineering. In order to construct any item, pertaining to Civil Engineering, one should have knowledge of resource required for the works as also the money required for completion of the job.

#### AIM:

To identify the schedule of works and make a correct estimate.

#### THEORY:

UNIT TOPIC/SUB-TOPIC	Hrs. Total hrs.
1.0 Introduction	3
1.1 What is estimating, uses of standard estimating forms, use of schedule of rates (procedure of taking out quantities) and mode of measurement as per IS: 1200	
1.2 Preparation of standard pro forma of estimate and abstract of various engineering works	
1.3 Unit of measurement and rate of payment	
2.0 Earth Work	3
2.1 Method of calculating quantity of earth, mid-sectional area method, prismoidal formula method, lead and lift, tabular forms for each method of calculating	
3.0 Road Work	2
3.1 Unit of measurement and method of estimating various items of work	
4.0 Concrete work	3
4.1 Method of estimating and costing mass concrete, reinforced concrete work and centering and shuttering work, preparation of bar bending schedule and taking out quantities of steel reinforcement in RCC for load bearing wall type buildings, RCC framed structures, RCC slab culverts, RCC retaining walls etc.	

5.0	Flooring	2
5.1	Method of estimating and costing of floor, floor finishing and DPC	
6.0	Finishing and decorating	2
6.1	Unit of measurement and method of estimating plastering and pointing	
6.2	Method of estimating white washing, colour and painting	
7.0	Sanitary and plumbing	2
7.1	Unit of measurement, method of estimating and costing of sanitary fittings and plumbing work in residential buildings	
8.0	Steel work and timber work	3
8.1	Unit of measurement and method of estimating and costing of a simple steel structure	
8.2	Unit of measurement, method of estimating and costing of timber work like roof trusses, timber bridges etc.	
9.0	Methods of Estimating, abstracting and billing of complete items of works	7
9.1	Double room/single storied building with wall foundation	
9.2	Double roomed single storied with front verandah, with wall foundation	
9.3	Three roomed single storied RCC framed building with front and back verandah	
9.4	Timber roof and steel roof trusses	
9.5	Bituminous road with cross slope	

**Class Test 3**

**TOTAL: 30**

10	Practicals	
10.1	To estimate the volume of earthwork required for excavation and filling of the trench for road construction	10
10.2	To prepare an estimate for sanitary & plumbing as required in a building.	8
10.3	To prepare an estimate for timber works for a roof trussed building.	10
10.4	To prepare an estimate for flooring items including finishing and decorating works	8
10.5	To prepare an estimate of a double storied R.C. building	24
	<b>TOTAL:</b>	<b>60</b>

**REFERENCE BOOKS:**

1. Estimating and costing - by B.N. Dutta & R.C. Rangwala
2. A Text Book of Estimating Costing and Accounts - by D.D. Kohli & R.C. Kar
3. Estimation, Costing & Specification by M. Chakravorty
4. Estimating & Costing by S. Ramamrutham, Charoathar Publishing Co.

**ESTIMATING - II**

L	T	P
1	0	4

Curri. Ref. No.: 503

Total Contact hrs.: Total marks:150

Theory: 15

Theory:  
End Term Exam: 70

Practical: 60

I.A: 30

Theory Class duration:

Practical:

15 classes of 1 hr. or

End Term Exam: 25

20 classes of 45 minutes

I.A:25

Pre requisite: Nil

Credit: 4

RATIONALE:



The subject of estimating is very important, as the students are required to know the various aspects of rate analysis, types of estimates, details of specifications for arriving at a correct estimate of a construction unit.

**AIM:**

The aim of the subject is to acquaint the students with the methods of estimating and to explain the reason behind.

**THEORY**

**UNIT TOPIC/SUB-TOPIC**

**Hrs. Total hrs.**

1.0	Rate Analysis	04
1.1	Analysis of rates of brick work, plain cement concrete work, RCC work, doors, windows, plastering, cement concrete floor, white washing centering and shuttering, damp proof course coverage, carriage of materials, earth work for foundation and for cutting and filling of trenches	
2.0	Types of estimates	04
2.1	Plinth area estimate, carpel are estimate, cube rate estimate, revised estimate, supplementary estimate, repair estimate	
2.2	Bill of quantities, building cost index, annual repair estimate	
3.0	General and detailed specification	04
3.1	Specification of earth work in excavation, first class brick and brick work , wood work in doors and windows, CGI sheet and AC sheet roofing, rolling and consolidation of road metals, construction of cement concrete floor, RCC slab/box culvert, plastering, white washing, plain concrete, cement mortar, mosaic floor, lime concrete in terracing centering and shuttering	
3.2	Describe the different forms of Valuation	
3.3	Describe the method of valuing the real estate properties both for free hold and lease hold. State the method of presentation of die valued properties in a tabular form	

**PRACTICAL**

4.0	Exercise	60
4.1	To prepare a detailed estimate of an irrigation canal fully in banking	
4.2	To prepare a detailed estimate of an irrigation canal fully in cutting	
4.3	To prepare a detailed estimate of an irrigation canal partly cutting and partly banking	
4.4	To prepare a detailed estimate of a double storied RCC framed building with verandah, latrines, septic tank, fencing wall with decorative finish (including plumbing, sanitary, steel and timber works)	
4.5	To prepare a detailed estimate of finishing items such as plastering, painting, varnishing etc.	
4.6	To prepare a supplementary estimate of a RC building for addition, alteration or deviation from the original plan of the building after part execution	
4.7	To prepare an estimate for annual repair of a RC building	

**Class Test**

**Class Test 3  
TOTAL: 75**

Note: The above exercise will be given to the students as specific guided project work. They will be supplied with necessary drawing details. These exercises should be preferably run in parallel with the theoretical instruction

**REFERENCE BOOKS:**

1. Estimating and costing - by B.N. Dutta & R.C. Rangwala
2. A Text Book of Estimating Costing and Accounts - by D.D. Kohli & R.C. Kar

2. Estimating, Costing and Specification - by M. Chakraborty
4. Estimating & Costing - by S. Ramamrutham; Charoathar Publishing Co.

### HIGHWAY ENGINEERING

L      T      P  
3      0      2

Curri. Ref. No.: 504

Total Contact hrs.:                      Total marks:150

Theory: 45

Theory:  
End Term Exam: 70

Practical: 30

I.A: 30

Theory Class duration:

Practical:  
End Term Exam: 25

45 classes of 1 hr. or

60 classes of 45 minutes

I.A:25

Pre requisite: Nil

Credit: 4

#### RATIONALE:

Construction of roads is one of the area in which diploma holders in Civil Engineering get employment. These diploma holders are responsible for construction and maintenance of highways. Basic concepts of road geometries, 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.

#### AIM:

To develop a thorough knowledge associated with different components of road & highway surveys & plans, construction, maintenance, drainage and related traffic engineering.

#### THEORY: 45

##### UNIT TOPIC/SUB-TOPIC

##### Hrs. Total hrs.

1.0 Introduction:	3
1.1 Importance of Highway transportation; Important organizations like Central Road Research Institute, Indian Roads Congress, Ministry of Surface Transport	
1.2 Functions of Indian Road Congress	
1.3 IRC classification of roads	
1.4 Organization of state highway department	
2.0 Road Geometries:	5
2.1 Glossary of terms used in geometric and their importance: Right of way, formation width, road 'margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient	
2.2 Design and average running speed, stopping and passing sight distance	
2.3 Necessity of curves, horizontal and vertical curves including transition curves and superelevation, Methods of providing superelevation	
2.4 Use of IRC design tables and specifications for finding elements of road geometries. Drawing of typical cross- sections in cutting and filling on straight alignment and at a curve	
3.0 Highway Surveys and Plans:	4
3.1 Designation of a topographic map, reading the data given on a topographic map	
3.2 Basic considerations governing alignment for a road in plain and hilly area	
3.3 Highway location; marking or alignment; importance of various stages viz.,	
a. Reconnaissance survey: Conduct reconnaissance and prepare reconnaissance report	
b. Preliminary survey: Object, organizing, conducting and information to be collected	
c. Location survey	

	d. Standards for preparing the highway plans as per Ministry of Surface Transport (MOST)	
4.0	Road Materials:	6
	4.1 Different types of road materials in use; soil, aggregates binders	
	4.2 Function of soil as highway subgrade	
	4.3 California Bearing Ratio; methods of finding CBR values in the laboratory and at site and their significance	
	4.4 Testing aggregates: Abrasion test, impact test, crushing strength test, water absorption test and soundness test	
	4.5 Aggregates: Availability of road aggregates in India, requirements of road aggregates as per IS specifications	
	4.6 Binders: Common binders; cement, bitumen and Tar, properties as per IS specifications, penetration and viscosity test of bitumen, procedures and a significance, cut back and emulsion and their uses	
5.0	Road Pavements:	6
	5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components	
	5.2 Sub-grade preparation: Setting out alignment of road, setting out bench marks, control pegs for embankment and cutting, borrow pits, making profiles of embankment, construction of embankment, compaction, stabilization, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation	
	5.3 Flexible pavements: necessity of sub base, stabilized sub base; purpose of stabilization. Types of stabilization:	
	a. Mechanical stabilization	
	b. Lime stabilization	
	c. Cement stabilization	
	d. Fly ash stabilization	
	5.4 Base Course:	
	Preparation of base course:	
	a. Brick soling	
	b. Stone soling	
	c; Metalling: Water bound macadam and bituminous macadams	
	5.5 Surfacing: Types of surfacing	
	a. Surface dressing	
	b. (i) premix carpet	
	(ii) semi dense carpet	
	c. Bituminous concrete	
	d. Grouting	
	Methods of constructions as per Ministry of Surface Transport, specifications and quality control.	
	5.6 Rigid Pavements:	
	Construction of concrete roads as per IRC specifications: Form laying, mixing and placing the concrete, compacting and finishing, curing, joints in concrete pavement, equipment used	
6.0	Hill Roads:	3
	6.1 Introduction:	
	Typical cross-sections showing all details of a typical hill road in cut, partly in cutting and partly in filling	
	6.3 Breast Walls, retaining walls, different types of bends	
	6.2 Land slides:	
	Causes prevention and control measures	
7.0	Road Drainage:	3
	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	
8.0	Road Maintenance:	4
8.1	Common types of road failures - their causes and remedies	
8.2	Maintenance of bituminous road such as patch work and resurfacing	
8.3	Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (berms), maintenance of traffic control devices	
9.0	Construction Equipment:	3
	Output and use of the following plant and equipment:	
9.1	Hot mixing 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	
10.0	Traffic studies:	5
10.1	Basic concept of traffic study	
10.2	Advantages and Disadvantages of traffic control signal	
10.3	Road junction and road marking stating their importance	
10.4	Types of traffic aggregation and their advantage	
10.5	Traffic island and refuge island; advantages and disadvantages	
Class Test		3
	TOTAL	
	45	

**PRACTICAL: 30**

**UNIT TOPIC/SUB-TOPIC**

**Hrs. Total hrs.**

11.0	Excercises	30
11.1	Determination of the California bearing ratio (CBR) for the sub-grade soil	3
11.2	Determination of penetration value of bitumen	3
11.3	Determination of softening point of Bitumen	3
11.4	Determination of impact value and crushing value of the road aggregate	3
11.5	Determination of abrasion value of road aggregate	3
11.6	Determination of ductility of bitumen	3
11.7	Determination of viscosity of tar/bitumen	3
	Viva-voce	9

**REFERENCE BOOKS:**

1. Principles and Practices of Highway Engineering - by R.C. Sharma & K.K. Sharma; Wiley Eastern
2. Highway Engineering - by Dr. N.K. Vaswani; Roorkee
3. Highway Material Tests - by S.K. Khanna & C.E.J. Justo; Nemchand & Bros.
4. Highway and Airport Engineering - by Priani, VB; Anand, Charotar Book Stall
5. A text Book on Highway Engineering and Airport - by Sehgal, SB and Bhanot; S Chand and Co., Delhi
6. A Course on Highway Engineering - by Bindra, SP; Dhanpat Rai and Sons, New Delhi
7. Principles and Practice of Highway Engineering - by Sharma, RC and Sharma, SK; Asia Publishing House.

## WATER SUPPLY & SANITARY ENGINEERING (Theory)

L      T      P  
4      0      2

Curri. Ref. No.: 505

Total Contact hrs.:                      Total marks:150

Theory: 60

Theory:  
End Term Exam: 70  
(35 from each half)

Practical: 30

I.A: 30

Theory Class duration:

60 classes of 1 hr. or

80 classes of 45 minutes

25

Practical:  
End Term Exam:

Pre requisite: C403

I.A:25

Credit: 5

### RATIONALE:

Providing potable water, one of the basic necessities of life, to a community is an important activity of a civil engineer. Knowledge and skill in the field of water supply engineering and waste water disposal is essential for maintaining the health and sanitation of a community.

### AIM:

The course content of Water Supply & Sanitary Engineering has been designed to provide adequate information to develop competency in a learner to-

1. Estimate the water requirements of a community
2. Select suitable source for a water supply project
3. Analyze the quality of water to determine its suitability for drinking
4. Identify the appropriate treatment processes required for making the water potable
5. Construct, operate and maintain the various units of water treatment plants
6. Lay out the necessary arrangement of pipe systems and structures for conveying water from the source to the treatment plant and for supply of treated water from the treatment plant to the consumer inside the building.
7. Estimate the volume of various types of sewage from a community
8. Layout the necessary sewerage system along with the appurtenances for collection and disposal of sewage
9. Analyze the sewage characteristics to determine the degree of treatment required for disposal according to government standards
10. Identify the appropriate treatment processes required to make the sewage fit for disposal
11. Construct, operate and maintain the various units of waste water treatment plants
12. Implement rural water supply and sanitation projects

### COURSE CONTENT:

#### WATER SUPPLY ENGINEERING

#### UNIT TOPIC/SUB-TOPIC

Hrs. Total hrs.

1.0 INTRODUCTION:	01
1.1 Necessity of protected water supply	
1.2 Historical development	
1.3 Brief description of water supply system	
2.0 QUANTITY OF WATER:	03
2.1 Water requirements and different uses of water	
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:	05

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:	03
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-types, 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 )		
4.5	Laying of pipes- method, testing	
4.6	Pipe corrosion- cause and remedies	
5.0	QUALITY OF WATER:	02
5.1	Impurities in water- organic and inorganic, classification	
5.2	Harmful effects of impurities	
5.3	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)	
5.4	Water quality standards for different uses	
6.0	TREATMENT OF WATER:	08
(Note:		
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 be 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, cleaning & maintenance	
	• Rapid Sand Filter- essential features, operation, cleaning & 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 disinfectant	
	• 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	
6.3	Chemicals required in various treatment units, their uses and feeding devices	
6.4	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:	05
7.1	General requirements, types of distribution system- gravity, direct and combined	
7.2	Methods of supply- intermittent and continuous	
7.3	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 pipe	
7.4	Storage- necessity, types- underground, ground level, overhead reservoirs, suitability, accessories	
7.5	Distribution system layout- types, comparison, suitability	
7.6	Loss and wastage-causes, detection, remedial measures	
8.0	APPURTENANCES IN DISTRIBUTION SYSTEM:	01
8.1	Valves-types, features, uses, purpose-slucice valves, check valves, air valves, scour valves	
8.2	Fire hydrants	
8.3	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:	03
9.1	Method of connection from water mains to building supply	
9.2	General layout of plumbing arrangement for water supply In single-storied and multi -storied building as per I.S. code	
9.3	Water supply fittings-features, uses, purpose, fixing and jointing	
9.4	Hot water supply- Electric water heater. Solar water heater features, fittings and fixing	

**SANITARY ENGINEERING**  
**UNIT TOPIC/SUB-TOPIC**

	Hrs, Total hrs.
10.0 INTRODUCTION:	01
10.1 Aims and objectives of sanitary engineering	
10.2 Definition of terms related to sanitary engineering	
10.3 Systems of collection of wastes- Conservancy and Water Carriage System- features, comparison, suitability	
11.0 QUANTITY OF SEWAGE:	02
11.1 Quantity of sanitary sewage- domestic & industrial Sewage, variations in sewage flow, numerical problem on computation quantity of sanitary sewage. Storm water flow-rational method of computation of flow	
11.2 Computation of size of sewer, application of Chazy's formula, Limiting velocities of flow- self-cleaning and scouring	

12.0	SEWARAGE SYSTEM:	03
	12.1 Types of system,-separate, combined, partially separate, features, comparison between the types, suitability	
	12.2 Shapes of sewer- rectangular, circular, ovoid-features, suitability	
	12.3 Sewer materials-features, suitability, handling & maintenance- stoneware, cast iron, cement concrete, asbestos cement, pre-cast & cast in situ sewer	
	12.4 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:	03
	13.1 Manholes and Lampholes- types, features, location, function, construction	
	13.2 Inlets, Grease & oil trap- features, location, function construction	
	13.3 Storm regulator, inverted syphon-feature, location, function, construction	
	13.4 Sewage Pumping- necessity, ejectors, location, component of pumping station, types of pumps and selection.	
14.0	SEWAGE CHARACTERISTICS:	02
	14.1 General importance, strength of sewage, Characteristics of sewage-physical, chemical & biological	
	14.2 Analysis of sewage-sampling , tests for- solids, pH, dissolved oxygen, BOD, COD, Nitrogen (Detailed methods of test to be discussed in laboratory)	
	14.3 Significance of parameters	
	14.4 Bacteriology of sewage-decomposition cycles of sewage- aerobic & anaerobic - C,N,S cycle	
15.0	SEWAGE DISPOSAL:	02
	15.1 Disposal on land-sewage farming, sewage application and dosing, sewage sickness-causes & remedies	
	15.2 Disposal by dilution-standards for disposal in different types Of water-bodies, self purification of stream	
16.0	SEWAGE TREATMENT:	08
	[Note: 1. Design of treatment units excluded.	
	2. Students may be asked to prepare detailed sketches of units, preferable from working drawing as home assignment	
	3. The field visit to treatment plant under practical should be arranged after covering this unit.)	
	16.1 Principles of treatment. Flow diagram of conventional treatment	
	16.2 Primary treatment - necessity, principles, essential features, functions, operation and maintenance of different units-Screens and racks, Grit chamber, primary sedimentation tank	
	16.3 Secondary treatment - necessity, principles, essential features, functions, operation and maintenance of different units-contact bed, trickling filter, activated sludge process, aerated lagoon, oxidation ditch, rotating biological disc	
	16.4 Sludge disposal-sludge digestion - necessity, principles, features, Operation, construction of sludge digesters, disposal of digested sludge	
	16.5 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:	02
	17.1 Requirements of building drainage, layout of lavatory blocks in residential buildings, layout of building drainage	
	17.2 Plumbing arrangement of single storied & multi-storied Building as per I.S. code of practice	
	17.3 Sanitary fixtures -features, function, and maintenance and fixing of the fixtures-water closets, flushing cisterns, urinals, inspection chambers, traps, anti-syphonage pipe	
	17.4 Inspection, testing and maintenance of sanitary fixtures	



- 18.0 RURAL WATER SUPPLY & SANITATION: 03
- 18.1 Spring water source- development, sanitary protection, Maintenance
  - 18.2 Roof top rain water harvesting -techniques , elementary Treatment, storage, maintenance
  - 18.3 Single pit & two pit latrine-features, construction, Maintenance, disposal of sludge

**CLASS TEST: 03**  
**TOTAL: 60**

**Reference Books :**

1. Text book on Water Supply and Sanitary Engineering – by G.S Birdhe
2. Public Health Engineering – by Hussain
3. Water Supply & Sanitary Engineering – by Ranghawal
4. Environment Engineering – by Duggal
5. Water Supply & Sewage – by Steel
6. Environmental Engineering by A.K Chatterjee
7. CPHEEO manual Water Supply – by Ministry of Urban Development, Govt. of India
8. CPHEEO Manual Sewage & Ministry of urban Sewage treatment – by Development, Govt. of India.

**WATER SUPPLY & SANITARY ENGINEERING (Practical)**

**RATIONALE:**

Laboratory practice is an essential component for study of the subject water supply & sanitary engineering. Data obtained tests conducted in the laboratory are the basis of decision-making process adopted in the field. The course work includes the tests for determination of essential parameters for assessing the quality of water and characteristics of waste water.

**AIM:**

The course content of water supply & sanitary engineering practical has been designed to provide adequate hands-on-experience to develop the competency in a learner to -

1. Assess the suitability of a water sample for drinking water use
2. Determine the chemical dosage requirements in various stages of water treatment process
3. Assess the characteristics of a waste water sample.

**COURSE CONTENT:**

The students will perform the following tests/exercises to determine different parameters of given samples of water and waste water.

<b>UNIT TOPIC/SUB-TOPIC</b>	<b>Hrs. Total hrs.</b>
1.0 Determination of Turbidity of a water sample using Turbidimeter/ Nephelometer/ Jackson's Candle Turbidimeter.	2
2.0 Determination of PH of a water sample using (a) PH-meter (b) colour comparator	2
3.0 Determination of conductivity of a water sample using conductivity meter	
4.0 Determination of Acidity/ Alkalinity of a water sample using method of Titration	2

5.0	Determination of Iron content of a water sample calorimetric method using Nessler's Tubes	2
6.0	Determination of chloride content of a water sample using method of titration	2
7.0	Determination of Bacteriological quality of a water sample by Coliform Test	2
8.0	Determination of Coagulant (Alum) dose requirement for a turbid water sample by method of Jar Test	2
9.0	Determination of Dissolved Oxygen of a water sample, collected from the field, using Winkler's method	2
10.0	Determination of total solids, suspended solids and dissolved solids of a waste water sample by Gravimetric method	2
11.0	Determination of Bio-chemical Oxygen Demand (BOD) of a waste water sample	2
12.0	Study of different types of pipe joints, valves, water meters	2
13.0	Study of Plumbing fixtures and fitting for water supply & sanitary arrangement	2
14.0	Field visits to study	
14.1	Water Supply and Sewage System of the Polytechnic Campus, including a building	2
14.2	A Water treatment Plant	2
14.3	A Waste water Treatment Plant	2
	<b>TOTAL</b>	<b>30</b>

### IRRIGATION ENGINEERING

L      T      P  
3      0      0

Curri. Ref. No.: 506

Total Contact hrs.:

Total marks:150

Theory: 45

Theory:

End Term Exam: 70

Theory Class duration:

I.A: 30

45 classes of 1 hr. or

60 classes of 45 minutes

Pre requisite: C403

Credit: 3

#### RATIONALE:

Many diploma holders in civil engineering supervise the construction or perform the maintenance of canals, head-works, river training works, cross drainage works, regulatory and other works. Some of diploma holders are also engaged for preventing water logging and irrigation by tube-wells. For a state which does not have a major Irrigation System the subject can be offered as an elective one so that a willing student can plan his carrier in Irrigation Engineering.

#### Aim:

This subject Irrigation Engineering aims imparting knowledge regarding hydrology, flow irrigation - storage and distribution system, constructional features of head works, river training works, cross drainage works, causes and prevention of water logging and construction of tube-wells.

#### UNIT TOPIC/SUB-TOPIC

**Hrs. Total hrs.**

1.0 INTRODUCTION:

2

1.1	Definition of irrigation	
1.2	Necessity of irrigation	
1.3	History of development of irrigation in India	
1.4	Types of irrigation	
1.5	Sources of irrigation water	
2.0	RAIN FALL AND RUN OFF	3
2.1	Definition of rainfall and run-off. Catchment area, relationship, Dicken's and Ryve's formulae	
2.2	Types of rain gauges - Automatic and non-automatic	
2.3	Stream gauging	
2.4	Concepts of Flydrograph	
3.0	WATER REQUIREMENT OP CROPS	3
3.1	Definition of crop season	
3.2	Duty, Delta and Base Period, their relationship	
3.3	Gross command area, culturable command area, Intensity of Irrigation, Irrigable area	
3.4	Water requirement of different crops - Kharif and Rabi	
4.0	LIFT IRRIGATION:	4
4.1	Types of wells - shallow and deep well, aquifer types, ground water flow, construction of open wells and tube- wells	
4.2	Yield of an open tube-well and problems	
4.3	Methods of lifting water - Manual and mechanical devices, use of wind mills	
5.0	FLOW IRRIGATION:	7
5.1	Irrigation canals	
5.2	Perennial irrigation	
5.3	Different parts of irrigation canals and their functions	
5.4	Sketches of different canal cross-sections	
5.5	Classification of canals according to their alignment	
5.6	Design of irrigation canals - Chezy's formula. Mannings formula, Kennedy's and Lacey's silt theories and equations, comparison of above two silt theories, critical velocity ratio	
5.7	Various types of canal lining - Advantages and disadvantages	
6.0	DIVERSION HEAD WORKS:	3
6.1	Definition, necessity & objective	
6.2	General layout, functions of different parts of barrage	
6.3	Difference between weir and barrage	
7.0	REGULATORY WORKS:	3
7.1	Functions and explanation of terms used	
7.2	Cross and head regulators	
7.3	Falls	
7.4	Energy dissipaters	
7.5	Outlets - different types	
7.6	Escapes	
8.0	CROSS DRAINAGE WORKS:	3
8.1	Functions and necessity of the following types: aqueduct, siphon, super-passage, level crossing, inlet and outlet	
8.2	Constructional detail of the above	
9.0	FLOOD CONTROL:	8
9.1	Necessity, storage structure - dam: Classification: Earthen, masonry and concrete dams	
9.2	Earthen dams - types, necessity, advantages of earthen dams, materials used in construction, compaction of soil, drainage problem, causes of failure and protection against failures	
9.3	Masonry and concrete dams: Forces acting on the dam, stresses developed at the base, solution of numerical problems	

9.4	Labeled cross section of gravity dam. Spillways	
9.5	River training works	
10.0	WATER LOGGING AND DRAINAGE:	2
10.1	Definition, causes and effects, detection, prevention and remedies	
10.2	Surface and sub-surface drains and their layout	
11.0	TUBEWELL IRRIGATION:	4
11.1	Introduction, occurrence of ground water/location and command, advantages of tube-walls.	
11.2	Tube-wells, explanation of terms water table, radius of influence, depression head, cone of depression, confined and unconfined aquifers	
11.3	Types of tube-wells and their choice-cavity, strainer and slotted type	
11.4	Method of construction— boring, installation of well assembly, development of well, pump selection, installation and maintenance	

Class Tests: 3

**REFERENCES:**

1. Irrigation Engineering - by Basak, N.N.; Tata Mc-Graw Hill
2. A Text Book on Irrigation Engineering - by Singhal, RP; Singhal Publications
3. Fundamentals of Irrigation Engineering - by Bharat Singh; Roorkee, Nem Chand & Bros.
4. Irrigation Engineering and Hydraulics Structures - by Garg, Santosh Kumar; Khanna Publishers, Delhi
5. Irrigation and Water Power Engineering - by Purnima, BC and Pande Brij Bansi Lal; Standard Publishers Distributors, Delhi
6. Text Book of Irrigation Engineering and Hydraulics Structures - by Sharma, RK; Oxford and IBH Publishing Company, New Delhi
7. Principles and Practice of Irrigation Engineering - by Sharma, SK; Prentice Hall of India Pvt. Ltd., New Delhi

**GEO-TECHNICAL ENGINEERING**

L     T     P  
3     0     2

Curri. Ref. No.: 504

Total Contact hrs.:

Total marks:150

Theory: 45

Theory:  
End Term Exam: 70

Practical: 30

I.A: 30

Theory Class duration:

45 classes of 1 hr. or

60 classes of 45 minutes

Practical:  
End Term Exam: 25

I.A:25

Pre requisite: Nil

Credit: 4

**RATIONALE:**

The knowledge and skills of Geo-Technical Engineering provided is as important as any other subject of Civil Engineering. Practical works in Geo-Technical Engineering are equally important. The theory together with practices of this subject will definitely help the Practicing Civil Engineers in Civil Engineering Construction Works, specially in the design and construction of building foundation.

**AIM:**

To develop knowledge and skills of (a) Classification of soils and soil structure (1) Soil mass and fundamental concepts and principles (c) Permeability, seepage, compaction, consolidation, stability of slopes and shear strength of soils (d) Bearing capacity of shallow and deep foundations of soils (c) Settlement of foundations (f) Estimation of thickness of pavement by CBR method (g) Stabilisation of soils.

<b>UNIT TOPIC/SUB-TOPIC hrs.</b>	<b>Hrs.</b>	<b>Total</b>
1.0 INTRODUCTION: 1.1 Define soil and soil engineering . 1.2 Define and explain the soil formation		1
2.0 CLASSIFICATION OF SOILS: 2.1 Classify soils according to : I.S. Particle size classification, Textural classification Chart and Plasticity chart. 2.2 Describe principal types of soils State properties of different soil components 2.3 Identify and describe (a) coarse grained soils (b) fine grained soils		2
3.0 SOIL STRUCTURE: 3.1 Define and explain (a) soil particles (b) electrical forces of clay particles 3.2 Define and explain particle size arrangement in coarse- grained and fine- grained soils, particle size .arrangement in composite soils, with sketches.		2
4.0 SOILS MASS AND ITS DEFINITIONS: 4.1 Define and derive expressions for the following terms : Soil-mass, water content, density and unit weight of soil solids, specific gravity, void ratio and porosity, percentage air voids and air content, degree of saturation, density index, bulk saturated / dry /submerged density. 4.2 Solve problems on 4.1 4.3 Class tests and assignments.		4
5.0 ATTERBERG LIMITS IN SOILS: 5.1 Define and explain consistency limits of soils with sketches 5.2 Define the following terms : (a) Liquid limit (b) Plastic limit (c) Plasticity index (d) Shrinkage limit (e) consistency index (f) liquidity index (g) Shrinkage ratio (i) Volumetric shrinkage. 5.3 Solve problems on Atterberg limits.		3
6.0 PERMEABILITY: 6.1 Define permeability of soils 6.2 Explain hydraulic head, hydraulic gradient & potential energy with sketches. 6.3 State and explain Darcy's law and its validity 6.4 State and explain the factors affecting the permeability of soils. 6.5 State and explain the formulae of co-efficient of permeability for fine grained and coarse grained soils. 6.6 Solve problems on 6.5		5
7.0 SEEPAGE FLOW-NET AND DRAINAGE: 7.1 Define seepage pressure and explain the phenomenon of quick sand condition. 7.2 Concept and applications of flownet		2
8.0 COMPACTION: 8.1 Define (a) compaction of a soil (b) optimum moisture content if a soil, with sketches. 8.2 State and explain factors affecting the compaction of a soil. 8.3 List various compaction tests and compare these tests using parametrical variations. Define the relative compaction of a soil. 8.4 Describe briefly the field compaction methods and its application in different soils. 8.5 Draw and compare compaction curves between dry density and water content % for different compaction test		4
9.0 CONSOLIDATION:		3

9.1	Define and explain consolidation and effective pressure	
9.2	Describe the followings with sketches : Void ratio (e)- effective pressure (CT) curve (b) $c$ -log $\sigma_v'$ curve (c) Time vs. consolidation curve, (d) coefficient of consolidation using Terzaghi's formula (e) Assumptions of Terzaghi's theory of consolidation (f) Consolidation settlement.	
10.0	CALIFORNIA BEARING RATIO (CBR):	1
10.1	Define and explain the CBR	
10.2	Describe briefly a method of estimating the thickness of Roads and Railway pavements using CBR	
11.0	SHEAR STRENGTH:	3
11.1	Define (a) shear strength (b) Cohesion (c) Angle of internal friction	
11.2	State and explain Coulomb's law and Mohr's strength theory and explain Coulomb — Mohr strength curve.	
11.3	Establish the relation between Major ( $\sigma_1'$ ) and Minor ( $\sigma_3'$ ) effective stresses.	
11.4	Describe briefly the different shear tests with sketches and their relative advantages	
12.0	EARTH PRESSURE ON RETAINING STRUCTURES:	2
12.1	Define and explain (a) Active earth pressure (b) Passive earth pressure (c) Neutral earth pressure with sketches.	
12.2	State the formula related to 12.1 for $c$ - $\phi$ soils	
12.3	Solve problems on 12.1	
13.0	STABILITY OF SLOPES:	2
13.1	Define a slope surface	
13.2	Explain the stability of different slopes and failure surfaces	
13.3	Describe the different types of failures with sketches and state the causes of failure.	
14.0	SOIL STABILISATION:	2
14.1	State general principles of soil stabilisation and describe briefly mechanical stabilization, water retentive, chemical and cement stabilisation. Stabilisation by grouting, electrical stabilisation (Handouts to be used).	
15.0	SOIL EXPLORATION:	2
15.1	Define and state the purpose of soil exploration	
15.2	Describe briefly different excavation and boring methods of sub-surface exploration with sketches	
15.3	State different types of soil samples and compare their merits and demerits	
15.4	State the principles of procuring and handling of undisturbed samples. (Note : to be provided extensively.)	
15.5	Class test and assignment.	
16.0	FOUNDATION ENGINEERING:	6
16.1	Define and state the functions of shallow foundation	
16.2	Draw failure planes of Terzaghi's bearing capacity for shallow foundation (sketch only)	
16.3	Bearing capacity of soils	
16.4	Calculate the bearing capacity of soils using Terzaghi's Formula.	
16.5	Determine allowable bearing capacity of soils using I. S. Code of Practice.	
16.6	Describe briefly the Plate load test for bearing capacity of soils.	
16.7	Explain the functions of deep foundations	
16.8	Different types of foundation: State the functions of raft or mat, pile, pier, strip and isolated footings, well foundation, cofferdams and caisson foundation (sketches only) and types of pile. Write down the formulae for bearing capacity of different types of piles as per I.S. Code of practices.	
17.0	SETTLEMENT OF FOUNDATIONS:	1
17.1	State the various causes of settlement of foundation, determine the permissible settlement using I.S. Code of practice.	

TOTAL: 45

**N.B.:** Geo-technical Engineering subject can best be learned through lecture - demonstrations using concrete examples of the functions of coarse and fine grained soils in the lecture room environment. The graphical representation of concepts and principles of Soil Mechanics and Foundation Engineering, can easily be taught using appropriate teaching Aids. If the majority of the lecture periods are covered using demonstration models and other related teaching Aids learners will be amply benefited by the presence of teachers teaching this subject. While teaching this subject it is desirable that teachers are devoting their whole-hearted time and energy using maximum number of related examples during the period of interactions with the learners acquiring the knowledge and skills of different concepts and principles of Soil Mechanics.

**PRACTICAL**

- 18.0 GEO-TECHNICAL ENGINEERING LABORATORY** 30
- 18.1 To determine the water content of a given soil sample by over-drying method.
  - 18.2 To determine the specific gravity of a given soil using specific gravity botde/Pyenometer.
  - 18.3 To determine the field density of a soil using core-cutter method. To determine the grading of particle sizes (Sieve analysis) of coarse-grained soils using I.S. Sieves for sand and gravel.
  - 18.4 To determine the grading of particle sizes (Wet analysis) of Fine-grained soils using Pippette method for clay and silt.
  - 18.5 To determine the liquid limit of a given soil sample using Casagrande's liquid limit, device using Casagrande's Tool / ASTM Tool.
  - 18.6 To determine the plastic limit and shrinkage limit of a given soil.
  - 18.7 To determine the coefficient of permeability of coarse- grained soils under constant head method.
  - 18.8 To determine the maximum dry density and optimum moisture content using Modified Proctor's Test.
  - 18.9 Demonstration Test in die Laboratory: To determine the cohesion and angle of internal friction of a c-(p soil using Triaxial Test Device.
  - 18.10 Demonstration Test in the Laboratory: To plot e log 0 curve by conducting consolidation test on a given fine-grained soil.
  - 18.11 To determine the value of CBR using the laboratory CBR testing device

**REFERENCE BOOKS:**

1. Soil Mechanics & Foundation - by Alam Singh & B. C. Punmia
2. A text book of Soil Mechanics - by Bharat Singh & Shamsher Prakash
3. Foundation Engg. - by W. C. Tcng
4. Geo-technical Engg. (Soil Mechanics) S. I. Units - by Appa Balwant Chowk; Everest Publishing House, Pune — 411 030, Maharashtra.
5. Soil Engineering in Theory & Practice, Part-1 (3rd Edition) - by Alam Singh & Chowdhary; CBS Publishers and Distributors.

**PROFESSIONAL PRACTICES  
& CONSTRUCTION MANAGEMENT**

L      T      P  
4      0      0

Curri. Ref. No.: 508

Total Contact hrs.:                      Total marks:150

Theory: 60

Theory:  
End Term Exam: 70  
(35 from each

Theory Class duration:  
half)

60 classes of 1 hr. or  
80 classes of 45 minutes

I.A: 30

Pre requisite: C501

Credit: 4

**FIRST HALF  
PROFESSIONAL PRACTICES**

**RATIONALE:**

Professional practice is essential for managers of different companies to determine the time, cost & money required for construction of a project

**AIM:**

Professional practice aims at organizing, disseminating duties & responsibilities and preparation of method for execution of works

<b>UNIT</b>	<b>TOPIC/SUB-TOPIC</b>	<b>Hrs.</b>	<b>Total</b>
	<b>hrs.</b>		
1.0	Organization of engineering department		5
	1.1 Permanent establishment		
	1.2 Duties and responsibilities of subordinate engineers		
2.0	Works		7
	2.1 Classification of work-original, major, minor, petty, repair work, annual repair, special repair, quadrantal repair		
	2.2 Method of execution of works through the contractors, departmentally, contract and agreement, work order, item rate contract, lump sum contract, labour contract and daily labour, piece work agreement, scheduled contract, cost plus percentage contract		
3.0	Account of works		15
	3.1 Explanation of various terms Administrative approval, technical sanction, contingency budget, tender, preparation of notice inviting tender, receiving of quotations, earnest money, security deposit, advance payment, on account payment, intermediate payment, final payment, running bill, final, regular and temporary establishment, cash, major & subhead of account, temporary advance, issue rate, storage, supervision charges, suspense account, debit, credit, book transfer, sub-voucher and related accounts vouchers		
	3.2 Measurement book use & maintenance, procedure of making entries of measurement of work and supply of materials, labour employed, standard measurement books and common irregularity		
	3.3 Master Roll: Its preparation & use for pay and wages		
	3.4 Acquittance Roll: Its preparation & use for making payment of pay & wages		
	3.5 Labour & Labour report, method of labour payment, use of forms and necessity of submission		
	3.6 Classification of stores, receipt / issue statement on standard form, method of preparation of stock account, preparation and submission of returns, verification of stocks, shortage and excess		
	Class Test		3
<b>TOTAL:</b>	<b>30</b>		

**REFERENCE BOOKS:**

1. Text Book of PWD Account - by S.C. Dixit
2. PWD Accounts - by A.C. Dhar
3. Engineering Duties & Accounts - by S.K. Hussain
4. PERT & CPM Principles and Applications - by Srinath L.S.; East West Press, New Delhi
5. Construction Planning and Management - by Gahlot P.S. and Dhir, B.M.; Wiley Eastern



- Limited, New Delhi
6. Construction Management and Accounts - Harpal Singh; Tata Mc.Graw Hill, New Delhi
  7. Management in Construction Industry - by Dhawadkar, P.P.; Oxford and IBH, New Delhi

## **SECOND HALF** **CONSTRUCTION MANAGEMENT**

### RATIONALE:

The knowledge of this subject is required For all engineers / technicians for working at the site/ field. This course includes the various aspects of constructional planning, construction organization and organizational behaviour including group dynamics, monitoring of progress and safety practices and quality control.

### AIM:

The course content of Construction Management has been designed to provide adequate information to develop competency in a learner to-

1. Pplan simple constructional activity
2. Prepare construction schedule
3. Handle material and T&P stores
4. Manage the work site
5. Work as member/ group leader in a construction team
6. Resolve disputes during construction activity
7. Adopt appropriate constructional safety practices.
8. Maintain quality of construction work

### COURSE CONTENT:

<b>UNIT TOPIC/SUB-TOPIC</b>	<b>Hrs.</b>	<b>Total</b>
<b>hrs.</b>		
1.0 INTRODUCTION:		02
1.1 Aims & objectives of construction management		
1.2 Functions of construction management		
1.3 The construction team components-owner, engineer, architect, contractor-their functions and interrelationship and jurisdiction		
1.4 Resources for construction management- men, machines, materials, money		
2.0 CONSTRUCTIONAL PLANNING:		06
2.1 Importance of constructional planning		
2.2 Developing work break down structure for construction works		
2.3 Construction planning stages -Pre-tendcr stage. Post- tender stage		
2.4 Construction scheduling by Bar charts-preparation of Bar charts for simple construction works		
2.5 Preparation of schedules for labour. Materials, machinery, finance for small works		
2.6 Limitations of bar charts		
2.7 Construction scheduling by network techniques- definitions of terms, PERT and CPM techniques, advantages and disadvantages of two techniques, network analysis, estimation of time and critical path, application of PERT & CPM techniques in simple construction works		
3.0 MATERIALS MANAGEMENT:		03
3.1 Classification of stores- storage of stock		
3.2 Issue of materials-indent, invoice, bin card		

3.3	Stores accounting procedure	
3.4	Inspection of stores T& P account's register, procedure of write off	
4.0	SITE MANAGEMENT:	03
4.1	Factors influencing selection, design and layout of temporary facilities and services at construction site	
4.2	Principles of storing materials at site	
4.3	Location of equipment Organizing labour at site	
5.0	CONSTRUCTION ORGANIZATION:	05
5.1	Organization types-line and staff, functions and their characteristics	
5.2	Principles of organization-meaning and significance of terms-control, authority, responsibility, command, accountability, job and task	
5.3	Leadership-necessity, styles of leadership, role of leader	
5.4	Principles of effective supervision	
5.5	Motivation-classification of motives, different approaches to motivation	
5.6	Human relations- relations with subordinates, peers, Supervisors, characteristics of group behaviour, mob psychology, handling of grievances, absenteeism. Labour Welfare	
5.7	Conflicts in organization- genesis of conflicts, types - Intrapersonal, interpersonal, inter group, resolving conflicts, team building	
6.0	SAFETY IN CONSTRUCTION WORKS:	03
6.1	Importance of safety	
6.2	Causes and effects of accidents in construction works	
6.3	Safety measures in work sites for-cxcavation, scaffolding, formwork, fabrication and erection, demolition	
6.4	Development of safety consciousness	
6.5	Safety legislation-workmen's compensation act, contract labour act	
7.0	MONITORING PROGRESS:	02
7.1	Programme and progress of work	
7.2	Work study	
7.3	Analysis & control of physical and financial progress Corrective measures	
8.0	DISPUTES:	02
8.1	Nature of disputes between contractor and owner Causes of disputes and claims Arbitration-procedure, criterion for arbitrator, conditions for arbitration.	
9.0	QUALITY CONTROL:	03
9.1	Concept of quality in construction	
9.2	Quality standards - during construction, after construction	
9.3	Methods of testing-during construction, after construction, Destructive & non-destructive methods	

Class Test: 01  
TOTAL: 30

**REFERENCE BOOKS:**

1. Construction Planning, Equipment and Methods - by R.L.Peurifoy; T.M.H
2. Management in Construction Industry - by P.P.Dharwadker; Oxford & IBH
3. Civil Engineering Management - by O.N.Wakhlo; New Delhi Light & Life Pub.
4. Construction Management Practice - by V.K.Raina; T.M.H
5. PERT and CPM-principles & application - by L.S.Srinath; East West Press

**DESIGN AND DETAILING -I**

L     T     P  
3     0     2

Total Contact hrs.:  
Theory: 45

Total marks:150

Curri. Ref. No.: 509

Theory:  
End Term Exam: 70

Practical: 30  
 Theory Class duration:  
 45 classes of 1 hr. or  
 60 classes of 45 minutes  
 Pre requisite: C404  
 Credit: 4

I.A: 30  
 Practical:  
 I.A:50

**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 draftsmen responsible for preparing detailed drawing for construction sites. Diploma holders are also called upon to assist designers, suggest modifications for repair and renovation works and also to design simple structural elements. The subject attempts to cover the above aspects of civil engineering profession.

**AIM:**

The subject aims to expose the civil engineering diploma students to design of simple R.C. structural elements and also to drawing structural details for construction.

**THEORY**

**UNIT TOPIC/SUB-TOPIC**

**Hrs. Total hrs.**

1.0	Introduction to design & detailing	6
	1.1 State & explain the objectives of design & detailing	
	1.2 Explain the advantages of Reinforced Concrete	
	1.3 State the different methods of design	
	1.4 Explain briefly die general concept, assumptions of old Working Stress Method (WSM) of design	
2.0	Limit State Method (LSM) of Design	5
	2.1 Define Limit States	
	2.2 State & explain limit states of collapse, serviceability and durability	
	2.3 State & explain the factors responsible for (i) durability of a structure, (ii) serviceability of a structure; and how they are taken into account in design	
	2.4 Define & explain characteristic strengths of materials, such as steel & concrete (IS:456-2000)	
	2.5 Define & explain briefly different characteristic loads for structures (IS 875 Parts I to V)	
	2.6 Explain the partial safety factors for loads and material strengths under different load combinations of different limit states	
	2.7 Draw and explain the assumed actual and design stress- strain diagrams of Mild Steel, HYSD bars and concrete as per IS 456	
	3.0 Limit State of Collapse of Singly Reinforced Members in 12 Bending	
	3.1 Explain Ultimate Strength of R.C. beams (Limit State of Collapse by flexure), balanced, under reinforced and over reinforced sections, compression stress block in concrete	
	3.2 Evaluate the depth of neutral axis of a given beam, solve problems	
	3.3 Calculate moment of resistance by Strain Compatibility and equilibrium, solve problems	
	3.4 Evaluate die minimum depth for a given design bending moment, solve problems	
	3.5 Design singly reinforced rectangular beams, one-way & cantilever slabs as per IS456	
	3.6 Use SP-16 for design of beams & slabs	

3.7	Explain basic considerations, behaviour of doubly reinforced beams, simplified & approximate analysis of doubly reinforced beams	
3.8	Design doubly reinforced beams by approximate method, solve problems.	
3.9	Explain the differences in the behaviours of 'T' and 'L' beams with rectangular beams	
4.0	Limit State of Collapse in Shear (Design for Sheer by LSM)	7
4.1	Explain shear cracks and shear failures with or without hear reinforcement	
4.2	Explain contribution of concrete in resisting design hear, types of shear reinforcement, design of stirrups, minimum shear reinforcement, stcp-by-stcp procedure for design of links, shear in slabs, detailing of steel. .3 Design rectangular beams for shear and bending, solve problems, concept of 'T' and 'L' beams	
5.0	Bond, Anchorage, Development lengths & Splicing (LSM)	6
5.1	Explain & differentiate between bond & anchorage	
5.2	Explain & calculate development length for HYSB bars for M20 & M25 grade concrete	
5.3	Explain and anchorage of bars (refer to SP 24 and IS 456 : clause 25.2.3.1)	
5.4	Check the development length at support of a beam	
5.5	Explain the conditions for termination of tension reinforcement in flexural members	
5.6	Explain the equivalent development length of bonds, IS code provision for anchorage, splicing of bars, laps, and importance of laps and anchorage length	
6.0	Two-way slabs (LSM)	5
6.1	Explain the action of two-way slabs with deflected slaps, detailed arrangement of reinforcements, torsional reinforcements at corners	
6.2	Perform design of rectangular two-way slabs as per IS 456 bending moment co-efficient, solve problems	
7.0	Axially loaded short columns (LSM)	4
7.1	Explain short columns, braced and unbraced columns, effective length of columns, design formula for short columns, minimum accidental eccentricity, minimum longitudinal reinforcement and transverse reinforcement, detailing at junctions with beams and footing	
7.2	Perform design of axially loaded short columns using IS 456&SP-16	

**SESSIONAL ASSIGNMENTS**

8.0	Draw the following with necessary details & schedule of bars from supplied hand sketches or given references such as SP 34	27
(a)	Slab, beam and lintel with chajja as in a simple building (Help from Sections 8 & 9 of SP 34 may be taken) Plate 1.	
(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 Counterfort retaining walls: Deflected shapes of sections at different locations, and details of reinforcement (Help from Section 11 and Sheet 20 of SP34 may be taken) - Plate 3.	

Class Tests: 3  
TOTAL: 75

**REFERENCE BOOKS:**

1. Limit State Design of Reinforced Concrete - by P.C. Varghese
2. Reinforced Concrete - by HJ. Shah
3. Reinforced Concrete : Limit State Design - by A.K. Jain
4. Design Aids for Reinforced Concrete to IS: 456-1978, BIS, SP-16
5. Handbook on Concrete Reinforcement & detailing, BIS, SP-34

## DESIGN AND DETAILING-II

L T P  
3 0 2

Curri. Ref. No.: 510

Total Contact hrs.: Total marks:150  
Theory: 45  
Practical: 30  
Theory Class duration:  
45 classes of 1 hr. or  
60 classes of 45 minutes  
Pre requisite: C404  
Credit: 4

Theory:  
End Term Exam: 70  
I.A: 30  
Practical:  
I.A:25

### 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 draftsmen responsible for preparing detailed drawing for construction sites. Diploma holders are also called upon to assist designers, suggest modifications for repair and renovation works and also to design simple structural elements. The subject attempts to cover the above aspects of civil engineering profession.

### AIM:

The subject aims to expose the civil engineering diploma students to design of simple structural elements and also to drawing structural details for construction.

### SESSIONAL ASSIGNMENTS

UNIT TOPIC/SUB-TOPIC hrs.	Hrs.	Total
1.0 Structural Detailing		30
1.1 Draw details of the following steel structures from the given line diagrams: a) A steel roof truss with details of bolted or riveted and welded joints and connections including that of the steel column at base level with foundation (Plate I) b) A two storied steel building frame showing typical details of possible bolted and welded connections including that of column at base with the foundation (Plate II)		
1.2 Details of an underground RCC water tank (such as Sheet No. 19 of SP 34 or any other) - Plate III.		
1.3 Combined detailed drawing of a two storied building with load-bearing wall spread footing and R.C. isolated column footing. (Plate IV).		
	TOTAL:	30

### THEORY

2.0 Design of simple steel structures		15
2.1 State and sketch types of joints, explain and show failure of joints through sketches.		
2.2 State the permissible stresses in rivets and bolts; Design joints (excluding joints subjected to moments).		
2.3 Design determinate framed structure connections, solve problems for riveted and bolted connections.		
2.4 Welding: State and explain the uses and types of welding.		
2.5 State the permissible stresses in welding, minimum size of welding.		
2.6 Design simple welded connections for axial forces.		
3.0 Tension Members		5
3.1 State and sketch the common sections of tension members. State the permissible stresses for structural steel.		

3.2	Explain the net effective sectional area for angles and tees under different conditions, use structural steel section hand book. Design tension members (angle & tubular sections) with detailing, and solve problems.	
4.0	Compression Members	5
4.1	Distinguish between a strut and a column, short and a long column. Explain effective length, state maximum slenderness ratio of different compression members.	
4.2	Explain and perform design of axially loaded compression members (angle & tubular sections) as per IS 800, solve problems	
5.0	Design of simple steel beams for bending and shear	3
6.0	Design (as per IS:883-1970) of timber structural elements for tension, compression and flexure as well as detailing of joints	6
7.0	Stair Case (RCC - LSM)	4
7.1	State & draw important types of staircases, explain effective span & principles of design	
7.2	Design a dog-legged stair case and show the details of reinforcement	
8.0	Design of footings (RCC - LSM)	4
8.1	State and sketch different types of footings	
8.2	Explain design loads for foundation design, basis of design of footings, soil pressure on foundation, design of independent footings, checking for development lengths, procedure for design of footings	
8.3	Design simple masonry foundation and R.C. slab foundation for a masonry wall	
8.4	Design isolated reinforced concrete square & rectangular footings for given data & draw detailed drawings	
8.5	Solve Problems	
	Class Test	3
	TOTAL :	45

**REFERENCE BOOKS:**

1. Analysis, Design & Detailing of Structures, Vol.111, Steel Structures & Timber Structures –  
by V.N. Vazirani & M.M. Ratwani; Khanna Publishers
2. Design of Steel Structure -by S. Ramamrutham
3. Design of Steel Structure -by B.N. Duggal
4. Design of Steel Structure -by Kazmi &Jindal
5. Code of Practice for design of structural timber in building - IS:883-1970
6. Limit State Design of Reinforced Concrete - by P.C. Varghese
7. Reinforced Concrete : Limit State Design - by A.K. Jain
8. Reinforced Concrete - by H.J. Shah
9. Design Aids for Reinforced Concrete IO IS: 456-1978, BIS, SP-16
10. Handbook on Concrete Reinforcement & detailing, BIS, SP-34
11. Code of Practice for General Construction in Steel - IS: 800
12. Structural Engineer's Handbook, Vol.1, II & III; BIS Publication
13. Steel & Timber Structures - by Hool & Kinne
14. Timber Design and Construction Handbook - Prepared by Timber Engineering Company.

## PROJECT & INDUSTRIAL VISIT

L T P  
0 0 0

Curri. Ref. No.: 511

Total Contact hrs.:

Total marks:125

Practical: 90

Practical

I.A: 100 + 25(I.V)

Pre requisite: Nil

Credit: 3

### RATIONALE:

The diploma-holders in Civil Engineering, many a times , are involved with project work in design and drawing offices. The major works involve making survey, drawing plan and sections, collection of data , organization and analysis of data, estimation and elementary design of structures or their components. They are also expected to have some knowledge of actual practice in construction work. The course " Project and Industrial visits" should therefore be very important to the diploma students of Civil Engineering to make them professionally sound and valuable.

### AIM:

The aim of the course —" Project and Industrial visits" is to:

- (i) Apply knowledge gained in different subjects through solving real life problems in Civil Engineering.
- (ii) Develop self-confidence for working in Civil Engineering projects.
- (iii) Prepare necessary drawings, estimates and project reports .
- (iv) Develop an idea of the state of art of construction practices through industrial visits

### UNIT TOPIC/SUB-TOPIC

Hrs. Total hrs.

1.0	Layout plan and detailed plan and section of ( any two of the following)	25
	1.1 Residential Building	
	1.2 Hostel building for accommodation of (80 to 160) students, the number may vary on yearly basis.	
	1.3 Hospital building for rural area.	
	1.4 School building involving science laboratories	
	1.5 An industrial building.	
2.0	Design and Planning	25
	2.1 Detailed design and planning of a roof truss.	
	2.2 Detailed design and planning of RCC roof slab and beam arrangement for a residential house.	
3.0	Project work on converting a village road	25
	3.1 Preparation of longitudinal and cross-sections after levelling the proposed road.	
	3.2 Calculation of earthwork after fixing the section and calculation of gradients.	
	3.3 Design for vertical curve, horizontal curve, super elevation if necessary.	
	3.4 Estimation of road materials from the longitudinal and cross-sections.	
	3.5 Full report on the project together with information of existing and new formation h\ els i.e., plan, elevation and sections.	
4.0	Industrial visit and report writing(Compulsory)	15
	TOTAL:	90

### NOTE:

- (i) Every student will have to present his/her pfo}ect work in a seminar. The evaluation of project work may be hand on the ability of tackling a problem, the project report, presentation in a seminar and viva-voce.
- (ii) Students may undergo practical training in an industry suitably for two weeks or more in between two terms before completion of the diploma programme as an alternative to 'industrial visits & report writing'. The effectiveness of industrial visits or

practical training in an industry should be evaluated through assessment of report submitted by a student & viva-voce.

### CONCRETE TECHNOLOGY (Elective)

L     T     P  
3     0     0

Curri. Ref. No.: 601

Total Contact hrs.:                      Total marks:100

Theory: 45

Theory:  
End Tenn Exam: 70

Theory Class duration:

I.A: 30

45 classes of 1 hr. or

60 classes of 45 minutes

Pre requisite: C402

Credit: 3

#### UNIT TOPIC/SUB-TOPIC

#### Hrs. Total hrs.

1.0 Concrete as a construction material:	1
1.1 Grades of concrete	
1.2 Advantage and disadvantages of concrete	
1.3 Concept of quality control of concrete	
2.0 Cement:	2
2.1 Composition, hydration of cement, water-cement ratio and compressive strength, fineness of cement, setting time, soundness, types of cement.	
3.0 Aggregate:	2
3.1 Classification and characteristics of aggregate, deleterious substances in aggregates, fineness modulus, grading of aggregate.	
4.0 Water:	1
4.1 Quality of mixing water, curing water	
5.0 Admixtures:	2
5.1 Important functions, classification of admixtures, I.S. 7861 (Part-11) 1981, accelerating admixtures, retarding admixtures, water-reducing admixtures, air-containing admixtures.	
6.0 Properties of fresh concrete:	3
6.1 Concept of fresh concrete. Workability, slump test, compacting factor test, Vc-bcc consistency test and flow test, requirement of workability.	
7.0 Properties of hardened concrete:	3
7.1 Cube and cylinder compressive strengths, flexural strength of concrete, stress-strain and elasticity, phenomena of creep and shrinkage, permeability, durability of concrete, sulphate and acid attack on concrete, efflorescence.	
8.0 Quality and control of concrete:	3
8.1 Factors causing the variations in the quality of concrete, field quality control, advantages of quality control, quality management in concrete construction.	
9.0 Proportioning of concrete mixers:	6
9.1 Basic consideration for concrete mix design, factors influencing the choice of mix proportions, grade designation, type of cement, maximum nominal size of coarse aggregate, grading of combined aggregate (IS : 483-1963 limits), analytical method, water-cement ratio, workability, durability.	
10.0 Production of concrete:	4
10.1 Batching of materials, mixing of concrete materials, transportation, placing of concrete, compaction of concrete compaction methods, vibrators, precautions for compaction by vibrators, curing and maturity of concrete, effects of delayed curing, form work- requirements and types, stripping of forms.	
11.0 Inspection and testing:	4



11.1	Inspection testing of fresh concrete,, workability tests, acceptance testing of hardened concrete, surface hardness method, pulse velocity method, core test method.	
12.0	Special concrete:	3
12.1	Introduction to Silica fume concrete, mass concrete, shot-crete concrete or gunniting, ferro-cement, construction in ferro-cement and applications, fibre reinforced concrete and its application, polymer concrete—types and application.	
13.0	Deterioration of concrete and its prevention:	2
13.1	Types of deterioration, prevention of concrete deteiTriination, corrosion of reinforcement, effects and prevention.	
14.0	Repair technology for concrete structures:	6
14.1	Symptom, cause, prevention and remedy of defects during construction, cracking of concrete due to different reasons, repair of cracks for different purposes, selection of techniques, polymer-based repairs, common types of repairs.	
	<b>TOTAL:</b>	<b>45</b>

**REFERENCE BOOKS:**

1. Concrete Technology -by M. L. Gambhir; Tata McGraw Mill
2. Concrete Technology - by A. M. Neville &J. J. Brook
3. Properties of concrete - by A. M. Neville; ELBS ,
4. Concrete Mix design -by Krishna Raju

**TUNNELS & BRIDGES (Elective)**

L	T	P	
3	0	0	
Total Contact hrs.:		Total marks:100	Curri. Ref. No.: 602
Theory: 45			Theory:
Theory Class duration:			End Term Exam: 70
45 classes of 1 hr. or			(20 from tunnel and 50
60 classes of 45 minutes			from Bridges)
Pre requisite: Nil			I.A:30
Credit: 3			

**RATIONALE:**

Tunnels and bridges constitute important specialized components of Transportation Engineering. Many—a-times diploma holders are involved in the construction of tunnels and bridges. As there is no common subject to cover the preliminary parts of the subject topics, they are covered in an elective subject, so that interested students have a chance to acquire necessary preliminary knowledge in the subject.

**AIM:**

The aim of the subject 'Tunnels and Bridges' is to impart knowledge of different components of tunnels and bridges through informative statements, description, explanation and sketches to the diploma students of civil engineering intending to be involved in the construction and maintenance of tunnels and bridges.

<b>UNIT</b>	<b>TOPIC/SUB-TOPIC</b>	<b>Hrs. Total hrs.</b>
<b>TUNNELS</b>		
1.0	Introduction:	1
	1.1 Definition of tunnels	
	1.2 Necessity of tunnels	
	1.3 Functions of tunnels	
	1.4 Advantages & disadvantages of tunnels	

2.0	Tunnel surveying	3
2.1	Factors affecting alignment & grade of a tunnel	
2.2	Method of location of centre line of tunnel on the ground	
2.3	Method of transferring the centre line of tunnel to inside of tunnel	
3.0	Size & Shape of Tunnel	2
3.1	Different shapes of tunnels - description, sketches	
3.2	Factors affecting the size of tunnels	
3.3	Typical sectional views of tunnels for (a) a National Highway (b) a single & double broad gauge railway track	
4.0	Construction of tunnels:	3
4.1	Methods of tunneling in rocks	
4.2	Operations involved in tunneling in rocks	
4.3	Methods of tunneling in soft soil	
4.4	Safety precautions to be adopted in tunneling	
4.5	Maintenance of tunnels	
5.0	Ventilation of tunnels	1
5.1	Necessity of ventilation	
5.2	Methods of ventilation	
5.3	Shafts - purpose, classification, location	
5.4	Methods of dust control	
6.0	Tunnel Lining	2
6.1	Necessity of lining	
6.2	Functions of lining	
6.3	Types of lining	
6.4	Operations involved in lining of tunnels	
7.0	Drainage of tunnels	1
7.1	Necessity of drainage	
7.2	Methods of drainage	
	Class Test	1
<b>BRIDGES</b>		
8.0	Introduction:	2
8.1	Definitions	
8.2	Components of a bridge	
8.3	Classification of bridges	
8.4	Requirements of an ideal bridge	
9.0	Bridge Site investigation, hydrology & planning	4
9.1	Selection of bridge site	
9.2	Bridge alignments	
9.3	Determination of flood discharge	
9.4	Waterway & economic span	
9.5	Afflux, clearance & free board	
9.6	Collection of bridge design data & sub surface investigation	
10.0	Bridge foundation	4
10.1	Scan depth, minimum depth of foundation	
10.2	Types of bridge, foundations - spread foundation pile foundation - pile driving, well foundation - sinking of wells, caisson foundation	
10.3	Coffer dams	
11.0	Bridge substructure and approaches	4
11.1	Piers & types - forces acting & design principles	
11.2	Abutments, types - forces acting & design principles	
11.3	Wing walls, types and their stability	
11.4	Approaches	
12.0	Permanent bridges	4
12.1	Masonry bridges	

12.2	Steel bridges - classification brief description with sketches - plated girder bridges, truss bridges, steel anch bridges, rigid frame steel bridges, cable stayed bridges, continuous steel bridges, suspension bridges	
12.3	Concrete bridges - classification, brief description with sketches - slab & girder bridges, balanced cantilever bridges, continuous bridges, anch bridges, rigid frame bridges, pre-stressed concrete bridges.	
12.4	IRC bridge loading	
13.0	Culverts & causeways	3
13.1	Types of culverts - brief description	
13.2	Types of causeways - brief description	
14.0	Bridge details	3
14.1	Bridge bearing - types with brief description & sketches	
14.2	Joints in bridges - description with sketches	
14.3	Railings	
15.0	Movable bridges - Swing bridges, bascule bridges, Transer bridges. Transporter bridges, lift bridges	2
16.0	Methods of Bridge Construction & Maintenance	3
16.1	Erection of steel girder, truss, RCC	
16.2	Maintenance of bridges	
	Class Test	2

**REFERENCE BOOKS:**

1. Tunnel Engineering - by S.P. Bindra; Dhunpad Rai & Sons
2. Tunnel Engineering - by S.C. Saxena; Chand Publications
3. Roads, Railways, Bridges & Tunnel Engineering - by B.L. Gupta & A. Gupta; Standard Publishers
4. Transportation Engineering - Vol.11 - by N. Vauroni & S.P. Chandrula; Khanna Publishers
5. Principles and Practice of Bridge Engineering - by S.P. Bindra; Dhanpat Rai & Sons
6. Roads, Railways, Bridges and Tunnel Engineering - by Ahuja & Biroi; Standard Book Mouse

**ENVIRONMENTAL ENGINEERING (Elective)**

L      T      P  
3      0      0

Curri. Ref. No.: 603

Total Contact hrs.:                      Total marks:100

Theory: 45

Theory:  
End Term Exam: 70

Theory Class duration:

I.A:30

45 classes of 1 hr. or  
60 classes of 45 minutes

Pre requisite: C505

Credit: 3

**RATIONALE:**

The construction activities taken up by the technical personnel, civil engineering technicians in particular, are responsible for the environmental degradation. The civil engineers are also responsible for adopting the remedial measures. As such, a civil engineering diploma holder should have adequate knowledge about the types of pollution caused by various construction activities for adopting preventive and remedial measures. They should be also be aware of the various environmental laws for effective control of environmental pollution.

**AIM:**

The course content of Environmental Engineering has been designed to provide adequate information to develop competency in a learner to-

1. Explain the different aspects of environmental engineering
2. Relate the various components of ecosystem
3. Identify the sources and effects of environmental pollution
4. Analyze the polluted water, air and soil by using appropriate sampling method
5. Describe the role of various agencies in environmental pollution and the environmental laws.

**COURSE CONTENT:**

<b>UNIT TOPIC/SUB-TOPIC hrs.</b>	<b>Hrs.</b>	<b>Total</b>
1.0 INTRODUCTION:		04
1.1 Definition of environment and components of Environment and related terms		
1.2 Aims & objectives of environmental engineering		
1.3 Impact of population growth, Indus trialization & urbanization and energy growth on environment		
1.4 Current issues of environmental concern like-Global warming. Acid rain. Ozone depletion-features, causes and impacts on living being		
2.0 ECOLOGY:		06
2.1 Concepts of ecosystem and its component		
2.2 Energy flow through an ecosystem		
2.3 Biochemical cycles-C,N,P		
2.4 Interrelationships between communities in an ecosystem		
2.5 Sustainable development		
3.0 ENVIRONMENTAL POLLUTION:		15
3.1 Definition of terms, parameters of pollution, types of pollution		
3.2 Water Pollution- Types of pollutants & their characteristics. Sources of pollutants, effects of water pollution, standards for industrial effluents, remedial measures for control		
3.3 Air Pollution- Types of pollutants & their characteristics Sources of pollutants, effects of pollutants on human, plants & vegetation, structures etc, permissible limits as per Indian and International standard, remedial measures for control		
3.4 Noise Pollution-definition and measure of noise, types, Sources of pollution, effects of noise pollution, prevention & control measures		
3.5 Land Pollution- Causes, Effects of Pesticides & fertilizers used in agricultural practice, impacts of blasting & open cast mining, degradation due to deforestation and due to natural disaster like land subsidence, case studies on mining; blasting and deforestation, soil pollution management-land conservation and land reclamation		
4.0 POLLUTION SURVEY:		05
4.1 Planning survey, sampling locations, criterion, equipment, and techniques for water & air pollution survey		
4.2 Analysis of water and air pollutants-principles & methods		
5.0 SOLID WASTE MANAGEMENT:		06
5.1 Definition of related terms and purpose		

5.2	Sources of solid wastes, characteristics of wastes-urban & rural communities, sampling methods	
5.3	Storage & collection- storage methods, frequency of collection, methods of collection, comparison	
5.4	Disposal of solid wastes- principles, description of process, planning, operation, maintenance & suitability of different methods of disposal- sanitary land fill, composting, incineration	
6.0	ENVIRONMENTAL MANAGEMENT:	06
6.1	Environmental legislation- salient features of different environmental protection acts in India	
6.2	Roles of pollution control boards, local bodies and citizens in environmental pollution management	
6.3	Environmental impact assessment- requirements and definition of related terms, method of assessment	
6.4	Environmental ethics	
	CLASS TEST & REVISION:	03
	TOTAL:	45

REFERENCE BOOKS:

1. Environmental Engineering - by Duggal
2. Water Supply & Sewage - by Steel
3. Environmental Engineering - by A.K.Chatterjee
4. A Text Book of Environmental Engineering - by Peavy, et.al.
5. Water Supply & Pollution Control - by dark
6. Air Pollution - by Rao
7. Environmental Protection - by Chanlett
8. Fundamentals of Ecology - by Odum
9. Concepts of Ecology - by Koromondy
10. Ecology & Environment - by P.D.Sharma
11. Chemistry for Environmental Engineers - by Sawyer & Macarty
12. Standard Methods for Examination of Water and Waste Water – by APHA
13. Water & Waste Water Analysis a Course Manual - by NEERI

**ADVANCED CONSTRUCTION TECHNOLOGY (Elective)**

L	T	P	Curri. Ref. No.: 604
3	0	0	
Total Contact hrs.:	Total marks:100		Theory:
Theory: 45			End Term Exam: 70
Theory Class duration:			I.A:30
45 classes of 1 hr. or			
60 classes of 45 minutes			
Pre requisite: C405			
Credit: 3			

RATIONALE:

Over and above the study of building construction this subject deals with construction procedures, foundation, framed structure and load bearing walls, shoring, underpinning and scaffolding as also other construction aspects and equipment.

AIM:

To detail out construction procedures of building, to find out bearing capacity of soil, types of foundations, timbering of side trenches, drainage from foundation soil, case studies in relation to foundation and other construction aspects.

<b>UNIT TOPIC/SUB-TOPIC</b>	<b>Hrs.</b>	<b>Total</b>
<b>hrs.</b>		
1.0 Construction procedures of a 3-storyed residential building with water supply, sanitary and electrical service facilities, (clear sketches to be provided)		3
2.0 Construction procedures of a workshop of an industrial organization.		3
3.0 Detailed construction procedures of a typical two storeyed Assam type building inclusive of all types of necessary facilities (clear sketches to be provided)		3
4.0 Detailed construction procedures of a ware-house with detailed requirements		3
5.0 General discussion of all aspects of building services including repairs, supervision and maintenance		3
6.0 Foundation		3
6.1 Bearing capacity of soils, plate load test, improvement of soil bearing capacity		
6.2 Types of foundation and method of construction (footing & raft foundations, pile foundations, pier foundation etc.)		
6.3 Under-reamed piles		
6.4 Form work needed in the construction of foundation		
6.5 Timbering of the sides of trenches		
6.6 Damp proofing of foundation		
6.7 Drainage from foundation soil		
6.8 Certain case study problems in relation to foundations		
7.0 Framed structures and bearing walls		3
7.1 Advantages of framed structures		
7.2 Steel frames		
7.3 RCC frames		
7.4 Combination of frames and bearing walls		
7.5 Method and sequences of framed building construction		
7.6 Frames and sliding forms for centering in the case of quick construction		
8.0 Shoring, underpinning and scaffolding		6
8.1 Purpose of shoring, underpinning and scaffolding		
8.2 Dead, Raking and flying shoring		
8.3 Use of shoring and strutting of foundation		
8.4 Method of underpinning		
8.5 Needle beams-odier ways of scaffolding		
8.6 Tubular scaffolding		
9.0 Other construction aspects		3
9.1 Construction aspects of fire proofing		
9.2 Acoustic treatment for building, auditorium and other special treatments for dancing halls, theatres etc.		
9.3 Construction aspects of eardiquake resistant structures		
10.0 Building Bye-Laws and Codes		12
11.1 Planning and orientation of building to sit the various zones of climatic regions		
11.2 Building Bye-Laws and Codes		
11.3 National Building Code		
11.4 Building Valuation		
11.5 CPM as applicable to building construction		
	Class Test	3
	TOTAL:	45

#### REFERENCE BOOKS:

1. Design Aids in Soil Engineering and Foundation Engineering- by S.R. Kaniraj
2. National Building Code
3. Construction Management and Accounts - by D. Nagrajan & B.K, Krishna Murthy
4. Quantity Surveying - by P.L. Bhurin
5. Fundamentals of RCC
6. Construction Technology - by R. Chudhury, Vol.1 to IV; ELBS and Longman Group Ltd.

#### ADVANCE TRANSPORTATION ENGINEERING (Elective)

L     T     P  
3     0     0

Curri. Ref. No.: 606

Total Contact hrs.: 45

Total marks:100

Theory: 45

Theory:

End Term Exam: 70

Practical: Nil

I.A:30

Pre requisite: C505

Practical :

Credit: 3

End term Exam : Nil

I.A : Nil

#### RATIONALE:

Docks, Harbours and Railways, as specialized topics of Civil Engineering constitute important components of Transportation Engineering. Many—a-times diploma holders are involved in the construction and/or maintenance of docks, harbours and railways. At the same time a state may not have the facilities mentioned above. In such a case the subject may be offered as an elective to a student who plans carrier in line with the subject matter.

#### AIM:

The aim of the subject 'Advanced Transportation Engineering' is to impart preliminary knowledge of docks, harbours and railways through information, description, explanation and sketches to the diploma students of civil engineering intending to be involved in their construction and maintenance.

UNIT	TOPIC/SUB-TOPIC	Hrs.	Total
	<b>DOCKS &amp; HARBOURS</b>		
1.0	Introduction:		2
	1.1 Definition		
	1.2 Necessity of harbour		
	1.3 Types of harbours		
	1.4 Components of harbour		
	1.5 Layout of harbour — sketches, description		
	1.6 Criterion for selection of site for a good harbour		
2.0	Break waters		2
	2.1 Definition		
	2.2 Functions of breakwaters		
	2.3 Types of breakwaters - sketches, description		
3.0	Jetties & Quays		2
	3.1 Definition		
	3.2 Function of jetties & quays		
	3.3 Types of jetties & quays - sketches, description		
4.0	Signals		2

4.1	Requirements of signals	
4.2	Types of signals — sketches, description, interpretation of signals	
5.0	Docks	3
5.1	Definition	
5.2	Necessity of docks	
5.3	Functions of docks	
5.4	Types of docks — sketches, description	
5.5	Comparison between dry and wet dock	
6.0	Dredging	3
6.1	Necessity of dredging	
6.2	Methods of dredging	
6.3	Dredging equipment	
		Class Test
		1
RAILWAYS		
7.0	Introduction:	2
7.1	Railway terminology	
7.2	Advantages of railways	
7.3	Classification of Indian Railways	
8.0	Permanent way	3
8.1	Definition and components of a permanent way	
8.2	Concept of gauge, different gauges prevalent in India, suitability of these gauges under different conditions	
9.0	Track materials	10
9.1	Rails	
9.1.1	Functions and requirement of rails	
9.1.2	Types of rail sections, length of rails	
9.1.3	Rail joints — types, requirement of an ideal joint	
9.1.4	Purpose of welding of rails & its advantages	
9.1.5	Creep — definition, cause & prevention	
9.2	Sleepers	
9.2.1	Definition, functions & requirements of sleepers	
9.2.2	Classification of sleepers	
9.2.3	Advantages & disadvantages of different types of sleepers	
9.3	Ballast	
9.3.1	Functions & requirements of ballast	
9.3.2	Materials for ballast	
9.4	Fixtures & fastenings	
9.4.1	Connection of rails to rail-fishplate, fish bolts	
9.4.2	Connection of rails to sleepers	
10.0	Geometric for Broad gauge	4
10.1	Typical cross-sections of single & double broad gauge railway track in cutting and embankment	
10.2	Permanent & temporary land width	
10.3	Gradients for drainage	
10.4	Super-elevation — necessity & limiting values	
11.0	Points and Crossings	4
11.1	Definition, necessity of points & crossings	
11.2	Types of points & crossings with tie diagrams	
12.0	Laying & maintenance of track	5
12.1	Methods of laying & maintenance of track	
12.2	Details of a permanent way inspector	
		Class test
		2

REFERENCE BOOKS:

1. Dock & Harbour Engg. - by S.P. Bindra; Bhanpat Rai & sons



2. Transportation Engineering Vol.11 - by N. Vazirani & S.P. Chandruta; Khanna Publishers
3. A Text Book of Railway Engineering - by S.C. Rangawala
4. A Text Book of Railway Engineering - by R.S. Deshpande; Poona United Book Corporation
5. Roads, Railway, Bridge and Tunnel - by B.L. Gupta & Amit Gupta; Standard publishers

## List of Resource Persons

Name	Designation	Organisation
<b>POLYTECHNIC</b>		
Sri S.K.Bhusan	Sr. Lecturer, C.E. Dept Head, C. E. Department	Polytechnic Institute, Narsingarb.Agartala
Ms. A. Ali (Nagi)	Lecturer, C.E. Dept	Shillong Polytechnic
Sri Kletus Rynjah	Lecturer, C.E. Dept	Shillong Polytechnic
Sri Israel G. Moinin	Lecturer, C.E. Dept	Shillong Polytechnic
Sri R. NongKhlaw	Lecturer, C.E. Dept	Shillong Polytechnic
Sri Mervinson Lyngdoh	Lecturer, C.B. Dept	Shillong Polytechnic
Sri S.Dkhar	Lecturer, C.E. Dept	Shillong Polytechnic
Sri S.S.Basaiawnait	Sr. Instructor, C.E. Dept	Shillong Polytechnic
Sri P. Dliar	Sr. Instructor, C.E. Dept	Shillong Polytechnic
Sri R. Chowdhury		Shillong Polytechnic
<b>WORLD OF WORK</b>		
Dr. K.K. Ganguly	Director	D.C.L, Calcutta
Sri A. K.Chatterjee	Director ( Planning)	C.M.D.A, Calcutta
Sri Eddie G. Binan.	Sub-ordinate Officer	Shillong Municipality
Sri Budon Rani	Sub-ordinate Officer	Shillong Municipality
<b>TTTI, CALCUTTA</b>		
Dr. M.Chakraborty	Professor, C.E. Department	TTTI, Calcutta
Sri D. K.Saha	Asstt. Prof. C.E. Department	TTTI, Calcutta
Sri Manoj Das	Asstt. Prof. C.E. Department	TTTI, Calcutta
Dr. S.K. Chakraborty	Professor, C.D.C	TTTI, Calcutta