

Final Version

REVISED CURRICULUM OF

**CIVIL ENGINEERING
DIPLOMA PROGRAM**

IN

**MULTI POINT ENTRY &
CREDIT SYSTEM**

PART - II

For the State of Meghalaya



National Institute of Technical Teachers' Training & Research
Block – FC, Sector – III, Salt Lake City, Kolkata – 700 106

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Scheme of Studies and Evaluation (MPECS) For Civil 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	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignm ent*		Sessional	Vi va		
1	G101	Communication Skill-I		2	0	2	70	15	15	-	25	-	125	3
2	G102	Communication Skill-II	G101	2	0	2	70	15	15	-	25	-	125	3
3	G103	Mathematics-I		4	1	0	70	15	15	-	-	-	100	5
4	G104	Mathematics-II	G103	4	1	0	70	15	15	-	-	-	100	5
5	G105	Applied Mathematics	G103 G104	3	1	0	70	15	15	-	-	-	100	4
6	G106	Physics -I		2	0	2	70	15	15	25	25	-	150	3
7	G107	Physics-II	G106	2	0	2	70	15	15	25	25	-	150	3
8	G108	Chemistry - I		2	0	2	70	15	15	25	25	-	150	3
9	G109	Chemistry - II	G108	2	0	2	70	15	15	25	25	-	150	3
TOTAL				23	3	12	630	135	135	100	150	0	1150	32

* The marks for assignment (15) should include five (5) marks for attendance.

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	Progressive Assessment		End Exam	Progressive Assessment			
						Class Test		Assignment			Sessional	Viva		
10	G201	Engineering Drawing-I		1	0	4	-	-	-	-	50	-	50	3
11	G202	Engineering Drawing-II	G201	1	0	4	-	-	-	-	50	-	50	3
12	G203	Workshop Practice-I		0	0	4	-	-	-	-	25	25	50	2
13	G204	Workshop Practice-II	G203	0	0	4	-	-	-	-	25	25	50	2
14	G205A	Introduction to Information Technology		2	0	3	50	0	0	25	50	-	125	4
	G205B	*Introduction to Computer Programming												
15	G206A	Engineering Mechanics	G106 & G107	3	0	2	70	15	15	0	50	-	150	4
	G206B	*C-Programming												
TOTAL				7/6	0/1	21	120	15	15	25	250	50	475	18

*G205B & G206B for CSE only

3. SOFT CORE COURSES: (301 and 302 are compulsory, any two from the rest)

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
					Class Test	Assignment *			Sessio nal		Viva			
16	G301	Development of Life Skill-I		1	0	2	-	-	-	-	25	25	50	2
17	G302	Development of Life Skill-II		1	0	2	-	-	-	-	25	25	50	2
18 & 19	G303	Engineering Economics & Accountancy		3	0	0	70	15	15	-	-	-	100	3
	G304	Entrepreneurship Development		3	0	0	70	15	15	-	-	-	100	3
	G305	Principles of Management		3	0	0	70	15	15	-	-	-	100	3
	G306	Organizational Behaviour		3	0	0	70	15	15	-	-	-	100	3
	G307	Environmental Education		3	0	0	70	15	15	-	-	-	100	3
TOTAL				8	0	4	140	30	30	-	50	50	300	10

* The marks for assignment (15) should include five (5) marks for attendance.

4. BASIC TECHNOLOGY COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
					Class Test	Assignment			Sessional		Viva			
20	CE 401	Mechanics of Material	G 206 A	3	0	2	70	15	15	0	50	-	150	4
21	CE 402	Civil Engg Drawing-I	G 201 & G 202	1	0	3	-	-	-	50	25	25	100	3
22	CE 403	Civil Engg Drawing-II	CE 402	1	0	3	-	-	-	50	25	25	100	3
23	CE 404	Surveying -1		3	0	4	70	15	15	25	25	-	150	5
24	CE 405	Building Construction		3	1	0	70	15	15			-	100	4
25	CE 406	Concrete Technology		3	0	2	70	15	15	25	25	-	150	4
26	CE 407	Hydraulics		3	0	2	70	15	15	25	25	0	150	4
27	CE 408	CE Workshop		0	0	3	0	0	0	0	75	0	75	2
28	CE 409	Theory of Structure	CE 401	3	0	0	70	15	15	0	0	0	100	3
TOTAL				20	1	19	420	90	90	175	250	50	1075	32

5. APPLIED TECHNOLOGY COURSES :

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
					Class Test	Assignment			Sessional		Viva			
28	CE 501	Design & Detailing I	CE 405	3	0	2	70	15	15	0	50	0	150	4
29	CE 502	Design & Detailing II	CE 501	3	0	2	70	15	15	0	50	0	150	4
30	CE 503	Surveying-II	CE 403	3	0	3	70	15	15	25	25	0	150	4
31	CE 504	Estimating I		2	0	4	70	15	15	0	25	0	125	4
32	CE 505	Estimating II	CE 504	2	0	4	70	15	15	0	25	0	125	4
33	CE 506	Geo-Technical Engineering I	CE 401	3	0	2	70	15	15	25	25	0	150	4
34	CE 507	Geo-Technical Engineering II	CE 506	3	1	0	70	15	15	0	0	0	100	4
35	CE 508	Computer Aided Drawing	CE 402	0	0	3	0	0	0	0	50	0	50	2
36	CE 509	Water Supply & Sanitary Engineering	CE 406	3	0	2	70	15	15	25	25	0	150	4
37	CE 510	Highway Engg		3	0	2	70	15	15	25	25	0	150	4
38	CE 511	Irrigation Engineering	CE 406	3	0	0	70	15	15	0	0	0	100	3

39	CE 512	Professional Practices -I		0	0	2	0	0	0	0	50	0	50	1
40	CE 513	Professional Practices-II		0	0	2	0	0	0	0	50	0	50	1
41	CE 514	Professional Practices-III		0	0	2	0	0	0	0	50	0	50	1
42	CE 515	Professional Practices-IV		0	0	2	0	0	0	0	50	0	50	1
43	CE 516	Professional Practices-V		0	0	4	0	0	0	0	50	0	50	2
44	CE 517	Project		0	0	6	0	0	0	0	100	50	150	3
TOTAL				28	1	44	660	120	120	300	550	50	1800	50

6. ELECTIVE COURSES (Any TWO to be taken) :

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
						Class Test		Assignment			Sessional	Viva		
44 & 45	CE 601	Earthquake resistant Design& Construction		3	1	0	70	15	15	-	-	-	100	4
	CE 602	Environmental Engineering		3	1	0	70	15	15	-	-	-	100	4
	CE 603	Tunnels & Bridges		3	1	0	70	15	15	-	-	-	100	4
	CE 604	Advanced Survey		3	1	0	70	15	15	-	-	-	100	4
	CE605	Transportation Engineering		3	1	0	70	15	15	-	-	-	100	4
	CE606	Advanced Construction Technology		3	1	0	70	15	15	-	-	-	100	4
TOTAL OF TWO COURSES				6	2	0	140	30	30	-	-	-	200	8

SAMPLE PATH FOR TERM - I

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	G101	Communication Skill-I		2	0	2	70	15	10	5	-	25	-	125	3
2	G103	Mathematics-I		4	1	0	70	15	10	5	-	-	-	100	5
3	G106	Physics - I		2	0	2	70	15	10	5	25	25	-	150	3
4	G108	Chemistry - I		2	0	2	70	15	10	5	25	25	-	150	3
5	G201	Engineering Drawing – I		1	0	4	-	-	-	-	-	50	-	50	3
6	G203	Workshop Practice - I		0	0	4	-	-	-	-	-	25	25	50	2
7	G205 A	Introduction to Information Technology		2	0	3	50	0	0	0	25	50	-	125	4
TOTAL				13	1	17	330	60	40	20	75	200	25	750	23

AMPLE PATH FOR TERM - II

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory			Practical					
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	G102	Communication Skill-II	G101	2	0	2	70	15	10	5	-	25	-	125	3
2	G104	Mathematics-II	G103	4	1	0	70	15	10	5	-	-	-	100	5
3	G107	Physics - II	G106	2	0	2	70	15	10	5	25	25	-	150	3
4	G109	Chemistry - II	G108	2	0	2	70	15	10	5	25	25	-	150	3
5	G202	Engineering Drawing – II	G201	1	0	4	-	-	-	-	-	50	-	50	3
6	G204	Workshop Practice - II	G203	0	0	4	-	-	-	-	-	25	25	50	2
7	G206 A	Engineering Mechanics	G106 & G107	3	0	2	70	15	10	5	0	50	-	150	4
8	G301	Development of Life Skill-I		1	0	2	-	-	-	-	-	25	25	50	2
9	CE512	Professional Practices - I		0	0	2	-	-	-	-	-	50	-	50	1
TOTAL				15	1	20	350	75	50	25	50	275	50	875	26

SAMPLE PATH FOR TERM - III

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
							End Exam	Progressive Assessment			End Exam	Progressive Assessment			
				L	T	P		Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	CE401	Mechanics of Material	G206A	3	0	2	70	15	10	5	0	50	--	150	4
2	CE402	Civil Engg Drawing I	G201 G202	1	0	3	-	-	-	-	50	25	25	100	3
3	CE404	Surveying -I		3	0	4	70	15	10	5	25	25	-	150	5
4	CE405	Building Construction		3	1	0	70	15	10	5	-	-	-	100	4
5	CE406	Concrete Technology		3	0	2	70	15	10	5	25	25	-	150	4
6	G105	Applied Mathematics	G103 G104	3	1	0	70	15	10	5	-	-	-	100	4
7	G302	Development of Life Skill - II		1	0	2						25	25	50	2
8	CE513	Professional Practices - II		0	0	2	-	-	-	-	-	50	-	50	1
TOTAL				17	2	15	350	75	50	25	100	200	50	850	27

SAMPLE PATH FOR TERM - IV

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	G303-G307	Soft Core-I (Engineering Economics & Accountancy)		3	0	0	70	15	10	5	0	0	0	100	3
2	CE403	Civil Engg Drawing II	CE402	1	0	3	-	-	-	-	50	25	25	100	3
3	CE503	Surveying-II	CE403	3	0	3	70	15	10	5	25	25	0	150	4
4	CE407	Hydraulics		3	0	2	70	15	10	5	25	25	0	150	4
5	CE501	Design & Detailing I	CE405	3	0	2	70	15	10	5	0	50	0	150	4
6	CE504	Estimating I		2	0	4	70	15	10	5	0	25	0	125	4
7	CE508	Computer Aided Drawing	CE402	0	0	3	0	0	0	0	0	50	0	50	2
8	CE408	CE Workshop		0	0	3	0	0	0	0	0	75	0	75	2
9	CE514	Professional Practices – III		0	0	2	0	0	0	0	0	50	0	50	1
TOTAL				15	0	22	330	60	40	20	125	350	25	950	27

SAMPLE PATH FOR TERM - V

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	CE505	Estimating II	CE504	2	0	4	70	15	10	5	0	25	0	125	4
2	CE509	Water Supply & Sanitary Engineering	CE406	3	0	2	70	15	10	5	25	25	0	150	4
3	CE502	Design & Detailing II	CE501	3	0	2	70	15	10	5	0	50	0	150	4
4	CE506	Geo-Technical Engineering I	CE401	3	0	2	70	15	10	5	25	25	0	150	4
5	CE510	Highway Engg		3	0	2	70	15	10	5	25	25	0	150	4
4	CE409	Theory of Structure	CE401	3	0	0	70	15	10	5	0	0	0	100	3
8	CE515	Professional Practices – IV*		0	0	2	0	0	0	0	0	50	0	50	1
TOTAL				17	0	14	400	75	50	25	100	225	0	875	24

*This includes industrial visit

SAMPLE PATH FOR TERM - VI

Sl. No	Code	Course	Study Scheme				Evaluation Scheme							Total Marks	Credit
			Pre-requisite	Contact Hours / Week			Theory				Practical				
				L	T	P	End Exam	Progressive Assessment			End Exam	Progressive Assessment			
								Class Test	Assignment	Attendance		Sessional	Viva-voce		
1	G303-G307	Soft Core – II (Entrepreneurship Development)		3	0	0	70	15	10	5	0	0	0	100	3
2	CE511	Irrigation Engineering	CE406	3	0	0	70	15	10	5	0	0	0	100	3
3	CE507	Geo-Technical Engineering II	CE506	3	1	0	70	15	10	5	0	0	0	100	4
4	CE601-604	Elective I		3	1	0	70	15	10	5	0	0	0	100	4
5	CE601-604	Elective-II		3	1	0	70	15	10	5	0	0	0	100	4
6	CE517	Project		0	0	6	0	0	0	0	0	100	50	150	3
7	CE516	Professional Practices – V*		0	0	4	0	0	0	0	0	50		50	2
TOTAL				15	1	12	350	75	50	25	0	100	50	700	23

*This includes seminar on project

FOUNDATION COURSES

APPLIED MATHEMATICS

L T P
3 1 0

Curri. Ref. No.: G105

Total marks: 100

Total Contact hrs.:

Lecture: 45

Tutorial: 15

Practical: 0

Pre-requisite: G103, G104

Credit : 4

Theory:

End Term Exam.: 70

P.A.: 30

RATIONALEE: - Mathematics is an important tool to solve wide variety of engineering problems. Most of the technological processes in industry are described effectively by using mathematical framework. Mathematics has played an important role in the development of mechanical, civil, aeronautical and chemical engineering through its contribution to mechanics of rigid bodies, hydrodynamics, aero-dynamics and heat transfer etc. It has become of great interest to electrical engineers through its application to information theory, design of digital computer etc.

AIM:-Through this syllabus we aim to give students a strong foundation in Matrix and Vector with their applications. We also aim to give detail idea of Numerical Integration, Numerical solution of Non-Linear Equation, Gauss Elimination method and Differential Equations with application problems.

UNIT	TOPIC/SUB-TOPIC	Contact Hrs.	Total Marks.
1.0	1.1 Numerical Solution of Algebraic Equations.		
	(i) Bisection Method.		
	(ii) Regula-falsi Method or method of false position	7	10
	(iii) Newton-Raphson Method.		
	(iv) Problems on the above methods.		
	1.2 Numerical solution of simultaneous equations	7	
	Containing 2 and 3 unknowns.		10
2.0	(i) Gauss elimination method.		
	(ii) Iterative methods:-Gauss Seidal and Jacobi's method.		
	PARTIAL DIFFERENTIATION.		
	(i) Introduction to functions of two or more variables.	8	

	(ii) Geometrical Interpretation of a Function of two variables.		10
	(iii) Partial Derivatives.		
	(iv) Second Order Partial Derivative.		
	(v) Homogeneous function.		
	(v) Euler's Theorem.		
	(v) Problems		
UNIT	TOPIC/SUB-TOPIC	Contact Hrs.	Total marks.
3.0	Numerical Integration.		
	(i) Introduction.		
	(ii) Formula for Trapezoidal Rule.		
	(iii) Geometrical Interpretation of Trapezoidal Rule.	7	10
	(iv) Formula for Simpson's one-third Rule.		
	(v)) Geometrical Interpretation of Simpson's one-third Rule.		
4.0	(vi) Problems related to other physical systems.		
	Differential Equations (ordinary)		
	(i) Introduction.		
	(ii) Order and degree of a differential equation.		
	(iii) Formation of Differential Equations.		
	(iv) Solution of a Differential Equation.		
	(V) Differential equation of the first order and first degree.		
	(vI) Variables separable.	21	20
	(v) Homogeneous Differential Equations.		
	(vi) Linear Differential Equations.		
	vii) Equations reducible to linear form.		
	(vii) Exact differential Equations.		
	(viii) Equations reducible to the exact form.		
	(ix) Linear Differential Equations of second order with constant coefficients.		
	(x) Complete solution = Complementary Function Particular Integral.		
	(xi) Method of finding Particular Integral.		
5.0	(xii) Applications of differential equations to civil engineering problems.		
	(xiii) Problems related to other physical systems.	10	10
	Probability Distribution.		
	(i) Binomial distribution.		
	(ii) Poisson's distribution.		
	(iv) Normal distribution.		
	(v) Simple problems relating to production processes.		
		Total hours	Total marks
		60	70

Reference Books.

- (1) Integral Calculus by B.C.Das and B.N.Mukherjee.
- (2) Diploma Engineering Mathematics (Volume-II) by B.K.Pal.
- (3) Applied Mathematics-I by Dr.J.S.Bindra and K.S.Gill.
- (4) Applied Mathematics-II by Dr.J.S.Bindra and K.S.Gill.
- (5) Applied Mathematics-III by Dr.J.S.Bindra.
- (6) Engineering Mathematics (Volume-I, Volume-II & Volume-III)
By S.Arumugam, A.Thangapandi Issac and A.Somasundaram.

PHYSICS - I

L T P
2 0 2

Curri. Ref. No.: G106

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 30

End Term Exam: 70

Tutorial :0

P.A.: 30

Practical: 30

Practical:

Credit: 3

End Term Exam: 25

P.A : 25

RATIONALE:

Physics form a foundation for all technician courses. The study of engineering concepts of physics will help the students in understanding engineering subjects where the emphasis will be on the application of these concepts. A good foundation in physics will also help students for self-development in future, to cope up with the continuous flow of new innovation and discoveries in technology. The topics in Applied Physics for the foundation course were identified on the following basis:

- The attainment level of students in Physics at entry level to polytechnics.
- Reference to engineering subjects.
- Continuity of sequence necessary for logical development of the subject

DETAILED COURSE CONTENTS

THEORY:

UNIT TOPIC / SUB-TOPIC		Lecture Hrs.
1.0	UNITS, DIMENSION AND MEASUREMENTS	2
1.1	Units, Dimension <ul style="list-style-type: none">• Concept of unit of physical parameters• Fundamental and derived units• SI system of units of different physical parameters• Dimension with examples of different physical parameters.	
1.2	Measurements <ul style="list-style-type: none">• Measuring devices e.g., slide callipers, screw gauge, spherometer with concept of vernier constant, least count and zero error.• Physical Balance	

2.0 MECHANICS

4

2.1 Motion along a straight line and Force

- Concept of scalar and vector quantities
- Speed, velocity and linear acceleration
- Equations of motion with constant acceleration (derivation not required)
- Equations of motion of falling body under gravity
- Simple problems on linear motion
- Newton's laws of motion, Action and reaction, tension
- Force, inertia, momentum, impulse and impulsive force with practical examples
- Conservation of linear momentum.

3.0 GRAVITATION

3

- Newton's laws of gravitation
- Newton's gravitational constant G and its SI unit
- Acceleration due to gravity (g) and its relation with " G ".
- Variation of g with altitude and latitude (deduction not required)
- Difference between mass and weight
- Simple problems

4.0 WORK, POWER AND ENERGY

3

- Work, power and energy with their units and mathematical expressions
- Relation between Horse power and Watt
- Different forms of mechanical energy : PE, KE and their expressions
- Conservation of energy and transformation of energy with examples
- Simple problems

5.0 PROPERTIES OF MATTER

6

5.1 Properties of solid

- Plasticity and elasticity in solids
- Deformation of bodies by the action of external forces change in size and change in shape
- Unit of stress – tensile stress, compressive stress and Shear stress with examples
- Unit of strain – tensile strain., volumetric strain and shear strain & Hooke's law

- Modulus of elasticity – Young’s modulus, Bulk modulus and Modulus of rigidity, Poisson’s ratio and their units [Definition & basic concepts only, no deduction]
- Stress – Strain curve

5.2 **Properties of Fluid**

- Thrust and pressure
- Law of fluid pressure, Pascal’s law and working principles of hydraulic press
- Archimedes Principle and its applications
- Specific gravity and relative density
- Hydrometers and their uses
- Properties of gas : Toricelli’s Expt. & Simple Barometer
- Simple problems

6.0 **HEAT**

6

6.1 **Heat and temperature (Review)**

- Heat and temperature
- Fixed points and different scales of temperature - Fahrenheit, Celsius and Kelvin and their relationships
- Simple problems

6.2 **Measurement of heat**

- Quantity of heat, units of heat: Joule and Calorie
- Specific heat of solid, heat capacity, water equivalent
- Principle of calorimeter, Measurement of specific heat
- Change of state : Latent heat, evaporation & boiling, effect of pressure
- Boyle’s law and Charles law, Universal gas law and universal gas constant.
- Idea of two specific heat capacities of gas: C_p and C_v and their relationships (deduction not required)

6.3 **Thermal expansion & Transmission of heat**

- Expansion of solid – linear, superficial and cubical co-efficient of expansion & their units
- Interrelationship between different co-efficient of expansion with examples
- Different methods of transmission of heat : conduction, convection and radiation
- Co-efficient of thermal expansion & its unit
- Good conductors and bad conductors of heat
- Simple problems

7.1 Simple Harmonic Motion

- Simple harmonic motion and its characteristics
- Time period, frequency & amplitude of vibration
- Mathematical expression of SHM
- Examples of SHM: Simple Pendulum
- Idea on Longitudinal & Transverse wave
- Simple problems

7.2 Production and propagation of Sound

- Natural vibration, forced vibration with examples
- Resonance of sound with examples
- Principle of resonance to find out velocity of sound in air.
- Velocity of sound, Newton's formula and Laplace correction (Idea only, no deduction)

7.3 Reflection of sound

- Echo, reverberation
- Simple problems

7.4 Musical sound, noise

- Characteristics of musical sound and noise with examples
- Factors affecting sound

(Note: 10 L Hrs. can be used for assessment and evaluation of students on each module.)

PRACTICAL:**Suggested list of experiments:**

1. To measure the volume of a wooden block by using Vernier callipers.
2. To measure the surface area of a metal washer by Vernier inside callipers
3. To measure the depth of a hole by Depth Gauge (Vernier callipers)
4. To measure the cross-section of a wire by Screw Gauge.
5. To determine the thickness of a glass plate by Spherometer.
6. To adjust a common balance and to determine the specific gravity of a liquid by specific gravity bottle.
7. To establish the relation between pressure and volume of a fixed mass of gas at a constant temperature using Boyle's apparatus.
8. To determine the acceleration due to gravity (g) of a place by simple pendulum.
9. To measure the velocity of sound in air by air resonance column method.

SUGGESTED LEARNING RESOURCES:

REFERENCE BOOK:

1. Principle of Physics – Subrahmanyam & Brizal
2. Intermediate Physics – S.C.Roy Chaudhury & D.B.Sinha
3. Fundamentals Of Physics – David Halliday, Robert Resnick & Jeal Walka
4. University Physics – Francis W. Sears, Mark W. Zemans Key & Hugh D. Young
5. University Physics – Hugh D. Young & Roger H. Freedman
6. A text book of Physics (Part I) – C. R. Dasgupta
7. Elements of Higher Secondary Physics (Part I) - D. Dutta, B. Pal & B. Chaudhuri
8. Physics (Volume I) - Ajoy Chakraborty
9. Applied Physics (Vol. 1) - Saxena H.C. & Singh Prabhakar
10. Physics for 10+2 students (Part I) - Das, S.K, Sisodia M.L, Neher P.K., Kachhawa C.M.

PHYSICS – II

L	T	P
2	0	2

Curri. Ref. No.: G107

Total Contact hrs.:

Lecture: 30

Tutorial: 0

Practical: 30

Prerequisite: G105

Credit: 3

Total Marks: 150

Theory:

End Term Exam: 70

P.A.: 30

Practical:

End Term Exam: 25

PA : 25

RATIONALE:

Physics form a foundation for all technician courses. The study of engineering concepts of physics will help the students in understanding engineering subjects where the emphasis will be on the application of these concepts. A good foundation in physics will also help students for self-development in future, to cope up with the continuous flow of new innovation and discoveries in technology. The topics in Applied Physics for the foundation course were identified on the following basis:

- To develop fundamentals knowledge and skills related to Light, Magnetism, Electricity, Modern Physics and their appropriate applications in engineering.
- Reference to engineering subjects
- Continuity of sequence necessary for logical development of the subjects.

DETAILED COURSE CONTENT

THEORY :

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 LIGHT	8
1.1 Reflection of light	
1.1.1 Reflection of light on plane surface (Review) :	
• Laws of reflection	
• Image formation for reflection in a plane mirror.	
• Geometrical method of locating image.	
1.1.2 Reflection of light on spherical surface :	
• Different types of spherical mirror	

- Radius of curvature and focus of a spherical mirror.
- Reflection by a spherical mirror: real and virtual images, magnification
- Geometrical method of determination of image position, size and nature of the images formed
- Relation between focal length and radius of curvature of the spherical mirror,
- Relation between object distance, image distance and focal length (no deduction).
- Uses of different types of mirrors.

1.2 **Refraction of light:**

1.2.1 **Refraction of light through plane surface (Review)**

- Laws of refraction
- Refractive index in terms of velocity of light in different media
- Total internal reflection and critical angle, concept of fibre optics & its various practical applications
- Dispersion of light through a prism.

1.2.2 **Optical Lens :**

- Different types of lenses
- Position and nature of images formed by convex and concave lenses ,
- Image formation formula (no deduction)
- Power of a lens
- Electromagnetic spectrum : Infrared, Ultra violet & visible light
- Simple problems

2.0 **MAGNETISM**

3

2.1 **Magnetic properties (Review)**

- Natural and artificial magnets
- Properties of magnets
- Types of magnets – bar, horse-shoe, needle

- Preparation of temporary and permanent magnets
- Induced magnetism

2.2 **Magnetic measurement:**

- Uniform and non-uniform field
- Magnetic moment
- Inverse square law
- Magnetic lines of force
- Elements of Earth magnetism : dip, declination and horizontal component

3.0 **ELECTROSTATICS**

3

3.1 **Electrostatics Basic:**

- Basic concept of Electric charge
- Its production and nature – electrification by rubbing : Kinds of electrification
- Electrostatic induction and conduction
- Conductors and non-conductors
- Surface density of charge, The lightning conductor
- Coulomb's law between electric charges
- Field intensity and electric potential
- Electric permittivity
- Lines of force in electrostatic field

4.0 **CURRENT ELECTRICITY**

10

4.1 **Electric current:**

- Cell: Primary & Secondary
- Flow of charge – electric current and its unit
- Electric motive force (EMF)
- Ohm's law
- Resistance and its unit, specific resistance

- Resistance in series and parallel
- Factors affecting resistance
- Wheatstone bridge circuit
- Relation for balanced Wheatstone bridge (No deduction)
- Meter bridge, P.O. Box
- Simple problems

4.2 **Heating Effects of Current:**

- Joule's law
- Electrical work, energy and power with units
- Simple problems.

4.3 **Magnetic Effect of Electric Current:**

- Magnetic effect of electric current, Bio-Savart law
- Fleming's left hand rule
- Application of Magnetic effect of electric current – Galvanometer (concept only)
- Electromagnetic Induction: Faraday's law, Fleming right hand rule , Basic concept of A.C. generator.

5.0 **MODERN PHYSICS**

6

5.1 **Photo-electric effect:**

- Photo-electron, Work function, photo electric effect
- Photo cell
- Einstein photo electric equation
- Stopping potential, Threshold Frequency
- Principle of solar photo-voltaic cell and its uses.

5.2 **Semiconductor:**

- Energy band in solids (Idea)
- Distinction between conductor, insulators & semi-conductors in terms of energy band diagram,
- Intrinsic and extrinsic (P-type; N-type) semiconductor,
- P – N junction diode, depletion region, potential barrier.
- Forward and reverse biasing; Forward and reverse bias characteristic curve.
- Application of P – N junction diode

(Note: 10 L Hrs. can be used for assessment and evaluation of students on each module.)

PRACTICAL:

Suggested list of experiments:

1. To determine refractive index of the material of glass slab by pin method.
2. To determine the focal length of a concave mirror by u, v method
3. To determine the focal length of the convex lens by u, v method
4. To plot magnetic lines of force of a bar magnet with North Pole pointing north and to locate the neutral points & measure the magnetic length
5. To plot magnetic lines of force of a bar magnet with South Pole pointing north and to locate the neutral points & measure the magnetic length.
6. To verify Ohm's law by ammeter and Voltmeter method with —
 - (a) Series connection of resistances;
 - (b) Parallel connection of resistances.
7. To measure the unknown resistance / resistivity of the material of a wire by meter Bridge
8. To measure the unknown resistance of the material of a wire by P. O. box.

SUGGESTED LEARNING RESOURCES:

Reference Books:

1. Principle of Physics – Subrahmanyam & Brizal
2. Intermediate Physics – S.C.Roy Chaudhury & D.B.Sinha
3. Fundamentals of Physics – David Halliday, Robert Resnick & Jeal Walka
4. University Physics – Francis W. Sears, Mark W. Zemans Key & Hugh D. Young
5. University Physics – Hugh D. Young & Roger H. Freedman
6. A text book of Physics (Part II) – C. R. Dasgupta
7. Elements of Higher Secondary Physics (Part II) - D. Dutta, B. Pal & B. Chaudhuri
8. Physics (Volume II) - Ajoy Chakraborty
9. Applied Physics (Vol. II) - Saxena H.C. & Singh Prabhakar
10. Physics for 10+2 students (Part II) - Das, S.K, Sisodia M.L, Neher P.K., Kachhawa C.M.

SOFT CORE COURSES

DEVELOPMENT OF LIFE SKILL -I

L T P
1 0 2

Curri. Ref. No.: G301

Total Contact hrs :

Total marks: 50

Practical:

Theory: 15

End Term Exam: 25

Tutorial: 0

P.A : 25

Practical: 30

Credit : 2

Aim :-This subject is kept to

- Conduct different session to improve students memory Power
- Conduct different session to improve time management skills
- Motivate student to face realistic problem with confidence and positive approach

Objective: - This course will enable the students to:

- Develop reading skills
- Use techniques of acquisition of information from various sources
- Draw the notes from the text for better learning.
- Apply the techniques of enhancing the memory power.
- Develop assertive skills.
- Prepare report on industrial visit.
- Apply techniques of effective time management.
- Set the goal for personal development.
- Enhance creativity skills.
- Develop good habits to overcome stress.
- Face problems with confidence

DETAILED COURSE CONTENT

THEORY:

UNIT	TOPIC/SUB-TOPIC	TOTAL HRS.
Unit -1	Importance of DLS	
	Introduction to subject, importance in present context ,application	01
Unit -2	Information Search	
	Information source –Primary, secondary, tertiary Print and non – print, documentary, Electronic Information center, Library, exhibition, Government Departments. Internet Information search – Process of searching, collection of data –questionnaire, taking	

Interview, observation method.	02
Unit – 3 Written communication	
Method of note taking	
Report writing –Concept, types and format.	01
Unit – 4 Self Analysis	
Understanding self—	
Attitude, aptitude, assertiveness, self esteem,	
Confidence buildings. Concept of motivation.	02
Unit – 5 Self Development	
Stress Management –Concept, causes, effects and remedies to	
Avoid / minimize stress.	
Health Management – Importance, dietary guidelines and	
exercises.	
Time management- Importance, Process of time planning, Urgent	
Vs importance, Factors leading to time loss and ways to handle it,	
Tips for effective time management.	
Emotion-concept, Types, Controlling, Emotional intelligence,	
Creativity-concept, Factors enhancing creativity	
Goal setting-concept, Setting smart goal	06
Unit – 6 Study habits	
Ways to enhance memory and concentration.	
Developing reading skill.	
Organisation of knowledge,	
Model and methods of learning.	03

SUGGESTED LEARNING RESOURCES

Reference Books:

1. Personality Development & Soft Skills - B. K. Mitra, Oxford University Press
2. Basic Managerial Skills for All - E.H. Mc Grath , S.J., Prentice Hall of India Pvt Ltd
3. Body Language - Allen Pease, Sudha Publications Pvt. Ltd.
4. Creativity and problem solving - Lowe and Phil, Kogan Page (I) P Ltd
5. Decision making & Problem Solving - Adair, J, Orient Longman
6. Develop Your Assertiveness - Bishop , Sue, Kogan Page India
7. Time management - Chakravarty, Ajanta, Rupa and Company
8. Life Skills Activities for Secondary Students with Special Needs - Darlene Mannix, Kindle Edition

Internet Assistance:

- 1) <http://www.mindtools.com>
- 2) <http://www.stress.org>
- 3) <http://www.ethics.com>
- 4) <http://www.coopcomm.org/workbook.htm>
- 5) <http://www.mapfornonprofits.org/>
- 6) <http://www.learningmeditation.com> <http://bbc.co.uk/learning/courses/>
- 7) <http://eqi.org/>
- 8) <http://www.abacon.com/commstudies/interpersonal/indisclosure.html>
- 9) <http://www.mapnp.org/library/ethics/ethxgde.htm>
- 10) http://www.mapnp.org/library/grp_cnfl/grp_cnfl.htm
- 11) <http://members.aol.com/nonverbal2/diction1.htm>
- 12) http://www.thomasarmstron.com/multiple_intelligences.htm
- 13) <http://snow.utoronto.ca/Learn2/modules.html>
- 14) <http://www.quickmba.com/strategy/swot/>

Practical :**Suggested List of activities:**

- 1 Conduct Guest Lectures.
- Conduct Industrial visits.
- Conduct Seminar/Group Discussions.

Suggested List of Assignments/Tutorial :**The Term Work Will Consist Of Following Assignments.**

1 Library search:-

Visit your Institute's Library and enlist the books available on the topic given by your teacher. Prepare a bibliography consisting name of the author, title of the book, publication and place of publication.

2 Enlist the magazines, periodicals and journals being available in your library. Select any one of them and write down its content. **Choose a topic for presentation.**

3 Attend a seminar or a guest lecture, listen it carefully and note down the important points and prepare a report of the same.

4 Visit to any one place like historical/office/farms/development sites etc. and gather information through observation, print resources and interviewing the people.

5 Prepare your individual time table for a week –

- (a) List down your daily activities.
- (b) Decide priorities to be given according to the urgency and importance of the activities.

(c) Find out your time wasters and mention the corrective measures.

6 Keep a diary for your individual indicating- planning of time, daily transactions, collection of good thoughts, important data, etc

7 Find out the causes of your stress that leads tension or frustration .Provide the ways to Avoid them or to reduce them.

8 Undergo the demonstration on yoga and meditation and practice it. Write your own views, feeling and experiences on it.

NOTE: - THESE ARE THE SUGGESTED ASSIGNMENT FOR GUIDE LINES TO THE SUBJECT TEACHER. HOWEVER THE SUBJECT TEACHERS CAN SELECT, DESIGN ANY ASSIGNMENT RELEVANT TO THE TOPIC, KEEPING IN MIND THE OBJECTIVES OF THIS SUBJECT.

DEVELOPMENT OF LIFE SKILL -II

L *T* *P*
1 *0* *2*

Curri. Ref. No.: G302

Total Contact hrs :

Total marks: 50

Practical:

Theory: 15

End Term Exam: 25

Tutorial: 0

P.A : 25

Practical: 30

Credit : 2

UNITS	CONTENTS	Hours
Unit1	Inter personal Relation Importance, Interpersonal conflicts, Resolution of conflicts, Developing effective interpersonal skills communication and conversational skills, Human Relation Skills (People Skills) Problem Solving I)Steps in Problem Solving(Who?What?Where?When?Why?How?How much?) 1.Identify,understand and clarify the problem 2.Information gathering related to problem	
Unit 2	3.Evaluate the evidence 4.Consider feasible options and their implications 5.Choose and implement the best alternative 6.Review II)Problem Solving Technique 1.Trial and Error,2.Brain Storming3.Thinking outside the Box Presentation Skills Concept ,Purpose of effective presentations,	
Unit 3	Components of Effective Presentations: Understanding the topic, selecting the right information, organizing the process interestingly, Good attractive beginning, Summarising and concluding, adding impact to the ending, Use of audio visual aids OHP, LCD projector, White	

board,

Non verbal communication:

Posture, Gestures ,Eye contact and facial expression,
Voice and Language Volume, pitch, Inflection, Speed,
Pause, Pronunciation,
Articulation, Language
Handling questions Respond, Answer, Check,
Encourage, Return to presentation

Evaluating the presentation Before the presentation,
During the presentation,
After the presentation

Looking for a Job

Unit 4 Identifying different sources announcing Job vacancies,
Skim, scan and read advertisements in detail, write
efficacious CVs, write covering letters to a company
CVs, write Job Application Letters in response to
advertisements and self-applications
Job Interviews

Prepare for Interviews:

Unit 5 Intelligently anticipating possible questions and framing
appropriate answers, Do's and don'ts of an
interview(both verbal and non verbal),

Group Discussion:

Use of Non verbal behavior in Group Discussion,
Appropriate use of language in group interaction,
Do's and don'ts for a successful Group Discussion
Non verbal graphic communication

Unit 6 Nonverbal codes: A .Kinesics ,.B
.Proxemics,.C.Haptics,.D.Vocalics,.E.Physical
appearance,.F..Chronemics,.G. Artifacts Aspects of
Body Language

Formal Written Skills:

Unit 7 Memos, Emails, Netiquettes,
Business correspondence Letter of enquiry, Letter of
Placing Orders, Letter of Complaint

Total 48

Sessional Activities

Unit 1 Case Studies:
Interpersonal 1.from books
2.from real life situations

Relation	3.from students' experiences Group discussions on the above and step by step write of any one or more of these in the sessional copies Case Studies:
Unit II	1.from books 2.from real life situations 3.from students' experiences
Problem Solving	Group discussions on the above and step by step write of any one or more of these in the sessional copies
Unit III	Prepare a Presentation (with the help of a Power point) on a Particular topic. The students may refer to the
Presentation Skills	Sessional activity (sl.No.8) of the Computer Fundamental syllabus of Semester1. For engineering subject oriented technical topics the cooperation of a subject teacher may be sought. Attach hand out of PPT in the sessional copy
Unit IV	Write an effective CV and covering letter for it.
Looking for a job	Write a Job Application letter in response to an advertisement and a Self-Application Letter for a job.
Unit V	Write down the anticipated possible questions for
Job Interviews & Group Discussions	personal interview (HR)along with their appropriate responses Face mock interviews.The cooperation of HR personnels of industries may be sought if possible Videos of Mock Group Discussions and Interviews may be shown
Unit 7	Write a memo,
Formal Written Skills	Write an effective official e-mail, write a letter of enquiry, letter of placing orders, letter of complaint

ENGINEERING ECONOMICS AND ACCOUNTANCY

L *T* *P*
3 0 0

Curri. Ref. No.: G303

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Credit: 3

P.A.: 30

RATIONALE:

The knowledge of Economics and Accountancy is needed by personal dealing with the cost of products of any kind related to quality and standards of production including its financial control. Engineers in general need to know the cost of the final products for marketing purposes. The knowledge of Economics as well as Accountancy is required by all people dealing in any business or enterprises.

This particular subject deals with the Basic Concepts of Economics, Factors of Production, Types of Industries, Market forms, Need of Economics Planning for overall development, Concept of Money, Unemployment causes and measures, Industrial Policy, Public Finance, Business Transactions and Accountancy, Maintenance of Cash and balances, Receipts and Expenditures Accounts, Final Accounts and Cost Concepts.

UNITS	TOPICS/SUB-TOPICS	TOTAL CONTACT HOURS
	INTRODUCTION:	1
	Introduction to Economics and its Utility of Study	
	Importance of the study of economics.	
	BASIC CONCEPTS OF ECONOMICS:	3
	Definition of Goods, Utility, Value, Price, Income, Capital	
	Classification of Goods, Human Wants-Classification and Types-	
	Relation between Wealth and Capital	
	Consumer Behaviour: Basic Law of Demands and Supply	
	Concepts and measurement of elasticity of demand	
	PRODUCTION:	3
	Meaning and Factors of Production	
	Land, Labour, Capital and Organisation – meaning and	
	characteristics	
	Formation of Capital, Break Even Analysis, Break Even Chart its	
	uses.	
	SCALE OF INDUSTRIES:	2
	Meaning of Small, Medium and Large Scale production	
	Advantages and Disadvantages of Small Scale and Large Scale	
	Production	
	MARKET FORMS:	3
	Meaning of Market-Forms of Market	
	Features of Perfect, Imperfect and Monopoly	

Price Determination under Perfect Competition and monopoly	
ECONOMIC PLANNING:	2
Basic features of underdeveloped Economy – Basic features of Indian Economy	
Meaning, Objectives and Needs of Planning	
Current Five Year Plan	
MONEY:	2
Meaning and Function of Money	
Introduction to the concepts of the value of Money	
UNEMPLOYMENT:	2
Meaning, types and causes of Unemployment in India	
Unemployment problems in India-Measures taken by the Government of India.	
INDUSTRIAL POLICY:	3
Current Industrial Policy	
Monopoly Restricted Trade Practices Act (MRTP), Foreign Exchange Management Act (FEMA), Competitions Act	
PUBLIC FINANCE:	2
Meaning of Public Finance-Distinction Between Public and Private Finance	
Sources of Public Revenue.	
BUSINESS TRANSACTIONS AND ACCOUNTANCY:	5
Transactions and classifications, need and objectives of proper records including double entry system	
Classification of accounts and its description (in respect of real accounts, personal accounts and nominal accounts)	
Debit and credit concepts: Golden rules of Debit and Credit.	
Objectives and Principles of Double Entry System of Book Keeping.	
BOOKS OF ACCOUNTS:	2
Journal and Ledger, their subdivisions; posting from journals to ledger.	
Balancing of Accounts	
CASH BOOK:	2
Objectives of Cash Book (in respect of all kinds of Cash Transactions)	
Single Column, Double Column and Triple Column	
Impress System of Petty Cash Book	
TRIAL BALANCE:	2
14.1 Objectives, Preparation – Errors and Rectification (In respect of Balance of Accounts for the Total period)	
FINAL ACCOUNTS:	5
Steps of preparing accounts: Trading Accounts, Profit and Loss Accounts	
Revenue and Depreciation Adjustment	
Introduction to Balance Sheet	
CAPITAL AND REVENUE EXPENDITURE DISTRIBUTION:	3
Receipt and Payments	

Income and Expenditure differences
MENAING AND PURPOSE OF COSTING: 3
Element of Cost Analysis and Classification of expenditure for
Cost Accounts.
Cost Control: Prime Cost, Overhead Cost and Indirect Material
and Tools

TEXT BOOKS FOR REFERENCE:

Elements of Economics	K. K. Dewett and J. D. Verma
An Introduction to Economics Theory	H. L. Ahuja
Double Entry Book Keeping	Mohan, Juneja, Chawla and Saxena
Double Entry System of Book Keeping	J. R. Batliboy

ENTREPRENEURSHIP DEVELOPMENT

L T P
3 0 0

Curri. Ref. No.: G304

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Tutorial :0

P.A.: 30

Practical: 0

Credit: 3

RATIONALE

The course intends to provide the fundamental aspects of entrepreneurship as a means for self employment and culminating in economic development of the country. It deals with basic issues like entrepreneurial characteristics and quality, governmental policy support and overall scenario along with opportunities and the facilities available for entrepreneurship development.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC		Lecture Hrs.
1.0	INTRODUCTION	10
1.1	Definition and functions of Entrepreneur, entrepreneurship quality, entrepreneurial spirit, need for entrepreneurship.	
1.2	Individual and social aspects of business – achievement motivation theory	
1.3	Social responsibilities of Entrepreneurs	
2.0	FORMS OF BUSINESS ORGANISATION	4
2.1	Types of company	
2.2	Merits and demerits of different types	
2.2	Registration of small scale industries	
2.4	Conglomeration.	
3.0	SMALL SCALE AND ANCILLARY INDUSTRIES	8
3.1	Definition – scope with special reference to self employment.	
3.2	Procedure to start small scale and Ancillary industries	
3.3	Pattern on which the Scheme/Project may be prepared	
3.4	Sources of finance - Bank, govt., and other financial institutions.	
3.5	Selection of site for factory	
3.6	Factors of selection	
3.7	N.O.C. from different authorities, e.g., Pollution Control Board,	

3.8	Factories Directorate etc. Trade License.	
4.0	SYSTEM OF DISTRIBUTION	1
4.1	Wholesale Trade	
4.2	Retail trade	
5.0	SALES ORGANISATION	3
5.1	Market survey, marketing trends, knowledge of competitors, product selection & its basis .	
5.2	Sales promotion	
5.3	Advertisement	
5.4	Public relations and selling skills	
6.0	PRICING THE PRODUCT	1
6.1	Basic guidelines	
7.0	INTRODUCTION TO IMPORT AND EXPORT	6
7.1	Procedures for export	
7.2	Procedures for import	
7.3	Technical collaboration – international trade	
7.4	Business insurance	
7.5	Rail and road transport	
7.6	Forwarding formalities, FOR, FOB, CIF, etc.	
8.0	BUSINESS ENQUIRIES	4
8.1	Enquiries: From SISI, DIC, SFC Dept. of Industrial Development Banks.	
8.2	Offers and Quotations	
8.3	Orders	
9.0	PROJECT REPORT	6
9.1	Project Report on feasibility studies for small scale industries, proposal for finances from bank and other financial institutions for establishing new industries and its extension, obtaining License enlistment as suppliers, different vetting organizations for Techno Economic feasibility report. Breakeven analysis, Breakeven point.	
10.0	ENVIRONMENT LEGISLATION	2
10.1	Air Pollution Act	

- 10.2 Water Pollution Act
- 10.3 Smoke Nuisance Control Act
- 10.4 ISO: 14000, OSHA

SUGGESTED LEARNING RESOURCES:

Reference Books:

1. Entrepreneurship Development
Prepared by CTSC Manila Publishers by Tata Mc Graw Hill Publishing Co. Ltd.
2. Small Enterprise Management Published by ISTE, Mysore
3. Motivation Published by ISTE, Mysore
4. S.S.M. in Environmental Engineering Published by ISTE, Mysore
5. Entrepreneurship New Venture Creations, Holt, Prentice Hall, India.
6. Essence of TQM by John Bank
7. Rathore, B.S. and J.S. Saini(ed), A Handbook of Entrepreneurship – Panchkula :
Aapga, 1997
8. Jose Pauletal, Entrepreneurship Development, Mumbai : Himalaya Publishing
House, 1996
9. Khanka, S.S., Entrepreneurship Development, New Delhi : S. Chand and Co.,
2001
10. Nagarazan, R.S. and A.A. Arivalagar, TQM New Delhi : New Age International
Publishers, 2005
11. Bhatia, R.C., Marketing Communication and Advertising, New Delhi : Galgotia
Publishing Co., 2003
12. Sinha, J.C., and V.N. Mugali : A Textbook of Commerce, New Delhi : R. Chand
and Co., 1994

PRINCIPLES OF MANAGEMENT

L T P
3 0 0

Curri. Ref. No. G305

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Tutorial :0

P.A.: 30

Practical : 0

Credit: 3

RATIONALE

Management is the integrated component of all areas of technological courses as recognized across the world. Technicians or supervisors coming out of the system hence need to study the basic components of the management relevant to them. Principles of management will enable them to apply basic knowledge of management in their field of work. Keeping with this in mind necessary content details of the course on Principles of Management has been developed. With the assumption that, it will develop some management foundation to the diploma students.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
FRAMEWORK OF MANAGEMENT	8
1.1 Nature of management	
1.2 Development of management thoughts	
1.3 Management and process skills	
2.0 PLANNING	9
2.1 Fundamentals of planning	
2.2 Planning premises and forecasting	
2.3 Decision making	
2.4 Mission and objective	
3.0 ORGANIZING	10

3.1	Fundamentals of organizing	
3.2	Design of organization structure	
3.3	Forms of organization structure	
3.4	Power and authority	
3.5	Authority relationship	
4.0	STAFFING	8
4.1	Fundamentals of staffing	
4.2	HR planning	
4.3	Recruitment and selection	
4.4	Training and development	
4.5	Performance appraisal	
5.0	DIRECTING	6
5.1	Fundamentals of directing	
5.2	Operational control techniques	
5.3	Overall control technique	
6.0	TOTAL QUALITY MANAGEMENT	4
6.1	Concepts and definitions	
6.2	Sages of quality gurus and their contributions	
6.3	Basic tools of TQM	

SUGGESTED LEARNING RESOURCES:

Reference books:

1. Principles of management, by: T.Ramasamy (Himalya publishing house)
2. Management by: S. P. Robins
3. Management principles by: Anil Bhat and Arya Kumar
4. Principles and practice of management by LM Prasad
5. Principles of management by LM Prasad
6. Essentials of Management / Joseph L. Massie / Prentice-Hall of India

ORGANIZATIONAL BEHAVIOUR

L T P
3 0 0

Curri. Ref. No.:G306

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Tutorial :0

P.A.: 30

Practical: 0

Credit: 3

RATIONALE

Knowledge in behavioural principles in an organization is an important requirement because concepts such as work motivation, behavioural patterns of individuals as also those of group of individuals etc are intimately related to it. Organizational Behavioural principles, its scopes, applicability etc. are therefore important to know by the students irrespective of the branch of specialization. Based of the above facts following content details of the subject on Organizational Behaviour has been suggested.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 ORGANIZATION:	8
Concept and Definition	
Structures (line, staff, functional divisional, matrix)	
2.0 MOTIVATION :	10
Principles of Motivation	
Aspects of Motivation	
Job motivation	
Theories of motivation (Maslow, Herzberg, Theory of X&Y of Mc. Gregar)	

3.0 DEVELOPING GOOD WORK HABITS: 10

Principles of habit formation

Attitude and values

Personality-

- Concepts
- Theories
- Personality and Behaviour

4.0 ORGANIZATIONAL CULTURE: 8

Concepts and its importance

Determinants of organizational culture

Rules & regulations

5.0 TEAM BUILDING: 9

Concepts

Team and Group

Formation of Team building

SUGGESTED LEARNING RESOURCES:

Reference Books:

1. Organisational Behaviour — An introductory Text – Huezyski A. & Bucheman C. (Prentice Hall of India)
2. Image of Organisation — Morgan G. (Sage)
3. Understanding Management — Linstoand S. (Sage)
4. Organizational Behaviour — Robbins (Prentice Hall of India)
5. Understanding and Managing – Organizational Behavior — George & Jones
6. Organisational Behaviour, L.M. PRASAD, New Delhi, Sultan Chand & Sons
7. Essentials of Management — Koontz (Tata McGraw Hill)

ENVIRONMENTAL EDUCATION

L T P
3 0 0

Curri. Ref. No. G307

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Tutorial : 0

P.A.: 30

Practical : 0

Credit: 3

RATIONALE

Management of Environmental Degradation as also its control using innovative technologies is of prime importance in the times we are living in. Since the days of the famed Rio Summit (1992) awareness about degradation of environment we live in and its management through participation of one and all has literally blossomed into a full fledged movement of universal importance. Technically qualified people, such as the Diploma Engineers, should not only be aware about new technologies to combat environmental degradation at their disposal but also various aspects of environment, ecology, bio-diversity, management, and legislation so that they can perform their jobs with a wider perspective and informed citizens. This course can be taken by all diploma students irrespective of their specializations.

DETAILED COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 INTRODUCTION	2
1.1 Introduction	
1.2 Environment and its components	
1.3 Environment in India	
1.4 Public Awareness	
2.0 ECOLOGICAL ASPECTS OF ENVIRONMENT	8
2.1 Ecology	
• Eco-system	
• Factors affecting Eco-system	
2.2 Bio-geochemical cycles	
• Hydrological cycle	
• Carbon cycle	
• Oxygen cycle	
• Nitrogen cycle	

- Phosphorous cycle
 - Sulphur cycle
- 2.3 Bio-diversity
- 2.4 Bio-diversity Index

3.0 NATURAL RESOURCES 5

- 3.1 Definition of Natural Resources
- 3.2 Types of Natural Resources
- 3.3 Quality of life
- 3.4 Population & Environment
- 3.5 Water Resources
- Sources of Water
- 3.6 Water Demand
- 3.7 Forest as Natural Resource
- Forest and Environment
 - Deforestation
 - Afforestation
 - Forest Conservation, its methods
- 3.8 Land
- Uses and abuses of waste and wet land

4.0 GLOBAL ENVIRONMENTAL ISSUES 9

- 4.1 Introduction
- 4.2 Major Global Environmental Problems
- 4.3 Acid Rain
- Effects of Acid Rain
- 4.4 Depletion of Ozone Layer
- Effects of Ozone Layer Depletion
- 4.5 Measures against Global Warming
- 4.6 Green House Effect

5.0 ENVIRONMENTAL POLLUTION 9

- 5.1 Introduction
- 5.2 Water Pollution
- Characteristics of domestic waste water
 - Principles of water treatment
 - Water treatment plant (for few industries only- unit operations & unit processes - names only)
- 5.3 Air Pollution
- Types of air pollutants
 - Sources of Air Pollution
 - Effects of Air Pollutants
- 5.4 Noise Pollution

- Places of noise pollution
- Effect of noise pollution

6.0 CLEAN TECHNOLOGY 6

- 6.1 Introduction to Clean Technologies
- 6.2 Types of Energy Sources
 - Conventional Energy sources
 - Non-conventional sources of Energy
- 6.3 Types of Pesticides
- 6.4 Integrated Pest Management

7.0 ENVIRONMENTAL LEGISLATION 3

- 7.1 Introduction to Environmental Legislation
- 7.2 Introduction to Environmental Laws

8.0 ENVIRONMENTAL IMPACT ASSESSMENT 3

- 8.1 Introduction to Environmental Impact Assessment
- 8.2 Environmental Management (elements of ISO 14001)
- 8.3 Environmental ethics

SUGGESTED IMPLEMENTATION STRATEGIES:

The teachers are expected to teach the students as per the prescribed subject content. This subject does not have any practical but will have only demonstration and field visit as stated. The students will have to prepare report of the site visit.

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Environmental Engineering	Pandya & Carny, Tata McGraw Hill, New Delhi
2.	Introduction to Environmental Engineering and Science	Gilbert M. Masters Tata McGraw Hill, New Delhi
3.	Waste Water Engineering – Treatment, Disposal & Reuse	Metcalf & Eddy Tata McGraw Hill, New Delhi
4.	Environmental Engineering	Peavy, TMH International New York
5.	Study / training materials, references, reports etc. developed by Central Pollution Control Board, New Delhi as also State Pollution Control	Central Pollution Control Board Postal Address: Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar, DELHI - 110 032, INDIA Tel.: 91-11-22307233

S. No.	Title	Author, Publisher, Edition & Year
	Boards	Fax: 91-11-22304948 e-mail: ccb.cpcb@nic.in
6.	Environmental Science	Aluwalia & Malhotra, Ane Books Pvt. Ltd, New Delhi
7.	Text Book of Environment & Ecology	Sing, Sing & Malaviya, Acme Learning, New Delhi
8.	Environmental Science & Ethics	Sing, Malaviya & Sing, Acme Learning, New Delhi
9.	Environmental Chemistry	Samir K. Banerji, Prentice Hall of India, New Delhi

(b) Others:

1. Text book mentioned in the references
2. Lab Manuals
3. OHP Transparencies
4. Video film on Environment

SUGGESTED LIST OF DEMONSTRATIONS/FIELD VISIT

- pH value of water sample.
- Hardness of water
- Calcium hardness
- Total Hardness
- Residual Chlorine to a given sample of water
- Turbidity
- B.O.D.
- C.O.D.

Visits: Following visits shall be arranged by the teachers during the semester:

- Water Treatment Plant
- Sewage Treatment Plant
- Maintenance work of water supply mains and sewage system

BASIC TECHNOLOGY COURSES

MECHANICS OF MATERIALS

L *T* *P*
3 0 2

Curri. Ref. No.: CE401

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Practical: 30

P.A.: 30

Theory Class duration:

Practical:

45 classes of 1hr. or

End Term Exam:

60 classes of 45 minutes

P.A : 50

Pre requisite: G206A

Credit: 4

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).	
	<ul style="list-style-type: none"> 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.	
	<ul style="list-style-type: none"> Identify the different parts of universal Testing Machine. 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.	
	<ul style="list-style-type: none"> 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).	
	<ul style="list-style-type: none"> • 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.	
	<ul style="list-style-type: none"> • Determine stresses in butt weld and fillet weld. 	
2.6	Stresses, strains, and Deformations of Axially Loaded Members :	
	Temperature stresses, composite bars/sections.	
	<ul style="list-style-type: none"> • Solve simple problems on determination of stresses and shortening of axially loaded members. 	
3.0	Analysis of beams:	14
3.1	Beam: definition, types of beams – Simply supported and cantilever beams, propped cantilever, fixed-ended and continuous beams.	
	<ul style="list-style-type: none"> • 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.	
	<ul style="list-style-type: none"> • 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.	
	<ul style="list-style-type: none"> 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.	
	<ul style="list-style-type: none"> 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).	
	<ul style="list-style-type: none"> 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-code formula for column design.	
	<ul style="list-style-type: none"> Determine the critical buckling load for a given column as per known formulae. Determine factor of safety for a given column with known end conditions and loading. 	
	Class Test	3

PRACTICAL: 30 Hours

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
8.0	SHEAR TEST:	3
8.1	Determination of Shear Modulus (Modulus of Rigidity) of a soft material	
9.0	TENSILE TEST	3
9.1	Determination of Young's Modulus of a material in a tensile testing machine.	
10.0	HARDNESS TEST:	3
10.1	Determination of hardness of a material by a Brinell or Rockwell testing machine.	
11.0	IMPACT TEST:	3
11.1	Testing of Cast Iron (C.I.) and Mild Steel (M. S.) test pieces by Impact testing machine.	
12.0	FATIGUE TEST:	3
12.1	Testing of a Mild Steel (M. S.) test piece for fatigue.	
13.0	DEFLECTION OF BEAMS	3
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 method.	
14.0	VIVA - VOCE:	12

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.
3. Theory and Problems of Strength of Materials - by William A. Nash; Shaum's outline of - Shaum's Outline Series, Mc. Graw Hill. Inc.
4. 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; Mc. 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`

CIVIL ENGINEERING DRAWING - I

L *T* *P*
1 *0* *3*

Curri. Ref. No.: CE402

Total Contact hrs.:

Total marks: 100

Practical:

Theory: 15

End Term Exam: 50

Practical: 45

P.A : 50

Pre requisite: G201,G202

Credit: 3

RATIONALE:

This subject is very important for diploma holders in Civil Engineering as this subject provides an input to the students to draw the different structural elements accurately to a chosen scale as required for construction. 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	STAIR CASE:	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. Warren J. Luzadder - Graphics for Engineers - Prentice Hall of India (Pvt.) Ltd.
8. K.L. 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; Mc. 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*
1 *0* *3*

Curri. Ref. No.: CE403

Total Contact hrs.:

Total marks: 100

Practical:

Practical: 60

End Term Exam: 50

Pre requisite: CE402

P.A : 50

Credit: 3

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. This 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.

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
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 + 10 = 20
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 + 04 = 10
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	DRAWING OF A SINGLE STORIED BUILDING	09

4.1	Plan, elevation, and section of a single storied RCC Building from a given plan. Details of chajja, lintel and beams should be shown (Plate No. 6)	
5.0	AIRPORT:	10
5.1	Components of an airport, general layout of an airport showing different components	
	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. Fraderik 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. Parkinson - 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.

SURVEYING-I (Theory)

<i>L</i>	<i>T</i>	<i>P</i>
3	0	4

Curri. Ref. No.: CE404

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Practical: 60

P.A.: 30

Theory Class duration:

Practical:

45 classes of 1hr. or

End Term Exam: 25

60 classes of 45 minutes

P.A: 25

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 organization	
	1.7 Office work-features, plotting, scales, effect of erroneous scale	
	1.8 Maintenance and adjustments of instruments	
2.0	LINEAR MEASUREMENT:	02
	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.	
	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	
4.0	CHAIN SURVEYING:	06
4.1	Purpose of chain surveying, Principles of chain surveying-well conditioned and ill conditioned triangles	
4.2	Field books- single line & double line entry, field book recording (detailed description to be covered in practical)	
4.3	Reconnaissance survey- method, index map, reference sketch	
4.4	Selection of survey stations, Base line, Tie lines, Check lines	
4.5	Offsets- Types & necessity	
4.6	Method of chain surveying, locating objects, recording entry in field book.	
4.7	Plotting- selection of scale, conventional signs, plotting on drawing sheet from field book data.	
5.0	ANGULAR MEASUREMENT:	08
5.1	Measurement of angles, with compass	
5.2	Compass- types- Surveyors' compass, Prismatic compass, features, parts.	
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 Fore bearing, 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.	
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	Computation of area from plotted survey map- planimeter, features, use of mensuration techniques- average ordinate rule, trapezoidal rule, Simpson's rule.	
7.0	LEVELLING:	12
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 collimation, axis of bubble tube, axis of telescope, Vertical axis	
7.5	Levelling staff- types, features and use	
7.6	Temporary adjustments of level, 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 Collimation method and Rise & Fall method, comparison, Numerical problems on reduction of levels applying both methods, Arithmetic checks	
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	
	CLASS TEST & REVISION	03
	TOTAL:	45

REFERENCE BOOKS :

1. Surveying & Levelling Vol.I - by T.P.Kanetkar & S.V.Kulkarni; Griha Prakash, Pune
2. Surveying Vol.I - 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 & Levelling - by N.N. Basak; Tata Mc. 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
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	
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	Measurement of bearings of lines (at least 3 lines) and determination of included angles using Prismatic compass and Surveyor's compass.	02
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 the field book.	04
	(5 to 6 students/group)	04
5.3	Preparation of survey map by plotting, individually, the field book data from exercise 5.2 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 the 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 length, taking L.S at every 15m and C.S. at 1m & 3m apart on both sides at every 30m interval and recording the data in level book and applying arithmetical check	04
6.9	Plotting the profile of the alignment surveyed in Exercise 6.8 and drawing the grade of alignment desired (To be drawn during the class hours)	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	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.

BUILDING CONSTRUCTION

L *T* *P*
3 1 0

Curri. Ref. No.: CE 405

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Practical: 0

P.A.: 30

Theory Class duration:

45 classes of 1hr. or

60 classes of 45 minutes

Pre requisite: Nil

Credit: 4

RATIONALE:

The subject of building construction 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 construction 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.

UNIT	TOPIC/SUB-TOPIC	Hrs.	Total hrs.
1.0	INTRODUCTION		4
	1.1 Classification of building bases on occupancy.		
	1.2 Different parts of building and their requirements.		
2.0	SITE INVESTIGATION:		6
	2.1 Object of site investigation (exploration)		
	2.2 Method of site investigation. Brief description of site reconnaissance (Inspection of site), boring methods.		
	2.3 Bearing capacity method of testing bearing capacity of soil.		
3.0	FOUNDATIONS:		8
	3.1 Definitions and purpose of foundation.		
	3.2 Essential requirements of foundations.		
	3.3 Type of foundation –deep foundations and shallow foundations and their classifications.		

3.4	Shallow foundation- constructional and details of spread foundations for walls, combined footings, raft foundation (with sketches).	
3.5	Deep foundations-pile foundation-types, classification and their relative merits and demerits, pier or well foundations.	
4.0	BRICK MASONRY:	5
4.1	Definition: Materials used in brick masonry, general principles to be observed in brick masonry.	
4.2	Definition of term-Mortar, bond, head, stretcher, bed, bat, closer, bull nose, frogs, cross joints, quoin, facing.	
5.0	STONE MASONRY	5
5.1	Uses, comparison between stone masonry and brick masonry.	
5.2	Materials used in brick masonry.	
5.3	Technical terms used in stone masonry.	
5.4	Types of stone masonry-Rubble masonry and ashlar masonry, their description with classification.	
6.0	PARTITION WALLS & CAVITY WALLS	3
6.1	Definition of partition and cavity wall.	
6.2	Advantage of cavity wall.	
6.3	Types of partition walls-Brief description of brick partitions, concrete partitions only	
7.0	ARCHES AND LINTELS	3
7.1	Meaning and use of arches and lintels.	
7.2	Technical terms in arches and lintel	
7.3	Classification of lintels.	
8.0	DOORS AND WINDOWS	5
8.1	Glossary of terms used in doors and windows.	
8.2	Door-use, types of doors(description with sketches)	
8.3	Window-use, types of windows (shallow foundations)	
9.0	DAMP PROOFING	4
9.1	Definition of dampness, defects of dampness, causes of Dampness.	
9.2	Sources of dampness, prevention of dampness,	
9.3	Materials used for damp proofing.	
10.0	FLOORS	4
10.1	Ground floor-definition, types of ground floors (name) description of concrete flooring, Mosaic flooring, terrazzo flooring	
10.2	Selection of a suitable type of floor	

11.0	STAIRS:	4
11.1	Definition, location of stairs.	
11.2	Common technical terms used in stairs construction.	
11.3	Requirements of good stairs.	
11.4	Classification of stairs (brief description with diagram)	
12.0	ROOFS	2
12.1	Types of roofs, description of sloping roofs, flat roofs.	
12.2	King post and Queen post truss.	
13.0	SURFACE FINISH	4
13.1	Plastering –definition, materials used for plastering, application of plaster, defects in plastering	
13.2	Pointing- definition, types of pointing, preparation of surface Mortar used.	

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 Shri 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

CONCRETE TECHNOLOGY

L *T* *P*
3 0 2

Curri. Ref. No.: CE406

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Theory Class duration:

P.A.: 30

45 classes of 1hr. or

Practical:

60 classes of 45 minutes

End Term Exam: 25

Pre requisite: NIL

P.A.: 25

Credit: 4

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, accelerating admixtures, retarding admixtures, water-reducing admixtures, air-containing admixtures, mineral admixtures.	
6.0	Properties of fresh concrete:	3
	6.1 Concept of fresh concrete, Workability, slump test, compacting factor test, Ve-bee consistency test and flow test, requirement of workability.	
7.0	Properties of hardened concrete:	3
	7.1 Role of w/c on strength, 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	Materials, workmanship etc. as per IS: 456, Acceptance criteria as per IS : 456, Quality management in concrete construction.	
9.0	Proportioning of concrete mixers:	6
9.1	Basic consideration for concrete mix design, choice of ingredients of the mix, mix proportioning as per IS: 10262 – 2009, 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 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	High performance:	3
12.1	Introduction to Silica fume concrete, mass concrete, ferro-cement, construction in ferro-cement and applications, concrete materials used, Definitions & fundamental principles.	
13.0	Deterioration of concrete and its prevention:	2
13.1	Types of deterioration, corrosion of reinforcement, effects and prevention.	
14.0	Repair & rehabilitation 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, shot-crete concrete or gunniting.	
	TOTAL :	45

PRACTICAL: 30hrs.

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
	<ol style="list-style-type: none">1. Determination of normal consistency of cement2. Determination of Initial & Final Setting time of cement (sample of hardened ring marks after final setting to be shown to the students)3. Determination of fineness of cement by sieving and soundness of cement by Le Chatelier apparatus4. Determination of compressive strength of cement5. Grading analysis of fine and coarse aggregates by sieving6. Determination of bulking of sand7. Determination of bulk density of coarse aggregate8. Determination of water absorption of brick9. Determination of compressive strength of brick10. Determination of Air content, Slump, Ve-bee and compaction factor of fresh concrete11. Determination of compressive strength of concrete12. Tensile testing of reinforcing rod13. Demonstration of the following non-destructive tests on concrete:<ol style="list-style-type: none">(i) Ultrasonic testing(ii) Rebound hammer testing	

REFERENCE BOOKS:

1. Concrete Technology -by M. L. Gambhir; Tata McGraw Hill
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

IS: Codes – IS : 456 – 2000
 : 10262 – 2009
 : 383
 : 1199

HYDRAULICS

L *T* *P*
3 0 2

Curri. Ref. No.: CE407

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Practical: 30

P.A.: 30

Theory Class duration:

Practical:

45 classes of 1hr. or

End Term Exam: 25

60 classes of 45 minutes

P.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:	12
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	27
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

Class Test	3	
TOTAL:		45

PRACTICAL

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
4.0	Hydraulic Lab Practical	30
4.1	Determination of metacentric height of a floating body	
4.2	Verification of Bernoulli's theorem	
4.3	Determination of the co-efficients of discharge, contraction and velocity of an orifice	
4.4	Determination of coefficient of discharge of a rectangular notch fitted in an open channel	
4.5	Determination of coefficient of discharge of a V- notch fitted in an open channel	
4.6	Determination of coefficient of discharge of a venturimeter, orificemeter fitted in a pipe	
4.7	Determination of head loss due to friction and coefficient of friction for flow through pipes.	
4.8	Study of the parts of a centrifugal pump	
4.9	Study of the parts of a reciprocating pump	
4.10	<u>Demonstration of discharge measurement by a currentmeter</u>	
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. Thanikachalam, Tata McGraw-hill Publishing Company Limited

C.E. WORKSHOP

L *T* *P*
0 0 3

Curri. Ref. No.: CE408

Total Contact hrs.:

Total marks: 75

Practical:

Practical: 45

P.A : 75

Credit: 2

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 arc welding fusion run on M.S. flat bar 6mm.thick both 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	4
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.P.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 the 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) English bond (ii) Flemish bond for a corner wall and a Tee-joint	
6.3	Casting of Reinforced cement concrete beam/slab with given proportion (a) 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) methods 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 outlet, 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)	

THEORY OF STRUCTURES

<i>L</i>	<i>T</i>	<i>P</i>
3	0	0

Curri. Ref. No.: CE409

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Pre requisite: CE401

P.A.: 30

Credit: 3

Practical:

End Term Exam : Nil

P.A : Nil

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 behaviour 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 behaviour 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 the past.

UNIT	TOPIC/SUB-TOPIC	Hrs.	Total hrs.
1.0	BENDING AND SHEAR STRESSES IN BEAMS:	12	
1.1	Overview of shear force and bending moments in beams		
1.2	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.		
1.3	Flitched beams – solve numerical problems on finding safe load of flitched beams, draw distribution of stresses, and find the moment of resistance given sections.		
1.4	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	
2.0	DAMS AND RETAINING WALLS:	16	
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 the 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 slope and deflection is important from the structural point of view, shape and nature of elastic curve(deflection curve).	
4.2	Formulae and their applications -- State and explain the formulae for deflection and rotation of simply supported beams and cantilevers under concentrated, uniformly distributed loads and end moments. Principle of superposition to solve propped cantilever beams for reactions, bending moments and shear force. Sketch the deflected shapes of determinate beams.	
4.3	Problems on simply supported and cantilever beams for determination of slope and deflection under different types of loadings by integration method (Macaulay's method).	
4.4	Moment area method, conjugate Beam method- basic principles and simple problems.	
	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

APPLIED TECHNOLOGY COURSES

DESIGN AND DETAILING -I

<i>L</i>	<i>T</i>	<i>P</i>
3	0	2

Curri. Ref. No.: CE501

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Practical: 30

P.A.: 30

Theory Class duration:

Practical:

45 classes of 1hr. or

P.A : 50

60 classes of 45 minutes

Pre requisite: CE405

Credit: 4

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 the 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	
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 Bending	12
3.1	Explain Ultimate Strength of R.C. beams (Limit State of Collapse by flexure), balanced, under reinforced sections, why over reinforced sections are not used, 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, solve problems	
3.4	Design singly reinforced rectangular beams, one-way & cantilever slabs as per IS456	
3.5	Use SP-16 for design of beams & slabs	
3.6	Explain basic considerations, behaviour of doubly reinforced beams	
3.7	Design of doubly reinforced beams, solve problems.	
4.0	Limit State of Collapse in Shear (Design for Shear by LSM)	7
4.1	Explain shear cracks and shear failures with or without shear reinforcement	
4.2	Explain contribution of concrete in resisting design shear, types of shear reinforcement, design of stirrups, minimum shear reinforcement, step-by-step procedure for design of links, shear in slabs, detailing of steel.	
4.3	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	Development length of bars	
5.2	Explain & calculate development length for HYSD bars for M20 & M25 grade concrete	
5.3	Check the development length at support of a beam	
5.4	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 slabs, 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 H.J. Shah
3. Reinforced Concrete : Limit State Design - by A.K. Jain
3. Design Aids for Reinforced Concrete to IS: 456-1978, BIS, SP-16
4. Handbook on Concrete Reinforcement & detailing, BIS, SP-34

DESIGN AND DETAILING-II

<i>L</i>	<i>T</i>	<i>P</i>
3	0	2

Curri. Ref. No.: CE502

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Practical: 30

P.A.: 30

Theory Class duration:

Practical:

45 classes of 1hr. or

P.A: 50

60 classes of 45 minutes

Pre requisite: CE501

Credit: 4

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. Total hrs.
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	4
7.0	Stair Case (RCC - LSM)	3
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		
9.0	Concept of seismics in Planning and Design of Buildings	03	
9.1	Introduction of earthquakes		
9.2	Magnitude and intensity as per IS:1893-2002		
9.3	Seismic Zoning, zones of different cities (IS:1893-2002)		
9.4	Planning a building in a seismic prone area, general structural arrangement and concept of tying the different elements (IS:4326)		
9.5	Ductile detailing of R.C. structural elements as per IS:13920, detailing of beams, columns and their junctions		
	Class Test:	3	
	TOTAL:		45

REFERENCE BOOKS:

1. Design of Steel Structure -by V.N. Vazirani & M.M. Ratwani
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
1. Reinforced Concrete - by H.J. Shah
2. Design Aids for Reinforced Concrete to IS: 456-1978, BIS, SP-16
3. Handbook on Concrete Reinforcement & detailing, BIS, SP-34

SURVEYING-II (Theory)

<i>L</i>	<i>T</i>	<i>P</i>
3	0	3

Curri. Ref. No.: CE503

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Practical: 60

P.A.: 30

Theory Class duration:

Practical:

45 classes of 1hr. or

End Term Exam: 25

60 classes of 45 minutes

P.A: 25

Pre requisite: CE403

Credit: 4

RATIONALE:

Surveying- II is the sequential course following Surveying-I. The course covers the 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-II.

AIM:

The course content of Surveying -II has been designed to provide adequate information to develop competency in a learner to- comprehend the 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.	
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, toposheets	
	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	TRIGNOMETRICAL 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 of stadia tacheometry, stadia constants determination	
5.4	Elevations and distances of staff stations-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)succcessive bisection of arc (iii)offsets from tangents (iv) offsets from chords produced (v) Rankine's method of tangential angles	
6.5	Transition curves -description and their characteristics (numerical problems not required)	
7.0	SETTING OUT WORKS:	2
7.1	Methods of setting out layouts of structures from construction plans of (i) buildings, (ii) culverts, (iii) bridge piers	
8.0	MINOR SURVEYING INSTRUMENTS:	2
8.1	Essential features and use of - (i)Hand Level, (ii) Abney's Level, (iii) Pantograph, (iv) Ceylone Ghat Tracer, (v) Box Sextant	
9.0	MODERN SURVEYING METHODS:	5
9.1	Principles, features and use of (i) Microoptic theodolite/ digital theodolite, (ii) Electronic Distance Meter	
9.2	Working principles of a Total Station	

9.3	Setting out traverses with Total Station, Determination of elevations of points, building heights	
9.4	Introduction to GPS	
	REVISION and CLASS TEST	3
TOTAL		45

REFERENCE BOOKS:

1. Surveying & Levelling Vol.I ,II - by T.P.Kanetkar & S.V.Kulkarni; Griha Prakash, Pune
2. Surveying Vol.I, 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. setout 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	TRIGNOMETRICAL 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 Rankine's method of tangential angle (Deflection angles)	04
7.0	SITE SURVEYING:	
7.1	Setting out at site the center line and foundation width of a building from the given plan	02
7.2	Setting out the foundation line for a culvert	02
7.3	Dividing an area into plots of given size	02
8.0	MODERN SURVEYING INSTRUMENTS:	
8.1	Total Station with EDM and GPS	02
8.2	Measure distance between two points with electronic distance meter	02
8.3	Measure distance, elevation, horizontal and vertical angle of an object with modern theodolite	02
8.4	Typical site layout by using Total Station.	04
	TOTAL:	60

ESTIMATING - I

<i>L</i>	<i>T</i>	<i>P</i>
2	0	4

Curri. Ref. No.: CE504

Total Contact hrs.:

Total marks: 125

Theory:

Theory: 30

End Term Exam: 70

Practical: 60

P.A. : 30

Pre requisite: Nil

Practical:

Credit: 4

P.A : 25

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 proforma 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	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	

TOTAL: 60

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

ESTIMATING - II

<i>L</i>	<i>T</i>	<i>P</i>
2	0	4

Curri. Ref. No.: CE505

Total Contact hrs.:
Theory: 30
Practical: 60
Pre requisite: CE504
Credit: 4

Total marks: 125

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

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, carpet area 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	
4.0	Valuation	04
4.1	Describe the different forms of Valuation	
4.2	Describe the method of valuing the real estate properties both for free hold and lease hold. State the method of presentation of the valued properties in a tabular form	

PRACTICAL

5.0	Exercise	56
5.1	To prepare a detailed estimate of an irrigation canal partly cutting and partly banking	
5.2	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)	
5.3	To prepare a detailed estimate of finishing items such as plastering, painting, varnishing etc.	
5.4	To prepare a supplementary estimate of a RC building for addition, alteration or deviation from the original plan of the building after part execution	
5.5	To prepare an estimate for annual repair of a RC building	
5.6	To prepare an estimate for RC box culvert.	
	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
3. Estimating, Costing and Specification - by M. Chakraborty
4. Estimating & Costing - by S. Ramamrutham; Charoathar Publishing Co.

GEO-TECHNICAL ENGINEERING - I

<i>L</i>	<i>T</i>	<i>P</i>
3	0	2

Curri. Ref. No.: CE506

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Practical: 30

P.A.: 30

Theory Class duration:

Practical:

45 classes of 1hr. or

End Term Exam: 25

60 classes of 45 minutes

P.A : 25

Pre requisite: CE401

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, especially in the design and construction of building foundation.

AIM:

To develop knowledge and skills of (a) Classification of soils and soil structure (b) 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 (e) Settlement of foundations (f) Estimation of thickness of pavement by CBR method (g) Stabilisation of soils.

UNIT	TOPIC/SUB-TOPIC	Hrs.	Total hrs.
1.0	INTRODUCTION	2	
	1.1 Definition of soil, formation of soil, residual and transported soil		
2.0	INDEX PROPERTIES	7	
	2.1 Preliminary definition of water content, density, specific gravity, void ratio, degree of saturation, density index, numerical problems		
	2.2 Determination of water content, specific gravity and particle size distribution of coarse and fine grained soil. Numerical problems		

2.3	Consistency limits of soil: Definition, relation and determination of liquid limit, plastic and shrinkage limit, Application of consistency limit. Numerical problems		
3.0	CLASSIFICATION OF SOIL	6	
3.1	Identification and description of coarse and fine grained soils		
3.2	Particle size classification , textual classification, HRB classification, unified soil classification , IS classification		
4.0	SOIL STRUCTURE	2	
4.1	Particle arrangement in coarse grained, clay and composite soil		
5.0	PERMEABILITY	4	
5.1	Definition of head, gradient		
5.2	Darcy's law, Validity of Darcy's law		
5.3	Laboratory and field determination of permeability		
5.4	Factors effecting permeability		
6.0	SEEPAGE ANALYSIS	4	
6.1	Definition and concept of seepage flow and flow net		
7.0	COMPACTION	5	
7.1	Definition, maximum dry density, optimum moisture content		
7.2	Factors effecting compaction		
7.3	Light and heavy compaction test as per IS specification		
7.4	Field compaction methods		
8.0	CONSOLIDATION	4	
8.1	Brief concept of compressibility and consolidation		
8.2	One dimensional consolidation test		
9.0	SHEAR STRENGTH	8	
9.1	Definition of shear and shear parameters		
9.2	Mohr circle, unconfined compression test, direct shear test, UU test, numerical problems		
9.3	Introduction to Triaxial tests		
10.0	CLASS TEST	3	
	TOTAL:		45

N.B.: Geotechnical Engineering subject can best be learned through lecture - demonstrations using 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.

REFERENCE BOOKS:

Sl. No.	Name of Book	Author	Publishers
1.	Principles of Geotechnical Engineering	B. M. Das	Thomson
2.	Basic and Applied Soil Mechanics	Gopal, Ranjan	New Age International (P) Ltd.
3.	Soil Mechanics and Foundations, 2ed, w/CD	Budhu	Wiley India
4.	Soil Mechanics SI Version	Lambe	Wiley India
5.	Soil Mechanics & Foundation Engineering	Raj	Pearson
6.	Soil Mechanics & Foundations	B. C. Punmia, Ashok Jain & Arun Jain	Laxmi Publication
7.	Basic Soil Mechanics & Foundation	Alam Singh	CBS Publishers
8.	Soil Mechanics & Foundation Engineering	VNS Murthy	CBS Publishers

GEO-TECHNICAL ENGINEERING – I (PRACTICAL)

List of Experiments / Tests

30

1. To determine the water content and specific gravity of a given soil sample.
2. To determine the field density of a soil using core-cutter and sand replacement method.
3. To determine the grain size distribution of a cohesionless soil sample by Mechanical Analysis.
4. To determine the grain size distribution of a fine grain soil sample by Hydrometer analysis.
5. To determine of the consistency limits of a given soil sample by using Casagrande's liquid limit device, cone penetrometer.
6. To determine the coefficient of permeability: Constant head and variable head method.
7. To determine the maximum dry density and optimum moisture content by light and heavy compaction.
8. Unconfined compression test, direct shear test
9. Demonstration Test in the Laboratory — One dimensional consolidation test
Triaxial test

GEO-TECHNICAL ENGINEERING – II

L *T* *P*
3 1 0

Curri. Ref. No.: CE507

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Tutorial: 15

P.A.: 30

Theory Class duration:

45 classes of 1hr. or

60 classes of 45 minutes

Pre requisite: CE 506

Credit: 4

RATIONALE:

The knowledge and skills of Geo-Technical Engineering is very important 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:

Geo-technical Engineering II aims at imparting basic knowledge on Earth Pressure Theories, slope stability, soil exploration, bearing capacity and settlement analysis of shallow foundations, deep foundations and introduction to soil improvement and stabilization techniques.

UNIT	TOPIC/SUB-TOPIC	Hrs.	Total hrs.
1.0	EARTH PRESSURE THEORIES	8	
	1.1 Rankine & Colomb's Earth Pressure theories		
	1.2 Determination of Earth Pressure on retaining wall by applying Rankine's Theory, simple problems		
	1.3 Stability of retaining walls: Fundamental consideration (no derivation)		
2.0	STABILITY OF SLOPES	4	
	2.1 Introduction, definition and types of slope		
	2.2 Slope protection measures		
3.0	SHALLOW FOUNDATIONS	12	
	3.1 Types and definition		
	3.2 Bearing capacity analysis of isolated shallow foundation by Terzaghi's and IS code method (IS 6403-1981)		

	3.3 Settlement: Immediate and consolidation settlement, estimation of immediate and consolidation settlement of isolated footings (IS 8009-part I), simple problems	
4.0	SOIL EXPLORATION & SITE INVESTIGATION	6
	4.1 Methods, undisturbed and disturbed samples, sampling and samplers	
	4.2 Standard penetration test, plate load test (demonstration of tests)	
5.0	DEEP FOUNDATION	6
	5.1 Types: Pile foundation, Pier, Well foundation	
	5.2 Determination of pile capacity by IS code method (IS 2911)	
6.0	INTRODUCTION TO GROUND IMPROVEMENT & SOIL STABILIZATION TECHNIQUES	6
	6.1 Different methods: Pre loading, sand drains, stone columns, grouting, earth reinforcement and stabilization by using admixtures (applicability and fundamental considerations only), Applications of geo-textiles and geo-synthetics	
7.0	CLASS TEST	3
	TOTAL:	45

REFERENCE BOOKS:

Sl. No.	Name of Book	Author	Publishers
1.	Principles of Foundation Engineering	B. M. Das	Thomson
2.	Soil Mechanics and Foundations, 2ed, w/CD	Budhu	Wiley India
3.	Soil Mechanics SI Version	Lambe	Wiley India
4.	Soil Mechanics & Foundation Engineering	Raj	Pearson
5.	Soil Mechanics & Foundations	B. C. Punmia, Ashok Jain & Arun Jain	Laxmi Publication
6.	Basic Soil Mechanics & Foundation	Alam Singh	CBS Publishers
7.	Soil Mechanics & Foundation Engineering	VNS Murthy	CBS Publishers
8.	Relevant IS Codes: IS 6403, IS 8009, IS 1892, IS 2911		Bureau of Indian Standards

COMPUTER AIDED DRAWING

L *T* *P*
0 *0* *3*

Curri. Ref. No.: CE508

Total Contact hrs.: 45

Total marks: 50

Theory:

Practical: 45

P.A.: 50

Pre requisite: CE402

Credit: 2

RATIONALE:

Drawing is very important for diploma holders in Civil Engineering as this subject provides an input to the students to draw the different structural elements accurately to a chosen scale as required for construction. Now-a-days different software are available for efficient drawing. Actually almost all drawings are carried out by using this software. The students should have basic understandings about computer aided drawing.

AIM:

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

1.0 COMPUTER AIDED DRAWING:

(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.)

- 1.1 Making of RC or masonry building and Culvert drawings.
- 1.2 Editing /modifying of existing drawing.
- 1.3 Dimensioning, drawing section lines and hashed section lines.
- 1.4 Writing texts on Drawings.
- 1.5 Display of drawings on Computer screens
- 1.6 Making use of different settings of drawings related to scale unit, co-ordinate system.
- 1.7 Creating and editing layers
- 1.8 Creating and editing blocks
- 1.9 Object dimensioning

2.0 PLOTTING OF DRAWING

WATER SUPPLY & SANITARY ENGINEERING (Theory)

<i>L</i>	<i>T</i>	<i>P</i>
3	0	2

Curri. Ref. No.: CE509

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Practical: 30

(35 from each half)

Pre requisite: CE406

P.A.: 30

Credit: 4

Practical:

End Term Exam: 25

P.A: 25

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
	<p>[<i>Note: 1. Design of treatment units excluded.</i></p> <p>2. <i>Students may be asked to prepare detailed sketches of units, preferably from working drawing, as home assignment</i></p> <p>3. <i>Field visit to treatment plant, under practical should be arranged after covering this unit]</i></p>	
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)	
	<ul style="list-style-type: none"> 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	
	<ul style="list-style-type: none"> Slow Sand Filter- essential features, operation, clearing & 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	
	<ul style="list-style-type: none"> 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:	
	<ul style="list-style-type: none"> 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-sluice valves, check valves, air valves, scour valves	
8.2	Fire hydrants	
8.3	Water meters- types, uses, fixing	
	<i>[Note: detailed study covered under practical. Students may be asked to prepare sketches as home assignment]</i>	

SANITARY ENGINEERING

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
9.0	INTRODUCTION:	01
	9.1 Aims and objectives of sanitary engineering	
	9.2 Definition of terms related to sanitary engineering	
	9.3 Systems of collection of wastes- Conservancy and Water Carriage System- features, comparison, suitability	
10.0	QUANTITY OF SEWAGE:	02
	10.1 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	
	10.2 Computation of size of sewer, application of Chazy's formula, Limiting velocities of flow- self-cleaning and scouring	
11.0	SEWARAGE SYSTEM:	03
	11.1 Types of system,-separate, combined, partially separate, features, comparison between the types, suitability	
	11.2 Shapes of sewer- rectangular, circular, ovoid-features, suitability	
	11.3 Sewer materials-features, suitability, handling & maintenance- stoneware, cast iron, cement concrete, asbestos cement, pre-cast & cast in situ sewer	
	11.4 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	
12.0	SEWER APPURTENANCES:	03
	12.1 Manholes and Lampholes- types, features, location, function, construction	
	12.2 Inlets, Grease & oil trap- features, location, function construction	
	12.3 Storm regulator, inverted syphon-feature, location, function, construction	
	12.4 Sewage Pumping- necessity, ejectors, location, component of pumping station, types of pumps and selection.	
13.0	SEWAGE CHARACTERISTICS:	02
	13.1 General importance, strength of sewage, Characteristics of sewage-physical, chemical & biological	

13.2	Analysis of sewage-sampling , tests for- solids, pH, dissolved oxygen, BOD, COD, Nitrogen (Detailed methods of test to be discussed in laboratory)	
13.3	Significance of parameters	
13.4	Bacteriology of sewage-decomposition cycles of sewage- aerobic & anaerobic -C,N,S cycle	
14.0	SEWAGE DISPOSAL:	02
14.1	Disposal on land-sewage farming, sewage application and dosing, sewage sickness-causes & remedies	
14.2	Disposal by dilution-standards for disposal in different types Of waterbodies, self purification of stream	
15.0	SEWAGE TREATMENT:	08
	<i>[Note: 1. Design of treatment units excluded.</i>	
	<i>2. Students may be asked to prepare detailed sketches of units, preferable from working drawing as home assignment]</i>	
	<i>3. The field visit to treatment plant under practical should be arranged after covering this unit.</i>	
15.1	Principles of treatment, Flow diagram of conventional treatment	
15.2	Primary treatment - necessity, principles, essential features, functions, operation and maintenance of different units-Screens and racks, Grit chamber, primary sedimentation tank	
15.3	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	
15.4	Sludge disposal-sludge digestion - necessity, principles, features, Operation, construction of sludge digesters, disposal of digested sludge	
15.5	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	
16.0	SANITARY PLUMBING FOR BUILDING:	05
16.1	Method of connection from water mains to building supply	
16.2	Plumbing arrangement of single storied & multi-storied Building as per I.S. code of practice	
16.3	Requirements of building drainage, layout of lavatory blocks in residential buildings, layout of building drainage	

16.4	Sanitary fixtures-features, function, and maintenance and fixing of the fixtures- water closets, flushing cisterns, urinals, inspection chambers, traps, anti-syphonage pipe	
16.5	Inspection, testing and maintenance of sanitary fixtures	
17.0	RURAL WATER SUPPLY & SANITATION:	03
17.1	Spring water source- development, sanitary protection, Maintenance	
17.2	Roof top rain water harvesting -techniques , elementary Treatment, storage, maintenance	
17.3	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.Birdie
2. Public Health Engineering - by Hussain
3. Water supply & Sanitary Engineering - by Rrangawala
4. Environmental 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.

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
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 Sewerage System of the Polytechnic Campus, including a building	2	
14.2	A water Treatment Plant	2	
14.3	A Waste water Treatment Plant	2	
	TOTAL:		30

HIGHWAY ENGINEERING

<i>L</i>	<i>T</i>	<i>P</i>
3	0	2

Curri. Ref. No.: CE510

Total Contact hrs.:

Total marks: 150

Theory:

Theory: 45

End Term Exam: 70

Practical: 30

P.A.: 30

Pre requisite: Nil

Practical:

Credit: 4

End Term Exam: 25

P.A : 25

RATIONALE:

The subject of highway engineering is very important as it deals essentially with road transportation. It is essential for the students to get a through input into the different components of road constructions, maintenance, drainage and related traffic engineering.

AIM:

To develop a thorough knowledge & skill in highway development, highway plans and administration, highway economics and financing, traffic engineering, bituminous materials, bituminous surface treatment, carpet coat, road-mix and intermediate type bituminous plant mix surfaces, high type bituminous pavement and their design portland cement concrete pavement and their base courses, verified brick and block pavement, pavement design both flexible and rigid, highway maintenance.

THEORY: 45

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
1.0	Highway development	4
1.1	To state the importance of highway transport both in the urban, semi-urban and rural area	
1.2	To state the concept of a road	
1.3	To know the rate of growth of road transport in India	
1.4	To distinguish between a kutchha road, a bituminous road and a rigid road	
2.0	Highway plans & administration	4
2.1	To classify the roads as per IRC	
2.2	To define National highway, state highway, district roads and village roads	
2.3	To define road mileage	
2.4	To state the formula for calculation of mileage of national and state highways and major district roads	
2.5	To state the meanings of symbols used in the formulae	

2.6	To calculate the road mileage with the appropriate formulae	
2.7	To define the terms central and state administration of roads	
3.0	Highway economics and financing	3
3.1	To state the meaning of road users services	
3.2	To define the term road users benefits	
3.3	To define annual cost, capital cost, maintenance cost operating cost pertaining to highway	
3.4	To know and calculate the annual cost of highway for a specific facility, projector road system and explain all the meaning of symbols used in the formula or formulae	
4.0	Road Geometrics	4
4.1	To state the concept of road geometrics	
4.2	To define camber	
4.3	To define super elevation	
4.4	To state where camber on road surfaces are provided	
4.5	To state how camber is provided on road surface	
4.6	To state where the super elevation is provided on the road surfaces	
4.7	To calculate the degree of super elevation camber to be provided on road surfaces as per IRC	
5.0	Highway survey	4
5.1	To state the method of carrying out survey for locations of the highway track line	
5.2	To state whether the track line is the real road alignment	
5.3	To map the road alignment	
6.0	Road construction	4
6.1	To prepare the sub-grade for road construction	
6.2	To list the steps of road construction	
7.0	Road drainage	4
7.1	To state the necessity of road drainage	
7.2	To state the method of laying the road drainage system	
7.3	To state the usefulness of kerbstones	
8.0	Road maintenance	4
8.1	To state when maintenance of road surface is necessary	
8.2	To describe how the maintenance work is carried out	
8.3	To state the steps of periodic maintenance of roads	
8.4	To state the steps for annual maintenance of roads	
9.0	Traffic studies	1
9.1	To state the basic concept of traffic studies	
10.0	Traffic signals	4
10.1	To classify the traffic signal	
10.2	To identify the important features of a traffic control signal and their importance	

	10.3	To explain the advantage and disadvantage traffic control signal	
	10.4	To list the steps for timings of signals	
11.0		Traffic segregation	3
	11.1	To list the different types of traffic segregation	
	11.2	To state the advantages of traffic segregation	
12.0		Highway street lighting	3
	12.1	To define illumination and brightness	
	12.2	To define lumen	
	12.3	To state the factors affecting street lighting	
	12.4	To state the advantage of street lighting	
	12.5	To define mounting height	
	12.6	To list the importance of mounting height	
		Class Test	3
		TOTAL:	45

13.0 PRACTICAL: 30 hours

UNIT	TOPIC/SUB-TOPIC	Hrs.	Total hrs.
13.1	Determination of size and shape of road aggregates		
13.2	Determination of crushing value of road aggregates		
13.3	Determination of impact value of road aggregates		
13.4	Determination of Los Angeles Abrasion value of coarse road aggregates		
13.5	Determination of C.B.R. value of subgrade soil		
13.6	Determination of penetration value of bitumen		
13.7	Determination of softening point of bituminous material		
13.8	Determination of ductility of bitumen		
13.9	Determination of Marshall stability value of bituminous mixture		

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 Bridges in West Bengal - by West Bengal PWD
4. Highway Engineering - by Leo J. Ritter & Radnorj Paquette; John Willey Publishers
5. Highway Engineering - by Robert Ashworth; Hienemann Educational Books
6. Highway - by Laurence I. House and Clurkson H. Oglesby; Asia Publishing Co.
7. Highway Material Tests - by S.K. Khanna & C.E.J. Justo; Nemchand & Bros.

IRRIGATION ENGINEERING

L *T* *P*
3 0 0

Curri. Ref. No.: CE511

Total Contact hrs.:

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Theory Class duration:

P.A.: 30

45 classes of 1hr. or

60 classes of 45 minutes

Pre requisite: CE406

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 an 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 Hydrograph	
3.0	WATER REQUIREMENT OF 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-wells	
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
5. 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

PROFESSIONAL PRACTICES -I

L T P
0 0 2

Curri. Ref. No.: CE512

Total Contact hrs :

Total marks: 50

Practical:

Theory: 0

End Term Exam: 25

Tutorial: 0

P.A : 25

Practical: 30

Credit : 1

Aim :-This subject is kept to

Deliver knowledge education beyond the baccalaureate degree for the practice

Objective: - On completion of this course, the Student will be able to:

- Search information from different sources for preparing notes on given topic.
- Present given topic in a seminar. Interact with peers to share thoughts.
- Prepare a report on industrial visit, expert lecture.

Suggested List of activities to be done:

1. Industrial Visits:

10

Structured industrial visits (two nos.) be arranged and report of the same should be submitted by the individual student, to form part of the term work.

2. Lectures by Professional / Industrial Expert / Student Seminars based on **06** information search to be organized Three nos.)

3. Group Discussion:

06

The students should discuss in a group of six to eight students and write a brief report on the same as a part of term work. Two topics for group discussions may be selected by the faculty members. Some of the suggested topics are -

- i) Sports
- ii) Current news items
- iii) Discipline and House Keeping
- iv) Current topics related to own engineering field.

4. Student Activities:

08

The students in a group of 3 to 4 will perform **one** activity (Faculty members of the concerned discipline may provide a list of activities)

PROFESSIONAL PRACTICE – II

L *T* *P*
0 *0* *2*

Curri. Ref. No.: CE513

Total Contact hrs.: 30

Total marks: 50

P.A.: 50

Credit: 1

Aim:

- Development and evaluation of individual skills
- Enhancement in soft skills through innovation.

Objective: Student will be able to:

1. Acquire information from different sources.
2. Prepare notes for given topic.
3. Present given topic in a seminar.
4. Interact with peers to share thoughts.
5. Prepare a report on industrial visit, expert lecture.

Unit -1: Industrial Visits

Structured industrial visits be arranged and report of the same should be submitted by the individual student, to form a part of the term work. Industrial visits may be arranged in the following areas / industries:

- Building construction site

Unit -2: Lectures by Professional / Industrial Expert be organized from ANY ONE of the following areas:

- Batching plant
- Different types of construction machineries and equipment

Unit – 3: Individual Assignments:

Any two from the list suggested OR Conduct ANY ONE of the following activities through active participation of students and write report

- Preparation of drawing of an existing structure
- Plot measurement
- Study of building rules – in panchayat, municipality and corporation areas
- Study of different fitting and fixtures and components of different types of shuttering

PROFESSIONAL PRACTICE – III

L *T* *P*
0 0 2

Curri. Ref. No.: CE514

Total Contact hrs.:
Practical: 30
Credit: 1

Total marks: 50

Practical:
P.A : 50

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
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	
	1.5 Collecting an estimate from P.W.D.	
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-tender 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	SITE MANAGEMENT:	03
	3.1 Factors influencing selection, design and layout of temporary facilities and services at construction site	
	3.2 Principles of storing materials at site	
	3.3 Location of equipment Organizing labour at site	
4.0	CONSTRUCTION ORGANIZATION:	05
	4.1 Organization types-line and staff, functions and their characteristics	

4.2	Principles of organization-meaning and significance of terms-control, authority, responsibility, command, accountability, job and task	
4.3	Leadership-necessity, styles of leadership, role of leader	
4.4	Principles of effective supervision	
4.5	Motivation-classification of motives, different approaches to motivation	
4.6	Human relations- relations with subordinates, peers, Supervisors, characteristics of group behaviour, mob psychology, handling of grievances, absenteeism. Labour Welfare	
4.7	Conflicts in organization- genesis of conflicts, types - Intrapersonal, interpersonal, inter group, resolving conflicts, team building	
5.0	SAFETY IN CONSTRUCTION WORKS:	03
5.1	Importance of safety	
5.2	Causes and effects of accidents in construction works	
5.3	Safety measures in work sites for-excavation, scaffolding, formwork, fabrication and erection, demolition	
5.4	Development of safety consciousness	
5.5	Safety legislation-workmen's compensation act, contract labour act	
6.0	DISPUTES:	02
6.1	Nature of disputes between contractor and owner Causes of disputes and claims Arbitration-procedure, criterion for arbitrator, conditions for arbitration.	
7.0	QUALITY CONTROL:	03
7.1	Concept of quality in construction	
7.2	Quality standards - during construction, after construction	
7.3	Methods of testing-during construction, after construction, Destructive & non-destructive methods	
	Class Test:	01
	TOTAL:	30

PROFESSIONAL PRACTICE – IV

L *T* *P*
0 *0* *2*

Curri. Ref. No.: CE515

Total Contact hrs.:

Total marks: 50

Practical:

Practical: 30

P.A : 50

Credit: 1

Unit-1: Structured industrial visits shall be arranged and report of the same should be submitted by the individual student, to form a part of the term work.

Following are the suggested type of Industries/ Field visits (Any one)

- Irrigation project for observing components of dam.
- Steel structure for study of its details.
- Residential apartment /public building to study plumbing & sanitary system.
- Water treatment plant

Unit -2: The Guest Lecture/s from field/industry experts, professionals to be arranged (2 Hrs duration), minimum 2 nos. from the following or alike topics. The brief report to be submitted on the guest lecture by each student as a part of term work.

- Construction of highway, material of construction, machinery used and manpower requirement.

Unit – 3: The students should discuss in group of six to eight students and write a brief report on the same as a part of term work. The topic of group discussions may be selected by the faculty members. Some of the suggested topics are -

- Recent trends in civil engineering as a service industry.
- Waterproofing and leakage prevention.
- Troubleshooting in plumbing system.
- Causes of failure of road.

PROFESSIONAL PRACTICE – V

L *T* *P*
0 0 4

Curri. Ref. No.: CE516

Total Contact hrs.:
Practical: 60
Credit: 2

Total marks: 50

Practical:
P.A : 50

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
1.0	Organization of engineering department	5
	1.1 Permanent establishment	
	1.2 Duties and responsibilities of subordinate engineers	
2.0	Works	10
	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
TOTAL: 30

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

PROJECT

L *T* *P*
0 0 6

Curri. Ref. No.: CE517

Total Contact hrs.:

Total marks: 150

Practical:

Practical: 90

P.A : 150

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 (<u>any two of the following</u>)	30
	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	30
	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	30

- 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 levels i.e., plan, elevation and sections.

TOTAL: 90

ELECTIVE COURSES

EARTHQUAKE RESISTANT DESIGN & CONSTRUCTION (Elective)

L T P
3 1 0

Curri. Ref. No.: CE601

Total Contact hrs.: 60

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Tutorial: 15

P.A.: 30

Credit: 4

RATIONALE:

The subject Earthquake Resistant Design and Construction is very important in the present day's context. This is particularly relevant for earthquake prone areas like Northeastern part of India. So it is felt that a course to cover these aspects of Civil Engineering should be mandatory in the diploma curriculum also.

AIM:

To develop basic understanding about earthquake and earthquake resistant design and construction. To get acquainted with specifications of Indian Codes of practice is this regard and detailing requirement for earthquake resistant structures.

UNIT	TOPIC/SUB-TOPIC	Hrs.	Total hrs.
1.0	INTRODUCTION	6	
	1.1 Introduction to earthquakes, causes of earthquakes		
	1.2 Brief history of major earthquakes in the past		
2.0	STRUCTURAL CONFIGURATION	4	
	2.1 Advantages of regular, simple and symmetrical configurations over irregular ones		
	2.2 Use of separation joints (IS:4326)		
3.0	USE OF CONCRETE BANDS, TIES AND REINFORCEMENTS IN MASONRY CONSTRUCTION	4	
	3.1 Reinforced Masonry work		
4.0	USE OF TIMBER CONSTRUCTION IN EARTHQUAKE RESISTANT DESIGN (IS:4326)	4	
5.0	INTRODUCTION TO IS: 1893 – 2002 (PART 1)	12	
	5.1 Magnitude and Intensity of earthquakes		
	5.2 Seismic zoning		
	5.3 Definition of terms related to earthquake engineering — ordinary and special moment resistant frames, shear wall, separation sections, centre of mass, centre of rigidity, ductility, storey drift.		
	5.4 General principles of earthquake resistant design, MCE, DBE		
6.0	DETAILED DISCUSSIONS ON DUCTILE DETAILING OF RC STRUCTURES AS PER IS: 13920	12	
7.0	FORMATIVE EVALUATION	3	
TOTAL:			45

REFERENCE BOOKS:

Sl. No.	Name of Book	Author	Publishers
1.	Elements of Earthquake Engineering	Jai Krishna & Jain	South Asian Publishers Private Limited
2.	Earthquake Resistant Design of Structures	Agarwal & Shrikhande	PHI
3.	Earthquake Resistant Design of Structures	S.K. Duggal	Oxford University Press
4.	Fundamentals of Soil Dynamics and Earthquake Engineering	Prasad	PHI Learning
5.	Geotechnical Earthquake Engineering	Kramer	Pearson
6.	Earthquake tips	C. V. R. Murthy	Publication of Nicee
7.	Publications of nicee		IIT Kanpur
8.	Relevant IS Codes: 1893, 4326, 13920		
9.	Website: www.nicee.org		

ENVIRONMENTAL ENGINEERING (Elective)

<i>L</i>	<i>T</i>	<i>P</i>
3	1	0

Curri. Ref. No.: CE602

Total Contact hrs.: 60

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Tutorial: 15

P.A.: 30

Credit: 4

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:

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
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, industrialization & 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:		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 Clark
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

TUNNELS & BRIDGES (Elective)

<i>L</i>	<i>T</i>	<i>P</i>
3	1	0

Curri. Ref. No.: CE603

Total Contact hrs.: 60

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Tutorial: 15

(20 from Tunnel and

Pre requisite: Nil

50 from Bridges)

Credit: 4

P.A.: 30

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.

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
	TUNNELS	
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	
	BRIDGES	
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 t	
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, bascular bridges, Transer bridges, Transporter bridges, lift bridges	2
16.0	Methods of Bridge Construction & Maintenance	3
16.1	Erection of steel girder, tress, RCC	
16.2	Maintenance of bridges	
CLASS TEST:		03
TOTAL:		45

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.II - 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 House

ADVANCED SURVEY

L *T* *P*
3 1 0

Curri. Ref. No.: CE604

Total Contact hrs.: 60

Total marks: 100

Theory:

Theory: 45

End Term Exam: 70

Tutorial: 15

P.A.: 30

Credit: 4

RATIONALE:

Now a days application of advanced survey equipment in Civil Engineering analysis, has become a routine. The diploma level students are directly associated with conduction of field survey. Hence this course will be immensely helpful in their service life.

AIM:

To familiarize the students about the use of advanced survey equipment along with a basic introduction to latest surveying methods.

COURSE CONTENT:

UNIT	TOPIC/SUB-TOPIC	Hrs.	Total hrs.
1.0	TRIANGULATION SURVEY		
	1.1 Angle Measurements and Solution of Braced Quadrilateral Network; Determination of Azimuth of a Line	3+8	10
2.0	DETAIL TOPOGRAPHIC	2+6	12
	2.1 Fill in works by Plain Tabling and Contouring using radial and spot levelling methods		
	2.2 Tacheometric Survey		
3.0	TOTAL STATION AND ITS APPLICATION	10+25	35
	3.1 Detail Survey and Profile Levelling; Calculation of Area and Volume		
	3.2 Engineering Surveys: Setting out of Curves – Horizontal: Simple, Compound, Reverse and Transition, Vertical. Hydrographic Survey and Tunneling.		
4.0	Class Test	3	
TOTAL:			60

REFERENCE BOOKS:

Sl. No.	Name of Book	Author	Publishers
1.	Surveying Volume -1	Dr. K.R. Arora	Standard Book House
2.	Surveying Volume -2	Dr. K. R. Arora	Standard Book House
3.	Surveying & Levelling	S.C. Rangwala	Charotar Publishing House
4.	Surveying – Volume 1	S. Duggal	TMH
5.	Surveying – Volume 2	S. Duggal	TMH
6.	Surveying & Levelling	N. Bask	TMH
7.	Surveying, 7/e	Bannister	Pearson
8.	Surveying & Levelling	R. Subramanian	Oxford University Press
9.	Advanced Surveying: Total Station, GIS and Remote Sensing	Gopi	Pearson Education India
10.	Higher Surveying	A. M. Chandra	New Age International

TRANSPORTATION ENGINEERING (Elective)

L T P
3 1 0

Curri. Ref. No.: CE605

Total Contact hrs.: 60

Total marks: 100

Theory:

Theory: 60

End Term Exam: 70

Tutorial: 15

P.A.: 30

Credit: 4

RATIONALE:

Airport Engineering 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 airports, and railways. At the same time a state may not have many airports or the facility of railways. 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 'Transportation Engineering' is to impart preliminary knowledge of Airport and Railway Engineering through information, description, explanation and sketches to the diploma students of civil engineering intending to be involved in their planning, construction and maintenance.

UNIT	TOPIC/SUB-TOPIC	Hrs. Total hrs.
	AIRPORT ENGINEERING	
1.0	Planning and Layout	4
1.1	Type, Size, Shape and orientation of Airport	
1.2	Factors affecting local and regional planning for integrated development	
1.3	Components of an Airport	
1.4	General operational requirements	
1.5	Brief description of runways , taxiways, aprons	
1.6	Description of general layout of an airport showing lighting for different components	
1.7	<u>Basic Runway length</u> – Conditions for (i) Normal landing (ii) Normal take off (iii) stopping in emergency <u>Correction to basic runway length</u> – (i) Correction for Elevation (ii) Correction for gradient (iii) Correction for temperature.	
2.0	Airport Survey	4
2.1	Introduction	
2.2	Topographical survey	

2.3	Approach zone survey	
2.4	Soil and drainage survey	
3.0	Aspects of Airport Design and Construction	6
3.1	Flexible and Rigid pavements for airport	
3.2	Brief explanation of factors influencing design of rigid and flexible airport pavements	
3.3	Methods of construction	
3.4	Precautions for quality control and durability	
	Class Test	1
	RAILWAYS	
4.0	Introduction:	2
4.1	Railway terminology	
4.2	Advantages of railways	
4.3	Classification of Indian Railways	
5.0	Permanent way	3
5.1	Definition and components of a permanent way	
5.2	Concept of gauge, different gauges prevalent in India, suitability of these gauges under different conditions	
6.0	Track materials	10
6.1	Rails	
6.1.1	Functions and requirement of rail s	
6.1.2	Types of rail sections, length of rails	
6.1.3	Rail joints – types, requirement of an ideal joint	
6.1.4	Purpose of welding of rails & its advantages	
6.1.5	Creep – definition, cause & prevention	
6.2	Sleepers	
6.2.1	Definition, functions & requirements of sleepers	
6.2.2	Classification of sleepers	
6.2.3	Advantages & disadvantages of different types of sleepers	
6.3	Ballast	
6.3.1	Functions & requirements of ballast	
6.3.2	Materials for ballast	
6.4	Fixtures & fastenings	
6.4.1	Connection of rails to rail-fishplate, fish bolts	
6.4.2	Connection of rails to sleepers	
7.0	Geometric for Broad gauge	4
7.1	Typical cross-sections of single & double broad gauge railway track in cutting and embankment	
7.2	Permanent & temporary land width	
7.3	Gradients for drainage	
7.4	Super-elevation – necessity & limiting values	
8.0	Points and Crossings	3
8.1	Definition, necessity of points & crossings	
8.2	Types of points & crossings with tie diagrams	
9.0	Signaling systems	2

9.1	Types of signals, location, functional characteristics, special signals	
10.0	Laying & maintenance of track	4
10.1	Methods of laying & maintenance of track	
10.2	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.II - 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