

**Curriculum for
Diploma Programme in
CIVIL ENGINEERING
For the State of Uttar Pradesh**



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PREFACE

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different culture and environment together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the forgettable years of closed economy to knowledge based and open economy in the last few decades. In order to cope with the challenges of handling new technologies, materials and methods, we have to develop human resources having appropriate professional knowledge, skills and attitude. Technical education system is one of the significant components of the human resource development and has grown phenomenally during all these years. Now it is time to consolidate and infuse quality aspect through developing human resources, in the delivery system. Polytechnics play an important role in meeting the requirements of trained technical manpower for industries and field organizations. The initiatives being taken by the State Board of Technical Education, UP to revise the existing curricula of 6 diploma programmes as per the needs of the industry and making them NSQF compliant, are laudable.

In order to meet the requirements of future technical manpower, we will have to revamp our existing technical education system and one of the most important requirements is to develop outcome-based curricula of diploma programmes. The curricula for diploma programmes have been revised by adopting time-tested and nationally acclaimed scientific method, laying emphasis on the identification of learning outcomes of diploma programme.

The real success of the diploma programme depends upon its effective implementation. However best the curriculum document is designed, if that is not implemented properly, the output will not be as expected. In addition to acquisition of appropriate physical resources, the availability of motivated, competent and qualified faculty is essential for effective implementation of the curricula.

It is expected of the polytechnics to carry out job market research on a continuous basis to identify the new skill requirements, reduce or remove outdated and redundant courses, develop innovative methods of course offering and thereby infuse the much needed dynamism in the system.

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Coordinator

1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN CIVIL ENGINEERING

- 1) Name of the Programme : Diploma Programme in Civil Engineering
- 2) Duration of the Programme : Three years (Six Semesters)
- 3) Entry Qualification : Matriculation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP
- 4) Intake : 60 (or as prescribed by the Board)
- 5) Pattern of the Programme : Semester Pattern
- 6) NSQF Level : Level - 5
- 7) Ratio between theory and Practical : 45 : 55 (Approx.)
- 8) Industrial Training:
Four weeks of industrial training is included after IV semester during summer vacation. Total marks allotted to industrial training will be 50.
- 9) Ecology and Environment :

As per Govt. of India directives, a subject on Environmental Studies has been incorporated in the curriculum.
- 10) Energy Conservation:
A subject on Energy Conservation has been incorporated in the curriculum.
- 11) Entrepreneurship Development:
A full subject on Construction Management Accounts and Entrepreneurship Development has been incorporated in the curriculum.
- 12) Student Centred Activities:
A provision of 3-6 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. Such activities will comprise of co-curricular activities such as expert lectures, self study, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities, disaster management and safety etc.
- 13) Project work

A project work has been included in the curriculum to enable the student get familiarize with the practices and procedures being followed in the industries and provide an opportunity to work on some live projects in the industry.

2. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN CIVIL ENGINEERING

Keeping in view, the present scenario of activities in the field of Civil Engineering, following employment opportunities are visualized for diploma holders in Civil Engineering:

a) **Wage Employment in:**

- i) Government Departments/Public sector / /Boards/ Corporations/ private construction companies
- ii) Service sector i.e. Estate Offices of Business organizations/ Universities/Colleges, Hotels , Hospitals etc. specially for repair and maintenance of buildings and their upkeep.
- iii) Military Engineering Services/BRO/Defence/Railways/ Power Projects/Banks/ Municipal Corporations and Committees/Airport Authority and Harbours etc.
- iv) Installation of communication towers and framed structure.
- v) Testing laboratories
- vi) Technical institutions.

b) **Self employment opportunities:**

- i) Small building contractors/Licensed contractors (Class B)
- ii) Approved building planner and valuer
- iii) Plumbing and water supply fitting contracts
- iv) White washing, distempering, repair and maintenance of buildings, renovations, POP work, texture work, false ceiling, specialized flooring etc. Anti - termite treatment Erection job
- v) Construction material suppliers/marketing
- vi) Preparation of computer aided design and drafting jobs
- vii) Estimating and costing jobs/bill maker
- viii) Surveyor/loss assessment/valuation of buildings etc
- ix) Water proofing of existing and new building

- x) A small enterprise like precast elements/hume pipes/water proofing chemicals, RCC pipes, hollow blocks, shuttering etc.
- xi) Rain water harvesting system installation
- xii) Sanitary Installation

3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN CIVIL ENGINEERING

At the end of the programme, a diploma holder in Civil Engineering will be able to:

1.	Communicate effectively in English with others
2.	Apply basic principles of Mathematics and Science to solve engineering problems
3.	Prepare computerized reports, presentations using IT tools and computer application software
4.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work
5.	Use appropriate procedures for preventing environmental pollution and energy conservation
6.	Use basic concepts and principles of fluid mechanics as applied to civil engineering practices.
7.	Apply concepts of mechanics to solve Engineering problems
8.	Carry out various types of surveying like levelling, plane tabling, theodolite surveying, and tachometry and contouring; and use modern surveying techniques like total station, remote sensing, GIS and GPS.
9.	Select, Use and carry out testing of construction materials including eco friendly and advanced materials as per their suitability and availability
10.	Supervise various building construction works from substructure to superstructure and their finishing operations.
11.	Prepare, read and interpret, component drawing, building drawings and layout
12.	Supervise production, placement and quality control of concrete operations.
13.	Supervise construction of pre cast elements.
14.	Carry out layout plan of water supply, sewerage and sanitary systems and monitor quality of water and waste water
15.	Supervise constructional aspects pertaining to irrigation structures
16.	Prepare, read and interpret public health and irrigation engineering drawings
17.	Analyse and design simple structural elements of R.C.C.

18.	Supervise constructional aspects pertaining to highway engineering
19.	Prepare, read and interpret R.C.C. drawings
20.	Prepare topographical plan of an area
21.	Use various computer softwares in the field of Civil Engineering
22.	Supervise constructional aspects pertaining to railways, bridges and tunnels
23.	Analyse, use and treat various types of soils for foundation purpose
24.	Plan and execute given task/projects as a team member/ leader
25.	Analyse and design simple structural elements of steel
26.	Prepare material estimates as per CSR, Specifications, costing, valuation and tender documents as per given drawings and prepare bill of quantity of construction.
27.	Apply basic principles of construction management techniques and accounts in Civil Engineering
28.	Carry out repair, maintenance and retrofitting of buildings as per requirement
29.	Use various advanced constructional techniques for construction of high rise and earthquake resistant structures keeping safety aspects in mind.
30.	Plan and execute activities related to disaster management.
31.	Apply the knowledge and skills gained through various courses in solving live problems/projects in the field
32.	Demonstrate appropriate values and attitude.

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum area subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Communicate effectively in English with others	– Communication Skills – Student Centred Activities (SCA)
2.	Apply basic principles of Mathematics and Science to solve engineering problems	– Applied Mathematics – Applied Physics – Applied Chemistry
3.	Prepare computerized reports, presentations using IT tools and computer application software	– Basics of Information Technology
4.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work	– General Workshop Practice – Basics of Mechanical and Electrical Engg.
5.	Use appropriate procedures for preventing environmental pollution and energy conservation	– Environmental Studies – Energy Conservation
6.	Use basic concepts and principles of fluid mechanics as applied to civil engineering practices.	– Hydraulics and Hydraulic Machines
7.	Apply concepts of mechanics to solve Engineering problems	– Applied Mechanics – Structural Mechanics
8.	Carry out various types of surveying like levelling, plane tabling, theodolite surveying, and tachometry and contouring; and use modern surveying techniques like total station, remote sensing, GIS and GPS.	– Quantity Surveying and Valuation
9.	Select, Use and carry out testing of construction materials including eco friendly and advanced materials as per their suitability and availability	– Construction Materials
10.	Supervise various building construction works from substructure to superstructure and their finishing operations.	– Building Construction – Building Drawings
11.	Prepare, read and interpret, component drawing, building drawings and layout	– Engineering Drawing
12.	Supervise production, placement and quality control of concrete operations.	– Concrete Technology

13.	Supervise construction of pre cast elements.	– Reinforced Cement Concrete Structures (RCC Structures)
14.	Carry out layout plan of water supply, sewerage and sanitary systems and monitor quality of water and waste water	– Water and Waste water Engineering
15.	Supervise constructional aspects pertaining to irrigation structures	– Irrigation Engineering
16.	Prepare, read and interpret public health and irrigation engineering drawings	– Waste Water and Irrigation Engineering Drawing
17.	Analyse and design simple structural elements of R.C.C.	– Reinforced Cement Concrete Structures (RCC Structures)
18.	Supervise constructional aspects pertaining to highway engineering	– Highway Engineering
19.	Prepare, read and interpret R.C.C. drawings	– RCC Drawing
20.	Prepare topographical plan of an area	– Surveying
21.	Use various computer softwares in the field of Civil Engineering	– Computer Aided Drawing – Software Application in Civil Engineering
22.	Supervise constructional aspects pertaining to railways, bridges and tunnels	– Railways, Bridges and Tunnels
23.	Analyse, use and treat various types of soils for foundation purpose	– Soil Mechanics and Foundation Engineering
24.	Plan and execute given task/projects as a team member/ leader	– Project Work
25.	Analyse and design simple structural elements of steel	– Design of Steel Structure – Steel Structure Drawing
26.	Prepare material estimates as per CSR, Specifications, costing, valuation and tender documents as per given drawings and prepare bill of quantity of construction.	– Quantity Surveying and Valuation
27.	Apply basic principles of construction management techniques and accounts in Civil Engineering	– Construction Management, Accounts and Entrepreneurship Development
28.	Carry out repair, maintenance and retrofitting of buildings as per requirement	– Repair and Maintenance of Buildings
29.	Use various advanced constructional techniques for construction of high rise and earthquake resistant structures keeping safety aspects in mind.	– Earthquake Engineering

30.	Plan and execute activities related to disaster management.	– Analysis of Structures
31.	Apply the knowledge and skills gained through various courses in solving live problems/projects in the field	– Project Work
32.	Demonstrate appropriate values and attitude.	– Student Centred Activities

5. ABSTRACT OF CURRICULUM AREAS

a) General Studies

1. Communication Skills
2. Environmental Studies
3. Energy Conservation

b) Applied Sciences

4. Applied Mathematics
5. Applied Physics
6. Applied Chemistry

c) Basic Courses in Engineering/Technology

7. Engineering Drawing
8. General Workshop Practice
9. Basics of Mechanical and Electrical Engg.
10. Basics of Information Technology

d) Applied Courses in Engineering/Technology

11. Construction Materials
12. Computer Aided Drawing
13. Applied Mechanics
14. Hydraulics and Hydraulic Machines
15. Concrete Technology
16. Structural Mechanics
17. Building Construction
18. Building Drawings
19. Construction Materials
20. Computer Aided Drawing
21. Applied Mechanics
22. Hydraulics and Hydraulic Machines
23. Concrete Technology
24. RCC Drawing
25. Water and Waste water Engineering
26. Railways, Bridges and Tunnels
27. Earthquake Engineering

28. Soil Mechanics and Foundation Engineering
 29. Waste Water and Irrigation Engineering Drawing
 30. Quantity Surveying and Valuation
 31. Construction Management, Accounts and Entrepreneurship
Development
 32. Design of Steel Structure
 33. Steel Structure Drawing
 34. Software Applications in Civil Engineering
- e) Industrial Training**
35. Project Work
- f) Elective**
36. Repair and Maintenance of Buildings
 37. Plumbing Services
 38. Analysis of Structures

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Periods per week in Various Semesters					
		I	II	III	IV	V	VI
1.	Communication Skills	6	-	-	6	-	-
2.	Applied Mathematics	5	5	-	-	-	-
3.	Applied Physics	7	-	-	-	-	-
4.	Applied Chemistry	7	-	-	-	-	-
5.	Engineering Drawing	8	-	-	-	-	-
6.	Construction Materials	5	-	-	-	-	-
7.	General Workshop Practice	8	8	-	-	-	-
8.	Computer Aided Drawing	-	8	-	-	-	-
9.	Applied Mechanics	-	7	-	-	-	-
10.	Basics of Mechanical and Electrical Engg.	-	8	-	-	-	-
11.	Basics of Information Technology	-	6	-	-	-	-
12.	Hydraulics and Hydraulic Machines	-	-	8	-	-	-
13.	Concrete Technology	-	-	8	-	-	-
14.	Environmental Studies	-	-	3	-	-	-
15.	Structural Mechanics	-	-	8	-	-	-
16.	Building Construction	-	-	9	-	-	-
17.	Building Drawings	-	-	8	-	-	-
18.	Highway Engineering	-	-	-	8	-	-
19.	Irrigation Engineering	-	-	-	5	-	-
20.	Surveying - I	-	-	-	12	12	-
21.	Reinforced Cement Concrete Structures (RCC Structures)	-	-	-	6	-	-
22.	Energy Conservation	-	-	-	5	-	-
23.	RCC Drawing	-	-	-	4	-	-
24.	Water and Waste water Engineering	-	-	-	-	8	-
25.	Railways, Bridges and Tunnels	-	-	-	-	6	-
26.	Earthquake Engineering	-	-	-	-	4	-
27.	Soil Mechanics and Foundation Engineering	-	-	-	-	8	-
28.	Waste Water and Irrigation Engineering Drawing	-	-	-	-	6	-
29.	Universal Human Values					3	
30.	Quantity Surveying and Valuation	-	-	-	-	-	6
31.	Construction Management, Accounts and Entrepreneurship Development	-	-	-	-	-	5
32.	Design of Steel Structure	-	-	-	-	-	6
33.	Steel Structure Drawing	-	-	-	-	-	4
34.	Software Applications in Civil Engineering	-	-	-	-	-	8
35.	ENVIRONMENTAL MANAGEMENT	-	-	-	-	-	5
36.	Project Work	-	-	-	-	-	10
37.	Student Centred Activities (SCA)	2	6	4	2	1	4

Total	48	48	48	48	48	48
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7. STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN CIVIL ENGINEERING

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	*Communication Skills-I	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
1.2	*Applied Mathematics - I	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
1.3	*Applied Physics – I	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
1.4	*Applied Chemistry	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
1.5	*Engineering Drawing-I	-	-	8	2	40	-	40	60	3	-	-	60	100
1.6	Construction Materials	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
1.7	General Workshop Practice - I	-	-	8	2	-	40	40	-	-	60	4	60	100
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		22	-	26	26	140	110	250	310	-	140	-	450	700

* Common with other diploma programmes

Student Centred Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

SECOND SEMESTER (CIVIL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*Applied Mathematics - II	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
2.2	Computer Aided Drawing	-	-	8	3	-	40	40	-	-	60	3	60	100
2.3	+Applied Mechanics	5	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.4	Basics of Mechanical and Electrical Engg.	6	-	2	5	20	10	30	50	2 ½	20	3	70	100
2.5	*Basics of Information Technology	-	-	6	2	-	40	40	-	-	60	3	60	100
2.6	General Workshop Practice -II	-	-	8	2	-	40	40	-	-	60	4	60	100
#Student Centred Activities (SCA)		-	-	6	1	-	30	30	-	-	-	-	-	30
Total		16	-	32	22	60	170	230	150	-	220	-	370	600

* Common with other diploma programmes

+ Common with diploma in Mechanical Engg. and Chemical Engg

Student Centred Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities and self study etc.

THIRD SEMESTER (CIVIL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
3.1	Hydraulics and Hydraulic Machines	6	-	2	5	20	10	30	50	2 ½	20	3	70	100	
3.2	Concrete Technology	6	-	2	5	20	10	30	50	2 ½	20	3	70	100	
3.3	*Environmental Studies	3	-	2	3	20	10	30	50	2 ½	20	3	70	100	
3.4	Structural Mechanics	6	-	2	5	20	10	30	50	2 ½	20	3	70	100	
3.5	Building Construction	6	-	3	6	20	10	30	50	2 ½	20	3	70	100	
3.6	Building Drawings	-	-	8	3	-	40	40	60	3	-	-	60	100	
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30	
Total		27	-	21	28	100	120	220	310	-	100	-	410	630	

* Common with other diploma programmes

Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

FOURTH SEMESTER (CIVIL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	*Communication Skill-II	4	-	2	4	20	10	30	50	2 ½	20	3	70	100
4.2	Highway Engineering	6	-	2	5	20	10	30	50	2 ½	20	3	70	100
4.3	Irrigation Engineering	5	-	-	4	20	-	20	50	2 ½	-	-	50	70
4.4	Surveying - I	4	-	8	6	20	10	30	50	2 ½	20	3	70	100
4.5	Reinforced Cement Concrete Structures (RCC Structures)	6	-	-	5	20	-	20	50	2 ½	-	-	50	70
4.6	*Energy Conservation	3	-	2	3	20	10	30	50	2 ½	20	3	70	100
4.7	RCC Drawing	-	-	4	2	-	20	20	50	3	-	-	50	70
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		28	-	20	30	120	90	210	350	-	80	-	430	640

* Common with other diploma programmes

- **4 weeks industrial training will be organised after 4th Semester exam. The evaluation of industrial training will be done in 5th semester.**

Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

FIFTH SEMESTER (CIVIL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		L	T	P		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
						Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
-	Industrial Training	-	-	-	2	-	-	-	-	-	50	3	50	50	
5.1	Water and Waste water Engineering	6	-	2	5	20	10	30	50	2 ½	20	3	70	100	
5.2	Railways, Bridges and Tunnels	6	-	-	5	20	-	20	50	2 ½	-	-	50	70	
5.3	Earthquake Engineering	4	-	-	3	20	-	20	50	2 ½	-	-	50	70	
5.4	Soil Mechanics and Foundation Engineering	6	-	2	5	20	10	30	50	2 ½	20	3	70	100	
5.5	Surveying-II	4	-	8	6	20	10	30	50	2 ½	20	3	70	100	
5.6	Waste Water and Irrigation Engineering Drawing	-	-	6	2	-	20	20	50	3	-	-	50	70	
5.7	Universal Human Values	2	-	1	1	-	20	20	-	-	30	3	30	50	
#Student Centred Activities (SCA)		-	-	1	1	-	30	30	-	-	-	-	-	30	
Total		28	-	20	30	100	100	200	300	-	140	-	440	640	

Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

Survey Camp of 2 weeks duration to be organized after 5th semester exam.

SIXTH SEMESTER (CIVIL ENGINEERING)

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME									Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
		L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
-	Survey Camp	-	-	-	2	-	40	40	-	-	60	-	60	100	
6.1	Quantity Surveying and Valuation	6	-	-	5	20	-	20	50	2 ½	-	-	50	70	
6.2	Construction Management, Accounts and Entrepreneurship Development	5	-	-	4	20	-	20	50	2 ½	-	-	50	70	
6.3	Design of Steel Structure	6	-	-	5	20	-	20	50	2 ½	-	-	50	70	
6.4	Steel Structure Drawing	-	-	4	2	-	20	20	50	3	-	-	50	70	
6.5	Software Applications in Civil Engineering	-	-	8	3	-	40	40	-	-	60	3	60	100	
6.6	**Elective:	5	-	-	4	20	-	20	50	2 ½	-	-	50	70	
6.7	Project Work	-	-	10	4	-	40	40	-	-	60	-	60	100	
#Student Centred Activities (SCA)		-	-	4	1	-	30	30	-	-	-	-	-	30	
Total		22	-	26	30	80	170	250	250	-	180	-	430	680	

**Elective :- Any one of the following:

- 6.6.1 Repair and Maintenance of Buildings
- 6.6.2 Plumbing Services
- 6.6.3 Analysis of Structures

Student Centred Activities will comprise of co-curricular activities like extension lectures, self study, games, hobby clubs e.g. photography etc., seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities, disaster management and safety etc.

8. GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

It was discussed and decided that the maximum marks for SCA should be 30 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows:

- i. 10 Marks for general behavior and discipline
(by HODs in consultation with all the teachers of the department)
- ii. 5 Marks for attendance as per following:
(by HODs in consultation with all the teachers of the department)
 - a) 75 - 80% 2 Marks
 - b) 80 - 85% 4 Marks
 - c) Above 85% 5 Marks
- iii. 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
(by In-charge Sports/NCC/Cultural/Co-curricular/NSS)
 - a) 15 - State/National Level participation
 - b) 10 - Participation in two of above activities
 - c) 5 - Inter-Polytechnic level participation

Note: There should be no marks for attendance in the internal sessional of different subjects.

3.1 HYDRAULICS AND HYDRAULIC MACHINES

L T P
6 - 2

RATIONALE

Subject of Fluid Mechanics is a basic engineering subject and helps in solving fluid flow problems in the field of Civil Engineering. The subject deals with basic concepts and principles in hydrostatics, hydro kinematics and hydrodynamics and their application in solving fluid -mechanics problems.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- interpret the different terms related to fluids.
- calculate the pressure exerted by fluids on the walls of containers.
- Calculate discharge through pipes, irrigation channels, water supply pipe lines.
- use different flow measurement devices like venturimeter, mouthpiece, notches, weir, orificemeter
- calculate size of the pipe for carrying a particular discharge.
- prepare the details like dimensions, slope of the irrigation, canals and water courses
- differentiate between different type of water pumps used in the field.
- measure the loss of head in pipes and channels

DETAILED CONTENTS

- | | | |
|----|---|--------------|
| 1. | Introduction | (02 Periods) |
| | 1.1 Fluids: Real and ideal fluids | |
| | 1.2 Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics | |
| 2. | Properties of Fluids (definition only) | (08 Periods) |
| | 2.1 Mass density, specific weight, specific gravity, viscosity, surface tension - cohesion, adhesion and, capillarity, vapour pressure and compressibility. Newton's Law of viscosity, Newtonian and Non-Newtonian fluids, simple numerical problems. | |

3. Hydrostatic Pressure (12 Periods)
- 3.1 Pressure, intensity of pressure, pressure head, Pascal's law and its applications.
- 3.2 Total pressure, resultant pressure, and centre of pressure.
- 3.3 Total pressure and centre of pressure on horizontal, vertical and inclined plane surfaces of rectangular, triangular, trapezoidal shapes and circular.
(No derivation - Simple Numerical Problems) Pressure on curved surfaces (concept only).
4. Measurement of Pressure (08 Periods)
- 4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.
- 4.2 Piezometer, simple manometer and differential manometer, micro manometers, Bourden gauge and dead weight pressure gauge, numerical problems related to manometers.
5. Fundamentals of Fluid Flow (10 Periods)
- 5.1 Types of Flow: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow, stream line, stream tubes, streak line and path line.
- 5.2 Discharge and continuity equation (flow equation) {No derivation}, Simple numerical problems.
- 5.3 Types of hydraulic energy: Potential energy, kinetic energy, pressure energy
- 5.4 Bernoulli's theorem; statement and description (without proof of theorem), Simple numerical problems.
6. Flow Measurements (10 Periods)
- Brief description with simple numerical problems of :
- 6.1 Venturimeter and orificemeter
- 6.2 Pitot tube
- 6.3 Orifices and mouthpieces
- 6.4 Current meters
- 6.5 Notches and weirs
7. Flow through Pipes (12 Periods)
- 7.1 Definition of pipe flow; Reynolds number, laminar and turbulent flow - explained through Reynold's experiment
- 7.2 Critical velocity and velocity distributions in a pipe for laminar flow

- 7.3 Head loss in pipe lines due to friction, sudden expansion and sudden contraction, entrance, exit, obstruction and change of direction (No derivation of formula), Simple numerical problems related to flow through pipes and siphons.
- 7.4 Hydraulic gradient line and total energy line. Simple numerical problems.
- 7.5 Pipes in series and parallel
- 7.6 Water hammer phenomenon and its effects (only definition and description)
8. Flow through open channels (14 Periods)
- 8.1 Definition of an open channel, uniform flow and non-uniform flow
- 8.2 Discharge through channels using
- i) Chezy's formula (no derivation)
 - ii) Manning's formula (no derivation)
- 8.3 Most economical channel sections (no derivation, only simple numerical problems)
- i) Rectangular
 - ii) Trapezoidal
- 8.4 Head loss in open channel due to friction
- 8.5 Concept of specific energy and specific force- hydraulic jump.
9. Hydraulic Machines (8 Periods)
- Hydraulic pump, reciprocating pump, centrifugal pumps (No numerical and No derivations), impulse and reaction turbines (may be demonstrated with the help of working models)

PRACTICAL EXERCISES

1. To verify Bernoulli's Theorem
2. To find out venturimeter coefficient
3. To determine coefficient of velocity (C_v), Coefficient of discharge (C_d) Coefficient of contraction (C_c) of an orifice and verify the relation between them
4. To perform Reynold's experiment
5. To verify loss of head in pipe flow due to
 - a. Sudden enlargement
 - b. Sudden contraction
 - c. Sudden bend
6. Demonstration of use of current meter and pitot tube
7. To determine coefficient of discharge of a rectangular notch and triangular notch.

INSTRUCTIONAL STRATEGY

Fluid Mechanics being a fundamental subject, teachers are expected to lay considerable stress on understanding the basic concepts, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room and provide tutorial exercises so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject be supplemented by demonstrations and practical work in the laboratory. Visit to hydraulic research stations must be carried out.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Fluid Mechanics and Hydraulics by Jagdish Lal; Delhi Metropolitan Book Co. Pvt Ltd.
2. Hydraulics and Fluid Mechanics by Modi, PN, and Seth, SM; Delhi Standard Publishers Distributors.
3. Hydraulics and Hydraulics Machines by Khurmi RS ; S Chand and Co., Delhi
4. Laboratory Manual for Fluid Mechanics by Poonia MP and Jakhar OP; Standard Publishers Distributors, Delhi
5. Fluid Mechanics by Birinder Singh; Kaption Publishing, New Delhi.
6. Fluid Mechanics by Sarao A.S; Tech. India Publication, New Delhi
7. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	02	02

2	08	08
3	12	14
4	08	10
5	10	12
6	10	12
7	12	14
8	14	18
9	08	10
Total	84	100

3.2 CONCRETE TECHNOLOGY

L T P
6 - 2

RATIONALE

Diploma holders in Civil Engineering are supposed to supervise concreting operations involving proportioning, mixing, transporting, placing, compacting, finishing and curing of concrete. To perform above functions, it is essential to impart knowledge and skills regarding ingredients of concrete and their properties; properties of concrete in plastic and hardened stage, water cement ratio and workability; proportioning for ordinary concrete; concreting operations and joints in concrete.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- evaluate physical properties of cement concrete as per IS codes
- conduct various tests on aggregate in laboratory to evaluate their characteristics
- interpret the grading charts of different aggregates and evaluate fineness modulus of aggregates
- evaluate workability and strength of concrete
- recognize bleeding, segregation, harshness defects in fresh concrete
- explain hydration process of cement, water to cement (w/c) ratio and analyze relationship between compressive strength and w/c ratio
- conduct various destructive and non-destructive (NDT) test
- design mix of concrete as per IS code
- describe the use of different admixture to enhance the properties of concrete
- explain the feature of special concretes
- demonstrate how to carry out various concreting operation

DETAILED CONTENTS

1. Introduction (04 Periods)

Definition of concrete, properties of concrete, uses of concrete in comparison to other building materials. Advantages and disadvantages of concrete.
2. Ingredients of Concrete (10 Periods)
 - 2.1 Cement: physical properties of cement; different types of cement as per IS Codes
 - 2.2 Aggregates:

- 2.2.1 Classification of aggregates according to size and shape
 - 2.2.2 Characteristics of aggregates: Particle size and shape, surface texture, specific gravity of aggregate; bulk density, water absorption, surface moisture, bulking of sand, deleterious materials soundness
 - 2.2.3 Grading of aggregates: coarse aggregate, fine aggregate and All-in-one aggregate; fineness modulus; interpretation of grading charts
- 2.3 Water: Water Quality requirements as per IS:456-2000
3. Water Cement Ratio (05 Periods)
- 3.1 Hydration of cement principle of water-cement ratio, Duff Abram's Water-cement ratio law: Limitations of water-cement ratio law and its effects on strength of concrete
4. Properties of Concrete (12 Periods)
- 4.1 Properties in plastic state: Workability, Segregation, Bleeding and Harshness
- 4.1.1 Factors affecting workability, Measurement of workability: slump test, compacting factor and Vee Bee consistometer; Recommended slumps for placement in various conditions as per IS:456-2000/SP-23
- 4.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;
5. Concrete Mix Design (12 Periods)
- 5.1 Objectives and parameters of mix design, introduction to various grades as per IS:456-2000; proportioning for nominal mix design as prescribed by IS 456-2000
- 5.2 Adjustment on site for: Bulking of fine aggregate, water absorption of aggregate, workability
- 5.3 Difference between nominal and controlled concrete
- 5.4 Introduction to IS-10262-2009-Code for controlled mix design.
- 5.5 Mix design problems of concrete for desired mix strength or grade.
6. Introduction to Admixtures (chemicals and minerals) for improving performance of concrete (06 Periods)
7. Special Concretes (only features) (12 Periods)
- 7.1 Concreting under special conditions, difficulties and precautions before, during and after concreting
- 7.1.1 Cold weather concreting

- 7.1.2 Under water concreting
- 7.1.3 Hot weather concreting

- 7.2 Ready mix concrete
- 7.3 Fibre reinforced concrete
- 7.4 Polymer Concrete
- 7.5 Fly ash concrete
- 7.6 Silica fume concrete
- 7.7 Self compacting concrete

- 8. Concreting Operations (20 Periods)

- **8.1 Storing of Cement
 - 8.1.1 Storing of cement in a warehouse
 - 8.1.2 Storing of cement at site
 - 8.1.3 Effect of storage on strength of cement
 - 8.1.4 Determination of warehouse capacity for storage of Cement

- **8.2 Storing of Aggregate: Storing of aggregate at site

- 8.3 Batching (to be shown during site visit)
 - 8.3.1 Batching of Cement
 - 8.3.2 Batching of aggregate by:
 - 8.3.2.1 Volume, using gauge box (farma) selection of proper gauge box
 - 8.3.2.2 Weight spring balances and batching machines
 - 8.3.3 Measurement of water

- ** 8.4 Mixing
 - 8.4.1 Hand mixing
 - 8.4.2 Machine mixing - types of mixers, capacities of mixers, choosing appropriate size of mixers, operation of mixers
 - 8.4.3 Maintenance and care of mixers
 - 8.4.4 Batching and mixing plants

- **8.5 Transportation of concrete: Transportation of concrete using: wheel barrows, transit mixers, chutes, belt conveyors, Dumpers and trucks, tremie, mono rail system, pumps, tower crane and hoists.

- 8.6 Placement of concrete

Type of form works and scaffoldings, Checking of form work, shuttering and precautions to be taken during placement

**** 8.7** Compaction

8.7.1 Hand compaction

8.7.2 Machine compaction - types of vibrators, internal screed vibrators and form vibrators

8.7.3 Selection of suitable vibrators for different situations

8.8 Finishing concrete slabs - screeding, floating and trowelling

8.9 Curing

8.9.1 Objective of curing, methods of curing like ponding, membrane curing, steam curing, chemical curing

8.9.2 Duration for curing and removal of form work

8.10 Jointing: Location of construction joints, treatment of construction joints, expansion joints in buildings - their importance and location

8.11 Defects in concrete: Identification of defects and methods of removing defects

9. Importance and methods of non-destructive tests (introduction only) (03 Period)

9.1. Rebound Hammer Test

9.2. Pulse Velocity method

NOTE: ** A field visit may be planned to explain and show the relevant things

PRACTICAL EXERCISES:

1. To determine the physical properties of cement such as fineness, consistency, setting time, soundness and compressive strength of cement as per IS Codes
2. To determine flakiness and elongation index of coarse aggregate
3. To determine silt content in fine aggregate
4. Determination of specific gravity and water absorption of aggregates
5. Determination of bulk density and voids of aggregates
6. Determination of particle size distribution of fine, coarse and all-in-one aggregate by sieve analysis (grading of aggregate)
7. To determine bulking of fine aggregates

8. To determine workability by slump test and to verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump
9. Compaction factor test for workability
10. Non destructive test on concrete by:
 - a) Rebound Hammer Test
 - b) Ultrasonic Pulse Velocity Test
11. To determine compressive strength of concrete cubes for different grades of concrete
12. To determine flexural strength of concrete beam

INSTRUCTIONAL STRATEGY

This subject is of practical nature. While imparting instructions, teachers are expected to organize demonstrations and field visits to show various stages of concreting operations. While working in the laboratory, efforts should be made to provide extensive practical training to students so as to make them confident in the preparation and testing of concrete. Teachers should also organize viva examination so as to develop understanding about concepts and principles involved.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Actual Practical Performance
- Report writing
- Viva-Voce

RECOMMENDED BOOKS

1. Concrete Technology by Krishnamurthy, KT Rao, A Kasundra and Khandekar, AA; Dhanpat Rai and Sons, Delhi
2. Text Book of Concrete Technology by Gupta BL and Gupta Amit; Standard Publishers Distributors, Delhi.
3. Concrete Tecnology by Handoo, BL, Puri, LD and Mahajan Sanjay; Satya Prakashan, New Delhi.
4. Laboratory Manual on Concrete Technology by Sood, Hemant, Mittal LN and Kulkarni PD; CBS Publishers, New Delhi
5. Concrete Technology by Birinder Singh; Kaption Publications, Ludhiana,
6. Module on Special Concretes by Dr. Hemant Sood; NITTTR Chandigarh
7. Video programme on different experiments in ‘Concrete Technology’ developed by NITTTR, Chandigarh.

8. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	05
2	10	12
3	05	06
4	12	14
5	12	14
6	06	07
7	12	14
8	20	24
9	03	04
Total	84	100

3.3 ENVIRONMENTAL STUDIES

L T P
3 - 2

RATIONALE

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the ecosystem and controlling pollution by various control measures. He should also be aware of environmental laws related to the control of pollution. He should know how to manage the waste. Energy conservation is the need of hour. He should know the concept of energy management and its conservation.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- Comprehend the importance of ecosystem and sustainable
- Demonstrate interdisciplinary nature of environmental issues
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abatement of pollution.
- Explain environmental legislation acts.
- Define energy management, energy conservation and energy efficiency
- Demonstrate positive attitude towards judicious use of energy and environmental protection
- Practice energy efficient techniques in day-to-day life and industrial processes.
- Adopt cleaner productive technologies
- Identify the role of non-conventional energy resources in environmental protection.
- Analyze the impact of human activities on the environment

DETAILED CONTENTS

1. Introduction (04 Periods)
 - 1.1 Basics of ecology, eco system- concept, and sustainable development, Resources renewable and non renewable.
2. Air Pollution (04 Periods)
 - 2.1 Source of air pollution. Effect of air pollution on human health, economy, plant, animals. Air pollution control methods.
3. Water Pollution (08 Periods)
 - 3.1 Impurities in water, Cause of water pollution, Source of water pollution. Effect of water pollution on human health, Concept of dissolved O₂, BOD, COD. Prevention of water pollution- Water treatment processes, Sewage treatment. Water quality standard.
4. Soil Pollution (06 Periods)
 - 4.1 Sources of soil pollution

- 4.2 Types of Solid waste- House hold, Hospital, From Agriculture, Biomedical, Animal and human, excreta, sediments and E-waste
- 4.3 Effect of Solid waste
- 4.4 Disposal of Solid Waste- Solid Waste Management
5. Noise pollution (06 Periods)
Source of noise pollution, Unit of noise, Effect of noise pollution, Acceptable noise level, Different method of minimizing noise pollution.
6. Environmental Legislation (08 Periods)
Introduction to Water (Prevention and Control of Pollution) Act 1974, Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986, Role and Function of State Pollution Control Board and National Green Tribunal (NGT), Environmental Impact Assessment (EIA).
7. Impact of Energy Usage on Environment (06 Periods)
Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain. Eco-friendly Material, Recycling of Material, Concept of Green Buildings.

LIST OF PRACTICALS

1. Determination of pH of drinking water
2. Determination of TDS in drinking water
3. Determination of TSS in drinking water
4. Determination of hardness in drinking water
5. Determination of oil & grease in drinking water
6. Determination of alkalinity in drinking water
7. Determination of acidity in drinking water
8. Determination of organic/inorganic solid in drinking water
9. Determination of pH of soil
10. Determination of N&P (Nitrogen & Phosphorus) of soil
11. To measure the noise level in classroom and industry.
12. To segregate the various types of solid waste in a locality.
13. To study the waste management plan of different solid waste
14. To study the effect of melting of floating ice in water due to global warming

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits to green house, effluent treatment plant of any industry, rain water harvesting plant etc. may also be organized.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,

- Mid-term and end-term written tests

RECOMMENDED BOOKS

1. Environmental and Pollution Awareness by Sharma BR; Satya Prakashan, New Delhi.
2. Environmental Protection Law and Policy in India by Thakur Kailash; Deep and Deep Publications, New Delhi.
3. Environmental Pollution by Dr. RK Khitoliya; S Chand Publishing, New Delhi
4. Environmental Science by Deswal and Deswal; Dhanpat Rai and Co. (P) Ltd. Delhi.
5. Engineering Chemistry by Jain and Jain; Dhanpat Rai and Co. (P) Ltd. Delhi.
6. Environmental Studies by Erach Bharucha; University Press (India) Private Ltd., Hyderabad.
7. Environmental Engineering and Management by Suresh K Dhamija; S K Kataria and Sons, New Delhi.
8. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	10
2	04	10
3	08	20
4	06	14
5	06	14
6	08	20
7	06	12
Total	42	100

3.4 STRUCTURAL MECHANICS

L T P
6 - 2

RATIONALE

This is a basic engineering subject. The purpose of the subject is to impart basic knowledge and skill regarding properties of materials, concept of stresses and strains, bending moment and shear force diagrams, second moment of area, bending and shear stresses, slope and deflection and analysis of trusses. The above knowledge will be useful for designing simple structural components. This subject is very important to develop basic concepts and principles related to strength of materials. This subject will also enable the students to continue their further education.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- conduct different tests on mild steel
- calculate modulus of elasticity
- analyse and explain stress-strain diagram of mild and HYSD steel
- calculate various forces used in design of structures
- calculate shear force, bending moment for simply supported, cantilever and overhanging beams with concentrated and uniformly distributed loads
- calculate moment of inertia, second moments of inertia, radius of gyration, section modulus for L, T, channel and I sections
- calculate the bending stresses, moment of resistance of simply supported beams
- explain shear stress, stress distribution diagram for rectangular, circular, I,T and L sections
- calculate slope and deflection of determinate structures
- verify forces in a framed structure

DETAILED CONTENTS

THEORY

1. Properties of Materials (06 Periods)
 - 1.1 Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials.
 - 1.2 Introduction to tensile test, compressive test, impact test, fatigue test, torsion test on metals.

2. Simple Stresses and Strains (20 Periods)
- 2.1 Concept of stress, normal and shear stresses,
 - 2.2 Concept of strain and deformation, longitudinal and transverse strain, poisson's ratio, volumetric strain
 - 2.3 Hooke's law, moduli of elasticity and rigidity, Bulk modulus of elasticity, relationship between the elastic constants.
 - 2.4 Stresses and strains in bars subjected to tension and compression. Extension of uniform bar under its own weight, stress produced in compound and tapering bars due to axial load.
 - 2.5 Stress-strain diagram for mild steel and HYSD steel, proof stress, mechanical properties, factor of safety.
 - 2.6 Temperature stresses and strains
3. Shear Force and Bending Moment (20 Periods)
- 3.1 Concept of a beam and supports (Hinges, Roller and Fixed), types of beams: simply supported, cantilever, propped, over hang, fixed and continuous beams (only concept).
 - 3.2 Types of loads (dead load, live load, snow load, wind load seismic load as per IS Codes etc) and types of loading (point, uniformly distributed and uniformly varying loads)
 - 3.3 Concept of bending moment and shear force, sign conventions
 - 3.4 Bending Moment and shear force diagrams for cantilever, simply supported and overhanging beams subjected to concentrated, uniformly distributed and varying loads
 - 3.5 Relationship between load, shear force and bending moment, point of maximum bending moment, and point of contraflexure.
 - 3.6 Fixed and continuous beams-simple numerical problems.
4. Moment of Inertia (04 Periods)
- Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle (*without derivations*). Second moment of area for L, T and I sections, section modulus.
5. Bending Stresses in Beams (08 Periods)
- 5.1 Concept of pure/simple bending
 - 5.2 Assumptions made in the theory of simple bending, derivation and application of bending equation to circular cross-section, I section, T&L sections only

- 5.3 Moment of resistance
 5.4 Calculations of bending stresses
6. Shear Stresses in Beams (06 Periods)
- 6.1 Concept of shear stresses in beams, shear stress distribution in rectangular, circular I, T, L sections for beams.
7. Slope and Deflection (08 Periods)
- Determination of slope and deflection using Moment Area Theorem for simply supported beam for pointed load and U.D.L, Conjugate beam method and double integration method. (no derivation, numerical problems only)
8. Columns (04 Periods)
- 8.1 Theory of columns- long and short columns, slenderness ratio
 8.2 Problem solving using Euler's and Rankine formula
9. Analysis of Trusses (08 Periods)
- 9.1 Concept of a perfect, redundant and deficient frames
 9.2 Assumptions and analysis of trusses by:
- a) Method of joints
 - b) Method of sections

PRACTICAL EXERCISES

1. Determination of yield stress, ultimate stress, percentage elongation and plot the stress strain diagram and compute the value of young's modulus on mild steel
2. Testing of HYSD Steel
3. Determination of Young's modulus of elasticity for steel wire with searl's apparatus
4. Determination of modulus of rupture of a concrete beam
5. Determination of maximum deflection and young's modulus of elasticity in simply supported beam with load at middle third point
6. Verification of forces in a framed structure

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple exercises involving the applications of various concepts and principles being taught in the subject. Efforts should be made to prepare tutorial sheets on various topics and students should be encouraged/guided to solve tutorial sheets independently. In the practical works, individual students should be given opportunities to do

practical work, make observations and draw conclusions. Teachers should also conduct viva examination in which stress should be given on the understanding of basic concepts and principles.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Strength of Materials by Ramamrutham, S ; Dhanpat Rai and Sons., New Delhi
2. Applied Mechanics and Strength of Materials by Ram Chandra; Standard Publishers. Delhi:
3. Strength of Materials by Punmia, BC ; Standard Publishers, Delhi,
4. Strengths of Materials by Sadhu Singh; Standard Publishers, New Delhi
5. Structural Mechanics by Singh Birinder; Kaption Publishers, Ludhiana
6. Strength of Material by Karamveer Saini, Krishna Publishing House, Meerut.
7. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference

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SUGGESTED DISTRIBUTION OF MARKS

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1	06	07
2	20	22
3	20	22
4	04	05
5	08	12

6	06	07
7	08	10
8	04	5
9	08	10
Total	84	100

3.5 BUILDING CONSTRUCTION

L T P
6 - 3

RATIONALE

Diploma holders in Civil Engineering are supposed to effectively supervise construction of buildings. Effective supervision is essential to obtain/provide a fault free service from contractors to users. To perform above task, it is essential that students should have knowledge of various sub components of buildings like foundations, walls, roofs, staircases, floors etc., and their constructional details as well as preventive, remedial and corrective methods of common construction faults. Therefore, the subject of Building Construction is very important for Civil Engineering diploma holders.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- define the different components and classification of building
- select a foundation for particular type of building
- explain different types of walls, scaffolding, shoring, underpinning and their constructional methodology
- carry out the construction of brick wall.
- supervise rubble and ashlar types of stone masonry construction
- demonstrate the construction details of lintels and arches at appropriate level in building
- select different types of doors, windows, floors and stairs cases in building
- recognize different parts of roof trusses and drainage system of roofs
- identify and select application procedure for different types of surfaces finishes in building i.e. plastering, pointing, painting, white washing and distempering
- evaluate the possible reason of dampness at various level in building and remedial means
- demonstrate how to carry out different types of possible anti termite treatments in building
- know about environmental friendly building and energy efficient building.
- list relevant IS codes.

DETAILED CONTENTS

1. Introduction (03 Periods)
 - 1.1 Definition of a building, classification of buildings based on occupancy
 - 1.2 Different parts of a building

2. Foundations (08 periods)
 - 2.1 Concept of foundation and its purpose
 - 2.2 Types of foundation-shallow and deep
 - **2.2.1 Shallow foundation - constructional details of: Spread foundations for walls, min. depth criteria, thumb rules for depth and width of foundation and thickness of concrete block, stepped foundation for masonry pillars and concrete columns, Raft foundation, combined footing grillage foundation.
 - 2.2.2 Introduction to deep foundation and their types
 - 2.3 Earthwork
 - 2.3.1 Layout/setting out for surface excavation, cutting and filling
 - 2.3.2 Excavation of foundation, trenches, shoring, timbering and de-watering

3. Walls (08 periods)
 - 3.1 Purpose of walls
 - 3.2 Classification of walls - load bearing, non-load bearing, dwarf wall, retaining, breast walls and partition walls
 - 3.3 Classification of walls as per materials of construction: brick, stone, reinforced brick, reinforced concrete, precast, hollow and solid concrete block and composite masonry walls
 - 3.4 Partition walls: Constructional details, suitability and uses of brick and wooden partition walls
 - 3.5 Scaffolding, construction details and suitability of mason's brick layers and tubular scaffolding, shoring, underpinning

4. Masonry (08 periods)
 - 4.1 Brick Masonry: Definition of terms like header, stretcher, queen closer, king closer, frog and quoin, course, bond, facing, backing, hearting, jambs, reveals, soffit, plinth, pillars and pilasters

- 4.1.1 Bond – meaning and necessity; English, flemish bond and other types of bonds
- 4.1.2 Construction of brick walls –methods of laying bricks in walls, precautions observed in the construction of walls, methods of bonding new brick work with old (toothing, raking, back and block bonding), Expansion and contraction joints
- 4.1.3 Mortars: types, selection of mortar and its preparation
- 4.2 Stone Masonry
 - 4.2.1 Glossary of terms – natural bed, bedding planes, string course, corbel, cornice, block in course grouting, moulding, templates, corner stone, bond stone, throating, through stone, parapet, coping, pilasters and buttress
 - 4.2.2 Types of stone masonry: rubble masonry - random and coursed; Ashlar masonry, principles to be observed in construction of stone masonry walls
- 5. Arches and Lintels (06 periods)
 - 5.1 Meaning and use of arches and lintels:
 - 5.2 Glossary of terms used in arches and lintels - abutment, pier, arch ring, intrados, soffit, extrados, voussoirs, springer, springing line, crown, key stone, skew back, span, rise, depth of an arch, haunch, spandril, jambs, bearing, thickness of lintel, effective span
 - 5.3 Arches:
 - 5.3.1 Types of Arches - Semi circular, segmental, elliptical and parabolic, flat, inverted and relieving
 - 5.3.2 Stone arches and their construction
 - 5.3.3 Brick arches and their construction
 - 5.4 Lintels
 - 5.4.1 Purpose of lintel
 - 5.4.2 Materials used for lintels
 - 5.4.3 Cast-in-situ and pre-cast lintels
 - 5.4.4 Lintel along with sun-shade or chhajja
- **6. Doors, Windows and Ventilators (06 periods)
 - 6.1 Glossary of terms with neat sketches
 - 6.2 Classification based on materials i.e. wood, metal and plastic and their suitability for different situations. Different type of doors- panel door, flush door, glazed door, rolling shutter, steel door, sliding door, plastic and aluminium doors

- 6.3 Window – Panel window, glazed windows (fixed and openable) ventilators, sky light window, Louveres shutters, plastic and aluminium windows.
- 6.4 Door and window frames – materials and sections, fixtures and fasteners, hold fasts

*7. Damp Proofing and Water Proofing (06 periods)

- 7.1 Dampness and its ill effects on bricks, plaster, wooden fixtures, metal fixtures and reinforcement, damage to aesthetic appearance, damage to heat insulating materials, damage to stored articles and health
- 7.2 Sources of dampness - moisture penetrating the building from outside e.g. rainwater, surface water, ground moisture. Moisture entrapped during construction i.e. moisture in concrete, masonry construction and plastering work etc. Moisture which originates in the building itself i.e. water in kitchen and bathrooms etc.
- 7.3 Damp proofing materials and their specifications: rich concrete and mortar, bitumen, bitumen mastic, polymer coating, use of chemicals
- 7.4 Damp proofing of basement, Ground floors, plinth and walls, water storage tank, kitchen, W.C., roof.
- 7.5 Plinth protection and aprons

**8. Floors (05 periods)

- 8.1 Glossary of terms-floor finish, topping, under layer, base course, rubble filling and their purpose
- 8.2 Types of floor finishes - concrete flooring, ceramic tile flooring, stone (marble and kota) flooring. Wooden flooring
- 8.3 Special emphasis on level/slope/reverse slope in bathrooms, toilets, kitchen, balcony and staircase.

9. Roofs (06 periods)

- 9.1 Types of roofs, concept of flat, pitched and arched roofs
- 9.2 Glossary of terms for pitched roofs - batten, eaves, facia board, gable, hip, lap, purlin, rafter, rag bolt, valley, ridge, rain water gutter, anchoring bolts
- 9.3 False ceilings using gypsum, plaster boards, cellotex, fibre boards
- 9.4 Roof drainage
- 9.5 Roof treatment-brick Koba

10. Stairs (06 periods)
- 10.1 Glossary of terms: Staircase, winders, landing, stringer, newel, baluster, riser, tread, width of staircase, hand-rail, nosing
- 10.2 Classification of staircase on the basis of material – RCC, timber, steel, Aluminium
- 10.3 Planning and layout of staircase: Relations between rise and tread, determination of width of stair, landing etc
- 10.4 Various types of layout - straight flight, dog legged, open well, quarter turn, half turn (newel and geometrical stairs), bifurcated stair, spiral stair
11. Surface Finishes (08 periods)
- 11.1 Plastering - classification according to use and finishes like plain plaster, grit finish, rough cast, pebble dashed, concrete and stone cladding etc., dubbing, proportion of mortars used for different plasters, techniques of plastering and curing
- 11.2 Pointing - different types of pointing and their methods
- 11.3 Painting - preparation of surface, primer coat and application of paints on wooden, steel and plastered wall surfaces
- 11.4 Application of white washing, colour washing and distempering, polishing, application of cement and plastic paints
- 11.5 Selection of appropriate paints/finishes for interior and exterior surfaces
- 11.6 Importance of preparation of surfaces such as hacking, grooving etc before application of surface finishes
12. Anti Termite Measures as per IS 6313-I-III (03 periods)
- 12.1 Anti Termite Treatment to Foundation, Masonary, RCC, Floors, Junction of walls and Floors.
- 12.2 Treatment to wooden joinery
- 12.3 Treatment to existing building
13. Green Buildings (08 Periods)
- Importance, components: Site, Rain water harvesting/water efficiency, energy efficiency, material efficiency Indoor air quality design and innovation rating system.
14. National Building code and IS code orientation of building (03 Periods)
- Note** * An expert may be invited from field/industry for extension lecture
- ** A field visit may be planned to explain and show the relevant things

PRACTICAL EXERCISES

CORRECTED AND APPROVED BY BOARD OF TECHNICAL EDUCATION, U.P., LUCKNOW IN MEETING HELD ON 10.07.2019 @ RASHMI SONKAR

1. Demonstration of tools and plants used in building construction
2. To prepare Layout of a building: two rooms building with front verandah
3. To construct brick bonds (English bond only) in one, one and half and two brick thick: (a) Walls for L, T and cross junction (b) Columns
4. Demonstration of following items of work at construction site by:
 - a) Timbering of excavated trenching
 - b) Laying damp proof courses
 - c) Construction of masonry walls
 - d) Laying of tile flooring on an already prepared lime concrete base
 - e) Plastering and pointing exercise
 - f) Constructing RCC work
 - g) Pre-construction and post construction termite treatment of building and woodwork
 - h) Interlocking tiles

Note: (A report of these activities will be submitted by the students)

INSTRUCTIONAL STRATEGY

While imparting instructions in this subject, teachers are expected to take students to work site and explain constructional process and special details for various sub-components of a buildings. It is also important to make use of audio visual aids/video films (if available) to show specialized operations. The practical work should be given due importance and efforts should be made that each student should perform practical work independently. For carrying out practical works, polytechnics should have construction yard where enough raw materials is made available for students to perform practical work

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Presentation
- Actual Practical Performance
- Report writing
- Viva-voce
- Repair work
-

RECOMMENDED BOOKS

1. Building Construction by Rangwala, SC; Charotar Book Stall, Anand

2. A Text Book of Building Construction by Kulkarni, GJ; Ahmedabad Book Depot
3. A Text Book of Building Construction by Arora, SP and Bindra, SP; Dhanpat Rai and Sons, New Delhi.
4. Building Construction by Sushil Kumar; Standard Publishers Distributors, Delhi
5. SP – 62 Hand Book of BIS
6. B.I.S. – 6313 Part 1, 2, 3
7. National Building Code
8. Handbook of Civil Engineering by PN Khanna
9. Video films on Damp proofing, water proofing, surface finishes
10. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	05
2	08	08
3	08	08
4	08	07
5	06	09
6	06	09
7	06	05
8	05	08
9	06	08
10	06	09
11	08	09
12	03	05
13	08	05
14	03	05
Total	84	100

3.6 BUILDING DRAWINGS

L T P
- - 8

RATIONALE

Drawing is the language of engineers. Engineering is incomplete without a thorough knowledge of drawing. A Civil Engineering diploma holder must be capable of sketching detailed constructional drawing of various components of building for the purpose of communication with the craftsman. Planning of small buildings, developing a line plan, dimensioning, key plan, drainage plan should be a part of curriculum. The diploma engineer must be conversant with reading and interpretation of drawings for execution of work.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Read and interpret building drawings
- Explain the drawing to craftsman
- Layout foundation plan of different types of foundations
- Prepare drawings of small buildings, developing different sections of building
- Guide and supervise carpenters in various carpentry works related to doors, windows etc.
- Prepare details of brick courses in joints
- Draw the sketches of various joints of carpentry
- Demonstrate circular arch and segmental arches

DETAILED CONTENTS

Section-I

Drawing No. 1

(2 sheets)

Details of spread footing foundations for a load bearing and non-load bearing wall for given thickness of walls with the help of given data or rule of the thumb, showing offsets, position of DPC. The details of the concrete and brick apron have to be shown in the drawing.

Drawing No. 2

(one sheet)

Plans of 'T' and Corner junction of walls of 1 Brick, 1-1/2 Brick and 2 brick thick in English bond

Drawing No. 3 (one sheet)

Drawing plan, elevation of arches: circular arch, segmental arch (one sheet)

Drawing No. 4 (3 sheets)

Elevation, sectional plan and sectional side elevation of flush door, fully glazed door, fully panelled door with wire gauge shutter. Partly panelled and partly glazed door.

Section-II

Drawing No. 5 (2 sheet)

Drawing plan, elevation of a small building by measurement and foundation detail and sectional elevation.

Drawing No. 6 (4 sheets)

Drawing detailed working plan, elevation and section of a residential building from a given line plan or given data showing details of foundations, roof and parapet

Drawing No. 7 (one sheet)

Drawings of following floors

Cement concrete floors at ground level and at first floor level.

- i) Brick floors:
 - a) Diagonal Bond
 - b) Herring Bone Bond
- ii) Bonded cement concrete flooring/ Marble flooring/ Terrazzo flooring
- iii) Ceramic/vitrified tile flooring

Drawing No. 8 (one sheet)

Drawing of flat roof, showing the heat/thermal insulation provisions.

Section-III

Drawing No. 9 (one sheet)

Drawing details of damp proofing arrangement of roofs and walls as per BIS Code. Show the rain water drainage arrangement also.

Drawing No 10

Drawing Damp Proofing details in basement of buildings.

NOTE

- a) All drawings should be as per BIS code and specifications in SI Units
- b) Intensive practice of reading and interpreting building drawings should be given
- c) Some practice should be done to prepare drawings on AutoCAD.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Laboratory and practical work
- Model Making
- Drawing Sheets
- Viva-Voce

RECOMMENDED BOOKS

1. Civil Engineering Drawing by RS Malik; Asia Publishing House
2. Civil Engineering Drawing by V.B.Sikka ; Katson Publishing, Ludhiana
3. Civil Engineering Drawing by NS Kumar ; IPH, New Delhi
4. Principles of Building Drawing by MG Shah and CM Kale; MacMillan, Delhi
5. Building Construction by Moorthy NRK
6. Civil Engg Drawing by Layal
7. Drawing and Design of Residential and Commercial Buildings by Zaidi, SKA and Siddiqui, Suhail; Standard Publishers and Distributors, Delhi.
8. SP : 20
9. National Building Code
10. Building Drawing by Mamta Kataria; North Publication, Jalandhar.
11. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

4.1 COMMUNICATION SKILLS – II

L	T	P
4	-	2

RATIONALE

Knowledge of English Language plays an important role in career development. This subject aims at introducing basic concepts of communication besides laying emphasis on developing listening, speaking, reading and writing skills as parts of Communication Skill.

LEARNING OUTCOMES

After undergoing the subject, the students will be able to:

- Frame correct sentences with illustrations
- Comprehend the language correctly
- Interpret the language correctly
- Use given material in new situations.
- Correspond effectively using various types of writings like letters, memos etc.
- Communicate effectively in English with appropriate body language making use of correct and appropriate vocabulary and grammar in an organised set up and social context.

DETAILED CONTENTS

- | | | |
|------|---|--------------|
| 1. | Functional Grammar | (16 periods) |
| 1.1 | Prepositions | |
| 1.2 | Framing Questions | |
| 1.3 | Conjunctions | |
| 1.4 | Tenses | |
| 2 | Reading | (16 periods) |
| 2.1 | Unseen Passage for Comprehension (Vocabulary enhancement - Prefixes, Suffixes, one word substitution, Synonym and Antonym) based upon the passage should be covered under this topic. | |
| 3 | Writing Skill | (24 periods) |
| 3.1. | Correspondence | |
| a) | Business Letters- Floating Quotations, Placing Orders, Complaint Letters. | |
| b) | Official Letters- Letters to Government and other Offices | |
| 3.2. | Memos, Circular, Office Orders | |
| 3.3. | Agenda & Minutes of Meeting | |

3.4. Report Writing

LIST OF PRACTICALS

Note: Teaching Learning Process should be focused on the use of the language in writing reports and making presentations.

Topics such as Effective listening, effective note taking, group discussions and regular presentations by the students need to be taught in a project oriented manner where the learning happens as a byproduct.

Speaking and Listening Skills

1. Debate
2. Telephonic Conversation: general etiquette for making and receiving calls
3. Offering- Responding to offers.
4. Requesting – Responding to requests
5. Congratulating
6. Exploring sympathy and condolences
7. Asking Questions- Polite Responses
8. Apologizing, forgiving
9. Complaining
10. Warning
11. Asking and giving information
12. Getting and giving permission
13. Asking for and giving opinions

INSTRUCTIONAL STRATEGY

Students should be encouraged to participate in role play and other student-centered activities in class rooms and actively participate in listening exercises

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-semester and end-semester written tests
- Actual practical work, exercises and viva-voce
- Presentation and viva-voce

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by RevathiSrinivas; Abhishek Publications, Chandigarh.

2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

Websites for Reference:

1. <http://www.mindtools.com/> page 8.html – 99k
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>
5. <http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	16	28
2	16	28
3	24	44
Total	56	100

4.2 HIGHWAY ENGINEERING

L T P
6 - 2

RATIONALE

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

DETAILED CONTENTS

- | | | |
|----|--|--------------|
| 1. | Introduction | (04 Periods) |
| | 1.1 Importance of Highway engineering | |
| | 1.2 Functions of IRC, CRRI, MoRT & H, NHAI | |
| | 1.3 Classification of roads | |
| | 1.4 Mass Transportation system | |
| | 1.5 Concept of Smart highways | |
| 2. | Road Geometrics | (08 Periods) |
| | 2.1 Glossary of terms used in road geo-metrics and their importance: Right- of-way, formation width, road margin, road shoulder, carriage way, side slopes, kerbs, formation levels, camber and gradient | |
| | 2.2 Average running speed, stopping and overtaking sight distance | |

- 2.3 Necessity of curves, horizontal and vertical curves including transition curves. Super elevation and methods of providing super elevation
- 2.4 Sketch of typical L-section and X-section in cutting and filling on straight alignment and at a curve
(Note: No design/numerical problem to be taken)
3. Highway Alignment (06 Periods)
- 3.1 Basic considerations governing alignment for a road in plain and hilly area
- 3.2 Highway location, marking of alignment on ground, setting out alignment of road, setting out bench marks, control pegs for embankment and cutting
4. Road Materials (10 Periods)
- 4.1 Different types of road materials in use; soil, aggregate and binders
- 4.2 Introduction to California Bearing Ratio, method of finding CBR value and its significance. Aggregate : Source and types, important properties, strength, durability
- 4.3 Binders: Common binders; bitumen, properties as per BIS specifications, penetration, softening point, ductility and viscosity test of bitumen, procedures and significance, cut back and emulsion and their uses, Bitumen modifiers (CRMB, PMB)
- 4.4 Use of recycled materials in pavements.
5. Road Pavements (16 Periods)
- 5.1 Road pavement: Flexible and rigid pavement, their merits and demerits, typical cross-sections, functions of various components
- 5.2 Sub-grade preparation
Borrow pits, making profiles of embankment, construction of embankment, compaction, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation.
- 5.3 Stabilization of subgrade. Types of stabilization mechanical stabilization, lime stabilization, cement stabilization, fly ash stabilization etc.(introduction only)
- 5.4 Base Course
Granular base course:
(a) Water Bound Macadam (WBM)
(b) Wet Mix Macadam (WMM)
Bitumen Courses:
(a) Bituminous Macadam
(b) Dense Bituminous Macadam (DBM)

*Methods of construction as per MoRT&H

5.5 Surfacing

* Types of surfacing

- a) Prime coat and tack coat
- b) Surface dressing with seal coat
- c) Open graded premix carpet
- d) Mix seal surfacing
- e) Semi dense bituminous concrete
- f) Bituminous Concrete

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

5.6 Rigid Pavements

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

6. Hill Roads (08 Periods)

- 6.1 Introduction: Typical cross-sections showing all details of a typical hill road, partly in cutting and partly in filling
- 6.2 Special problems of hill areas
 - 6.2.1 Landslides: Causes, prevention and control measures, use of geogrids, geoflexibles, geo synthetics
 - 6.2.2 Drainage
 - 6.2.3 Soil erosion
 - 6.2.4 Snow: Snow clearance, snow avalanches, frost
 - 6.2.5 Land Subsidence

7. Road Drainage (06 Periods)

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

8. Road Maintenance (08 Periods)

- 8.1 Common types of road failures of flexible pavements: Pot hole, cracks, rutting, alligator, cracking, upheaval - their causes and remedies (brief description)
- 8.2 Maintenance of bituminous road such as crack sealing, patch-work and resurfacing.
- 8.3 Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (beams)

9. Road Construction Equipment (10 Periods)

Output and use of the following plant and equipment

- 9.1 Hot mix plant
- 9.2 Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline
- 9.3 Asphalt mixer and tar boilers
- 9.4 Road pavers
- 9.5 Paver finisher

10 Airport Engineering (08 Periods)

- 10.1 Necessity of study of airport engineering, aviation transport scenario in India.
- 10.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.
- 10.3 Introduction to Runways, Taxiways, Apron and Hanger

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

PRACTICAL EXERCISES

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

10. Demonstration of working of mixing and spraying equipment through a field visit

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Actual Practical Performance
- Report Writing
- Viva-voce

RECOMMENDED BOOKS

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

Websites for Reference:

<http://swayam.gov.in>

IRC Publications

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	04	05
2	08	10
3	06	07
4	10	12
5	16	19
6	08	10
7	06	07
8	08	10
9	10	12
10	08	08
Total	84	100

4.3 IRRIGATION ENGINEERING

L T P
5 - -

RATIONALE

Diploma holders in Civil Engineering have to supervise the construction, repair and 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 tubewells. This subject imparts 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.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- explain concept of necessity of irrigation in India
- recognize different crops and their water requirements
- define rainfall and runoff
- measure rainfall and read rain gauges and hydrographs
- monitor construction and maintenance work of canal and canal linings
- monitor installation of tubewells and water harvesting techniques
- supervise maintenance and construction work of canal head works and cross regulators
- supervise construction of various river training works
- carry out desilting operation of canals

DETAILED CONTENTS

THEORY

- | | | |
|----|---|--------------|
| 1. | Introduction | (03 Periods) |
| | 1.1 Definition of irrigation | |
| | 1.2 Necessity of irrigation, Role of Irrigation in country's economy. | |
| | 1.3 History of development of irrigation in India | |
| | 1.4 Major, medium and minor irrigation projects of India. | |
| 2. | Water Requirement of Crops | (06 Periods) |
| | 2.1 Principal crops in India and their water requirements | |
| | 2.2 Crop seasons – Kharif and Rabi | |

- 2.3 Soil water, soil crop and crop water relationships, Duty, Delta and Base Period, their relationship
- 2.4 Gross commanded area (GCA), culturable commanded area (CCA), Intensity of Irrigation, Paleo, Kor, Crop Ratio, Crop period, Base period, Duty, Delta. Relation between Duty-Delta and Base period.
3. Hydrological Cycle Catchment Area and Run-off (06 Periods)
- Rainfall , definition rain-gauges – automatic and non-automatic, methods of estimating average rainfall, Advantages of keeping rainfall records, (Arithmetic system); catchment area, runoff, factors affecting runoff, hydrograph, basic concept of unit hydrograph.
4. Methods of Irrigation (06 Periods)
- 4.1 Flow irrigation - its advantages and limitations
- 4.2 Lift Irrigation – Tubewell, submersible and well irrigation advantages and disadvantages
- 4.3 Sprinkler irrigation conditions favourable and essential requirements for sprinkler irrigation, sprinkler system – classification and component parts
- 4.4 Drip irrigation, suitability of drip irrigation, layout, component parts, advantages
5. Canals (10 Periods)
- 5.1 Factors to be considered in Canal Alignment.
- 5.2 Functions/Purpose of various components of Canal.
- 5.3 Classification of Canals and their functions, sketches of different canal cross-sections
- 5.4 Various types of canal lining - their related advantages and disadvantages, sketches of different lined canal X-sections
- 5.5 Breaches – Causes, Method to plug canal breaches and their control
- 5.6 Maintenance of lined and unlined canals
6. Tubewell Irrigation (09 Periods)
- 6.1 Introduction, occurrence of ground water, location and command, advantages and disadvantages, comparison with canal irrigation
- 6.2 Tubewells, explanation of terms: water table, radius of influence, depression head, cone of depression, confined and unconfined aquifers. Yield of a well and methods of determining yield of well
- 6.3 Types of tubewells (cavity type, strainer type and slotted type) and their choice

- 6.4 Method of boring, installation of well assembly, development of well, pump selection and installation and maintenance
- 6.5 Water Harvesting Techniques: Need and requirement of various methods, Run-off from roof top and ground surface, construction of recharge pits and recharge wells and their maintenance.
7. Dams (08 Periods)
- 7.1 Classification of dams; earthen dams - types, causes of failure; cross-section of homogeneous, zoned and diaphragm type earthen dams, method of construction. Gravity dams – types, cross-sections of a dam, method of construction
- 7.2 Concept of small and micro dams
- 7.3 Concept of spillways and energy dissipators
8. Canal Head Works and Regulatory Works (06 Periods)
- Choice of location of Canal Head Works, definition, object, general layout, functions of different parts of head works. Difference between weir and barrage
9. Cross Drainage Works (05 Periods)
- 9.1 Functions and necessity Cross Drainage Works, Types of Cross Drainage Works: aqueduct, super passage, level crossing, inlet and outlet
- 9.2 Sketches of the above cross drainage works
10. Definitions of following Hydraulic Structures with Sketches (04 Periods)
- 10.1 Falls
- 10.2 Cross and head regulators
- 10.3 Outlets
- 10.4 Canal Escapes
11. River Training Works (04 Periods)
- Various River Stages, Purpose/functions of River Training works, Meandering of rivers, Methods of river training, guide banks, Marginal Embankment, retired (levees) embankments, groynes and spurs, pitched island, cut-off
12. Water Logging and Drainage and Ground Water Re-charge (03 Periods)
- 12.1 Definition of water logging – its causes and ill effects, detection, prevention and remedies
- 12.2 Surface and sub-surface drains and their layout

12.3 Concept and various techniques used for ground water re-charge

INSTRUCTIONAL STRATEGY

The teaching of the subject should be supplemented by field visits at regular intervals of time to expose the students to irrigation works. Students should be asked to prepare and interpret drawings of various irrigation works.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Irrigation Engineering and Hydraulics Structures by Garg, Santosh Kumar; Khanna Publishers, Delhi,
2. Irrigation and Water Power Engineering by Punmia, BC and Pande Brij Bansi Lal; Standard Publishers Distributors, Delhi
3. Irrigation Engineering and Hydraulic Structures by Saharsabudhe SR
4. BIS Codes
5. Central Ground Water Board and Central Water Commission Guidelines and Reference Books.
6. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	04
2	06	08
3	06	08
4	06	08
5	10	16
6	09	12
7	08	12
8	06	08
9	05	08
10	04	06
11	04	06
12	03	04
Total	70	100

4.4 SURVEYING - I

L T P
4 - 8

RATIONALE

The important functions of a diploma civil engineer includes the jobs of detailed surveying, plotting of survey data, preparation of survey maps and setting out works

While framing the curriculum for the subject of surveying, stress has been given to the development of the skill in each type of survey like chain surveying, compass surveying leveling, that the Civil Engineering diploma holder will normally be called upon to perform and plane table surveying,

Field work should be a selected one so that student can check his work and have an idea of the results the extent of error in the work done by him. As far as possible, the surveys done should be got plotted, as this will also reveal errors in the work and develop skill in plotting.

LEARNING OUTCOMES

After undergoing the subject, the student will be able to:

- Measure a long line with chain or tape
- Prepare maps for closed traverse and open traverse with survey instruments
- Measure bearing of line
- Perform leveling with digital level
- Find difference of level between two points with dumpy level, auto level and digital level
- Perform temporary adjustments of leveling instruments

DETAILED CONTENTS

- | | | |
|----|---|--------------|
| 1. | Introduction | (05 Periods) |
| | 1.1 Basic principles of surveying | |
| | 1.2 Concept and purpose of surveying, measurements-linear and angular, units of measurements | |
| | 1.3 Instruments used for taking these measurements, classification based on surveying instruments | |
| 2. | Chain surveying | (06 Periods) |
| | 2.1 Purpose and principles of Chain Surveying | |
| | 2.2 Introduction, advantages and disadvantages | |

- 2.3 Direct and indirect ranging, offsets and recording of field notes
- 2.4 Obstacles in Chain Surveying
- 2.5 Errors in Chain Surveying and their correction.
3. Compass surveying (11 Periods)
- 3.1 Purpose of compass surveying. Use of prismatic compass: Setting and taking observations
- 3.2 Concept of following with simple numerical problems:
- a) Meridian - Magnetic and true, Arbitrary
 - b) Bearing - Magnetic, True and Arbitrary
 - c) Whole circle bearing and reduced bearing
 - d) Fore and back bearing
 - e) Magnetic dip and declination
- 3.3 Local attraction - causes, detection, errors and corrections, problems on local attraction, magnetic declination and calculation of included angles in a compass traverse (Simple Numerical Problems)
4. Levelling (17 Periods)
- 4.1 Purpose of levelling, concept of a level surface, horizontal surface, vertical surface, datum, reduced level and bench marks
- 4.2 Identification of various parts of Dumpy level and use of Dumpy level, Engineer' level, Auto level: advantages and disadvantages, use of auto level.
- 4.3 Concepts of line of collimation, axis of the bubble tube, axis of the telescope and vertical axis
- 4.4 Levelling staff: single piece, folding, invar precision staff, telescopic
- 4.5 Temporary adjustment and permanent adjustment of dumpy level by two peg method.
- 4.6 Concept of back sight, foresight, intermediate sight, change point, to determine reduce levels
- 4.7 Level book and reduction of levels by
- 4.7.1 Height of collimation method and
 - 4.7.2 Rise and fall method
- 4.8 Arithmetic checks, problem on reduction of levels, fly levelling, check leveling and profile levelling (L-section and X-section), errors in levelling, permissible limits, reciprocal leveling. Numerical problems.
5. Plane Table Surveying (17 Periods)
- 5.1 Purpose of plane table surveying, equipment used in plane table survey:
- 5.2 Setting of a plane table:
- (a) Centering
 - (b) Levelling

- (c) Orientation

5.3 Methods of plane table surveying

- (a) Radiation,
- (b) Intersection
- (c) Traversing
- (d) Resection

5.4 Concept of Two point and Three point problems (Concept only)

5.5 Errors in plane table survey and precautions to control them. Testing and adjustment of plane table and alidade

PRACTICAL EXERCISES

I. Chain surveying

- i)
 - a) Ranging a line
 - b) Chaining a line and recording in the field book
 - c) Taking offsets - perpendicular and oblique (with a tape only)
 - d) Setting out right angle with a tape
- ii) Chaining of a line involving reciprocal ranging
- iii) Chaining a line involving obstacles to ranging
- iv) Chain Survey of a small area.

III. Compass Surveying

- i)
 - a) Study of prismatic compass
 - b) Setting the compass and taking observations
 - c) Measuring angles between the lines meeting at a point

III. Levelling

- i)
 - a) Study of dumpy level and levelling staff
 - b) Temporary adjustments of various levels
 - c) Taking staff readings on different stations from the single setting and finding differences of level between them
- ii)
 - a) To find out difference of level between two distant points by shifting the instrument
- iii) Longitudinal and cross sectioning of a road/railway/canal
- iv) Setting a gradient by dumpy and auto-level

IV. Plane Table Surveying

- i)
 - a) Study of the plane table survey equipment
 - b) Setting the plane table
 - c) Marking the North direction
 - d) Plotting a few points by radiation method
- ii)
 - a) Orientation by
 - Trough compass
 - Back sighting
 - b) Plotting few points by intersection, radiation and resection method
- iii) Traversing an area with a plane table (at least five lines)

V. Layout of Buildings (from given drawing of two room residential building) by use of surveying instruments.

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students. Technical visit to Survey of India, Northern Region and Great Trigonometrical Survey(GTS), Dehradun.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests,
- Mid-term and end-term written tests
- Actual Practical Performance
- Viva-Voce

RECOMMENDED BOOKS

1. A Text Book of Surveying by Kochar, CL; Katson Publishing House, Ludhiana,
2. Surveying and Leveling by Kanetkar, TP and Kulkarni, SV; AVG Parkashan, Poona
3. Surveying –I by Mahajan, Sanjay; Tech. Publication, Delhi
4. Surveying and Leveling by Punmia, BC; Standard Publishers Distributors, Delhi.
5. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

Websites for Reference

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	05	10
2	06	10
3	11	20
4	17	30
5	17	30
Total	56	100

4.5 REINFORCED CEMENT CONCRETE STRUCTURES

L T P
6 - -

RATIONALE

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

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain methods of RCC design i.e.
 - Working stress methods
 - Limit state methods
- Design singly, doubly reinforced rectangular and T&L beams as per IS Code
- Design one way and two way slab
- Design axially loaded column and their isolated footing

DETAILED CONTENTS

- | | | |
|----|--|---------------|
| 1. | Introduction | (03 Periods) |
| | 1.1 Concept of Reinforced Cement Concrete (RCC) | |
| | 1.2 Reinforcement Materials: <ul style="list-style-type: none"> - Suitability of steel as reinforcing material - Properties of mild steel, HYSD steel and TMT bars | |
| | 1.3. Loading on structures as per IS: 875 | |
| 2. | Introduction to following methods of RCC design | (04 Periods) |
| | 2.1 Working stress method: Definition and basic assumptions | |
| | 2.2 Limit state method: Definition and basic assumptions | |
| | 2.3 Problems of singly, doubly and T beam analysis by working stress method | |
| 3. | Shear and Development Length | (06 Periods) |
| | Shear as per IS: 456-2000 by working stress method <ul style="list-style-type: none"> i) Shear strength of concrete without shear reinforcement ii) Maximum shear stress iii) Shear reinforcement | |
| 4. | Concept of Limit State Method | (08 Periods) |

- 4.1. Definitions and assumptions made in limit state of collapse (flexure)
- 4.2. Partial factor of safety for materials
- 4.3. Partial factor of safety for loads
- 4.4. Design loads
- 4.5. Stress block, parameters

5. Singly Reinforced beam (10 Periods)
Theory and design of singly reinforced beam by Limit State Method

6. Doubly Reinforced Beams (10 Periods)
Theory and design of simply supported doubly reinforced rectangular beam by Limit State Method

7. Behavior of T beam, inverted T beam, isolated T beam and 'L' beams. Simple problems related to moment capacity. (07 Periods)

8. One Way Slab (11 Periods)
Theory and design of simply supported one way slab including sketches showing reinforcement details (plan and section) by Limit State Method..

9. Two Way Slab (11 Periods)
Theory and design of two-way simply supported slab with corners free to lift, no provisions for torsional reinforcement by Limit State Method including sketches showing reinforcement details (plan and two sections)

10. Axially Loaded Column (09 Periods)
 - 10.1 Definition and classification of columns
 - 10.2 Effective length of column,
 - 10.3 Specifications for longitudinal and lateral reinforcement
 - 10.4 Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement(sectional elevation and plan)

11. Pre-stressed Concrete (05 periods)
 - 11.1 Concept of pre-stressed concrete
 - 11.2 Methods of pre-stressing: pre-tensioning and post-tensioning
 - 11.3 Advantages and disadvantages of pre-stressing

11.4 Losses in pre-stress

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

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various RCC structural members. For creating comprehension of the subject, teachers may prepare tutorial sheets, which may be given to the students for solving. It would be advantageous if students are taken at construction site to show form work for RCC as well as placement of reinforcement in various structural members. Commentary on BIS:456 may be referred along with code for relevant clauses.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

Websites for Reference:

<http://swayam.gov.in>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	03	03
2	04	05
3	06	07
4	08	10
5	10	12
6	10	12
7	07	10
8	11	12
9	11	12
10	09	10
11	05	07
Total	84	100

4.6 ENERGY CONSERVATION

L T P
3 - 2

RATIONALE

The requirement of energy has increased manifolds in last two decades due to rapid urbanization and growth in industrial/service sector. It has become challenging task to meet ever increasing energy demands with limited conventional fuels and natural resources. Due to fast depletion of fossil fuels and a tremendous gap between supply and demand of energy, it is essential to adopt energy conservation techniques in almost every field like industries, commercial and residential sectors etc. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This course covers the concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in general industry and details out energy audit methodology and energy audit instruments.

LEARNING OUTCOMES

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

- define principles and objectives of energy management and energy audit.
- understand Energy Conservation Act 2001 and its features.
- understand various forms & elements of energy.
- identify electrical and thermal utilities. Understand their basic principle of operation and assess performance of various equipments.
- identify areas of energy conservation and adopt conservation methods in various systems.
- evaluate the techno economic feasibility of the energy conservation technique adopted.

DETAILED CONTENTS

1. Basics of Energy
 - 1.1 Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy, Capacity factor of solar and wind power generators.
 - 1.2 Global fuel reserve
 - 1.3 Energy scenario in India and state of U.P. Sector-wise energy consumption (domestic, industrial, agricultural and other sectors)
 - 1.4 Impact of energy usage on climate

2. Energy Conservation and EC Act 2001

- 2.1 Introduction to energy management, energy conservation, energy efficiency and its need
 - 2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.
 - 2.3 Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating
3. Electrical Supply System and Motors
 - 3.1 Types of electrical supply system
 - 3.2 Single line diagram
 - 3.3 Losses in electrical power distribution system
 - 3.4 Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)
 - 3.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers
 - 3.6 Electric Motors
Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors
4. Energy Efficiency in Electrical Utilities
 - 4.1 Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps
 - 4.2 Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.
 - 4.3 Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.
5. Lighting and DG Systems
 - 5.1 Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting
 - 5.2 DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation
6. Energy Efficiency in Thermal Utilities

- 6.1 Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)
 - 6.2 Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces
 - 6.3 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers
 - 6.4 Efficient Steam Utilization
- 7. Energy Conservation Building Code (ECBC)
 - 7.1 ECBC and its salient features
 - 7.2 Tips for energy savings in buildings: New Buildings, Existing Buildings
- 8. Waste Heat Recovery and Co-Generation
 - 8.1 Concept, classification and benefits of waste heat recovery
 - 8.2 Concept and types of co-generation system
- 9. General Energy Saving Tips

Energy saving tips in:

 - 9.1 Lighting
 - 9.2 Room Air Conditioner
 - 9.3 Refrigerator
 - 9.4 Water Heater
 - 9.5 Computer
 - 9.6 Fan, Heater, Blower and Washing Machine
 - 9.7 Colour Television
 - 9.8 Water Pump
 - 9.9 Cooking
 - 9.10 Transport
- 10. Energy Audit
 - 10.1 Types and methodology
 - 10.2 Energy audit instruments
 - 10.3 Energy auditing reporting format

PRACTICAL EXERCISES

- 1. To conduct load survey and power consumption calculations of small building.

2. To check efficacy of different lamps by measuring power consumption and lumens using lux meter.
3. To measure energy efficiency ratio (EER) of an air conditioner.
4. To measure effect of valve throttling and variable frequency drive (VFD) on energy consumption by centrifugal pump.
5. To measure and calculate energy saving by arresting air leakages in compressor.
6. To measure the effect of blower speed on energy consumed by it.

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

- Presentations of Case Studies
- Debate competitions
- Poster competitions
- Industrial visits
- Visual Aids

INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable stress on understanding the basic concepts in energy conservation, principles and their applications. For this purpose, teachers are expected to give simple problems in the class room so as to develop necessary knowledge for comprehending the basic concepts and principles. As far as possible, the teaching of the subject must be supplemented by demonstrations and practical work in the laboratory. Visits to industries must be carried out. Expert from industry must be invited to deliver talks on energy conservation to students and faculty.

RECOMMENDED BOOKS

1. Guide book on General Aspects of Energy Management and Energy Audit by Bureau of Energy Efficiency, Government of India. Edition 2015
2. Guide book on Energy Efficiency in Electrical Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
3. Guide book on Energy Efficiency in Thermal Utilities, by Bureau of Energy Efficiency, Government of India. Edition 2015
4. Handbook on Energy Audit & Environmental Management by Y P Abbi & Shashank Jain published by TERI. Latest Edition

Important Links:

- (i) Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India.
www.beeindia.gov.in
- (ii) Ministry of New and Renewable Energy (MNRE), Government of India.
www.mnre.gov.in

- (iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.
- (iv) **Central Pollution Control Board (CPCB)**, Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.
- (v) **Energy Efficiency Services Limited (EESL)**. www.eeslindia.org.
- (vi) Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

4.7 REINFORCED CEMENT CONCRETE (RCC) DRAWING

L T P
- - 4

RATIONALE

Diploma holders in Civil Engineering are required to supervise the construction of RC structures. Thus one should be able to read and interpret drawings of RC structures. The competence to read and interpret structural drawings is best learnt by being able to draw these drawings. Hence there is a need to have a subject devoted to preparation of structural drawings.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Draw the reinforcement details for various structural elements from the given data
- Calculate reinforcement details from the given drawings
- Draw bar bending schedule from drawing
- Read and interpret R.C.C. drawings

DETAILED CONTENTS

1. RC Drawing:

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

- (i) General instruction and rules, Drawing 1- lap, joint, development drawing: length, rings, hook etc.
- (ii) Drawing No. 2: RC Slabs - One way slab, Two way slab and Cantilever Slab.
- (iii) Drawing No.3: Beams - Singly and doubly reinforced rectangular beams and Cantilever beam (All beams with vertical stirrups), T Beam, Tapered Beam.
- (iv) Drawing No.4: Columns and Footings – Square, Rectangular and Circular Columns with lateral ties and their isolated sloped column footings, column and beam junction
- (v) Drawing No. 5: Portal Frame – Three bay two storey RC portal frame with blow up of column beam junctions.
- (vi) Drawing of cantilever retaining wall showing details of all the members and reinforcement.
- (vii) Drawing of Intze type water tank showing details of all the members and reinforcement.
- (viii) Drawing No. 6 : Draw at least one sheet using AutoCAD software

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Software installation and operation
- Drawing sheets
- Report writing
- Viva-voce

RECOMMENDED BOOKS

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

Websites for Reference:

<http://swayam.gov.in>

INDUSTRIAL TRAINING

It is needless to emphasize further the importance of Industrial Training of students during their 3 years of studies at Polytechnics. It is industrial training, which provides an opportunity to students to experience the environment and culture of industrial production units and commercial activities undertaken in field organizations. It prepares student for their future role as diploma engineers in the world of work and enables them to integrate theory with practice. Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

This document includes guided and supervised industrial training of 4 weeks duration to be organised during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

Equally important with the guidance is supervision of students training in the industry/organization by the teachers. Students should be encouraged to write daily report in their diary to enable them to write final report and its presentation later on.

An external assessment of 50 marks has been provided in the study and evaluation scheme of 5th Semester. Evaluation of professional industrial training report through viva-voce/presentation aims at assessing students understanding of materials, industrial process, practices in industry/field organization and their ability to engage in activities related to problem solving in industrial setup as well as understanding of application of knowledge and skills learnt in real life situations.

Teachers and students are requested to see the footnote below the study and evaluation scheme of 4th semester for further details.

The teacher along with field supervisors will conduct performance assessment of students. The components of evaluation will include the following:

a) Punctuality and regularity	15%
b) Initiative in learning new things	15%
c) Presentation and Viva	15%
d) Industrial training report	55%