

**Curriculum for  
Diploma  
Programme in**

**CIVIL AND ENVIRONMENTAL ENGINEERING**

**For the State of  
Uttar Pradesh**



**Complied by:  
Institute of Research Development and Training,  
Uttar Pradesh, Kanpur**

**APPROVED AND IMPLEMENTED BY:**

**BOARD OF TECHNICAL  
EDUCATION,LUCKNOW**

## CONTENTS

Sr. No	Particulars	Page No.
-	Preface	5
-	Acknowledgement	6
1.	Salient Features of the Diploma Programme	7
2.	Employment Opportunities	8
3.	Learning Outcomes of the Programme	9
4.	Deriving Curriculum Areas from Learning Outcomes of the Programme	11
5.	Abstract of Curriculum Areas	14
6.	Horizontal and Vertical Organization of the Subjects	16
7.	Study and Evaluation Scheme	17
8.	Guidelines (for Assessment of Student-Centered Activities and Internal Assessment)	23
9.	Detailed Contents of various Subjects	24-188
10.	Resource Requirement	189
11.	Evaluation Strategy	206
12.	Recommendations for Effective Implementation of Curriculum	209
13.	List of Participants	212

## FIRST SEMESTER

1.1	Communication Skills-I	24
1.2	Applied Mathematics - I	27
1.3	Applied Physics – I	30
1.4	Applied Chemistry	36
1.5	Engineering Drawing-I	41
1.6	Construction Materials	45
1.7	General Workshop Practice - I	50

## SECOND SEMESTER

2.1	Applied Mathematics - II	54
2.2	Computer Aided Drawing	56
2.3	Applied Mechanics	58
2.4	Basics of Mechanical and Electrical Engineering	62
2.5	Basics of Information Technology	68
2.6	General Workshop Practice -II	74

## THIRD SEMESTER

3.1	Hydraulics and Hydraulic Machines	77
3.2	Concrete Technology	82
3.3	Environmental Studies	88
3.4	Structural Mechanics	91
3.5	Building Construction	95
3.6	Building Drawings	102

## FOURTH SEMESTER

4.1	Communication Skill-II	105
4.2	Highway Engineering	108
4.3	Irrigation Engineering	114
4.4	Surveying - I	119
4.5	Reinforced Cement Concrete Structures (RCC Structures)	125

4.6	Energy Conservation	129
4.7	RCC Drawing	134
4.8	Industrial Training	136

#### **FIFTH SEMESTER**

5.1	Water and Waste Water Engineering	137
5.2	Railways, Bridges and Tunnels	142
5.3	Solid Waste Management	146
5.4	Soil Mechanics and Foundation Engineering	148
5.5	Surveying-II	155
5.6	Waste Water and Irrigation Engineering Drawing	159
5.7	Universal Human Values	162

#### **SIXTH SEMESTER**

-	Survey Camp	166
6.1	Quantity Surveying and Valuation	167
6.2	Construction Management, Accounts and Entrepreneurship Development	171
6.3	Design of Steel Structure	176
6.4	Steel Structure Drawing	179
6.5	Software Application in Civil Engineering	181
6.6	Environmental Management	182
6.7	Project Work	185

## PREFACE

An important issue generally debated amongst the planners and educator's 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 have 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.

## ACKNOWLEDGEMENTS

We gratefully acknowledge the guidance and contribution received from the following persons:

1. Sh. Alok Kumar-III, IAS, Secretary, Technical Education Department, U.P. Govt.
2. Sh. Sunil Kumar Chaudhary, Special Secretary, Technical Education Department, U.P. Govt.
3. Sh. Manoj Kumar, Director, Technical Education, UP & I.R.D.T., Kanpur, for taking keen interest in the review of this curriculum.
4. Secretary, Board of Technical Education, UP for initiating this project of review of curriculum.
5. All the participants from industry/field organizations, engineering colleges, polytechnics and other technical institutions for their professional inputs during curriculum workshops.
6. Faculty/Subject Experts from U.P. Government polytechnics and BBDEC, Lucknow

Coordinator  
Institute of Research Development & Training,  
Kanpur, U.P.

**1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN CIVIL AND ENVIRONMENTAL ENGINEERING**

- 1) Name of the Programme : Diploma Programme in Civil and Environmental 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 Centered Activities:  
A provision of 3-6 hrs. per week has been made for organizing Student Centered 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 AND ENVIRONMENTAL ENGINEERING

**Keeping in view, the present scenario of activities in the field of Civil and Environmental Engineering, following employment opportunities are visualized for diploma holders in Civil and Environmental 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 AND ENVIRONMENTAL ENGINEERING

At the end of the programme, a diploma holder in Civil and Environmental 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.	computer application software Prepare computerized reports, presentations using IT tools and
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 our testing of construction materials including ecofriendly 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 software's in the field of Civil & Environment Engineering
22.	Supervise constructional aspects pertaining to railways, bridges and tunnels
23.	Analyses, use and treat various types of soils for foundation purpose
24.	Plan and execute given task/projects as a team member/ leader
25.	Analyses 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 Engineering.
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 totalstation, remote sensing, GIS and GPS.	– Quantity Surveying and Valuation
9.	Select, Use and carry our 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.	Analyses 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.	Analyses, 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.	Analyses 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.	Identify major sources of pollution and plan remedial measures for its control	– Environmental Management
29.	Prepare concept design for functional elements of the waste management systems.	– Solid Waste Management

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 Centered 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

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



## 7. STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN CIVIL AND ENVIRONMENTAL 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
<b>Total</b>		<b>22</b>	<b>-</b>	<b>26</b>	<b>26</b>	<b>140</b>	<b>110</b>	<b>250</b>	<b>310</b>	<b>-</b>	<b>140</b>	<b>-</b>	<b>450</b>	<b>700</b>

\* Common with other diploma programmes

# Student centered 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

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	
<b>Total</b>		<b>16</b>	<b>-</b>	<b>32</b>	<b>22</b>	<b>60</b>	<b>170</b>	<b>230</b>	<b>150</b>	<b>-</b>	<b>220</b>	<b>-</b>	<b>370</b>	<b>600</b>	

\* Common with other diploma programmes

+ Common with diploma in Mechanical E Engineering and Chemical Engineering.

# Student centered 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

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	
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

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	Reinforced Cement Concrete (RCC) Drawing	-	-	4	2	-	20	20	50	3	-	-	50	70
#Student Centred Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
<b>Total</b>		<b>28</b>	<b>-</b>	<b>20</b>	<b>30</b>	<b>120</b>	<b>90</b>	<b>210</b>	<b>350</b>	<b>-</b>	<b>80</b>	<b>-</b>	<b>430</b>	<b>640</b>

\* Common with other diploma programmes

- **4 weeks industrial training will be organized after 4<sup>th</sup> Semester exam. The evaluation of industrial training will be done in 5<sup>th</sup> semester.**

# Student centered 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

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	
-	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	Solid Waste Management	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
<b>Total</b>		<b>28</b>	<b>-</b>	<b>20</b>	<b>30</b>	<b>100</b>	<b>100</b>	<b>200</b>	<b>300</b>	<b>-</b>	<b>140</b>	<b>-</b>	<b>440</b>	<b>640</b>

# 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 5<sup>th</sup> semester exam.

SIXTH 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
-	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	Environmental Management	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
<b>Total</b>		<b>22</b>	<b>-</b>	<b>26</b>	<b>30</b>	<b>80</b>	<b>170</b>	<b>250</b>	<b>250</b>	<b>-</b>	<b>180</b>	<b>-</b>	<b>430</b>	<b>680</b>

# Student centered 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 subject

## 1.1 COMMUNICATION SKILLS – I

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:

- Understand the importance of effective communication
- Describe the process of communication
- Communicate effectively in different contexts
- Identify parts of speech
- Write correct sentences using appropriate vocabulary
- Reproduce and match words and sentences in a paragraph
- Write various types of paragraphs, notices for different purposes and composition on picture with appropriate format
- Read unseen texts with comprehension

### DETAILED CONTENTS

1	Basics of Communication	(13 periods)
1.1	Definition and process of communication	
1.2	Types of communication - formal and informal, oral and written, verbal and non-verbal	
1.3	Communications barriers and how to overcome them	
1.4	Barriers to Communication, Tools of Communication	
2	Application of Grammar	(18 periods)
2.1	Parts of Speech (Noun, verb, adjective, adverb) and modals	
2.2	Sentences and its types	
2.3	Tenses	
2.4	Active and Passive Voice	
2.5	Punctuation	
2.6	Direct and Indirect Speech	

3 Reading Skill (10 periods)

Unseen passage for comprehension (one word substitution, prefixes, suffixes, antonyms, synonyms etc. based upon the passage to be covered under this topic)

4 Writing Skill (15 periods)

4.1 Picture composition

4.2 Writing paragraph

4.3 Notice 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.

### **Listening and Speaking Exercises**

1. Self and peer introduction
2. Newspaper reading
3. Just a minute session-Extempore
4. Greeting and starting a conversation
5. Leave taking
6. Thanking
7. Wishing well
8. Talking about likes and dislikes
9. Group Discussion
10. Listening Exercises.

### **INSTRUCTIONAL STRATEGY**

Student should be encouraged to participate in role play and other student centred activities in class room 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 Revathi Srinivas; 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. Excellent General English-R.B.Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra
5. The Functional aspects of Communication Skills – Dr. P. Prasad, S.K. Katria & Sons, New Delhi
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR.

**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**

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	13	24
2	18	32
3	10	16
4	15	28
<b>Total</b>	<b>56</b>	<b>100</b>

## 1.2 APPLIED MATHEMATICS - I

L T P  
5 - -

### RATIONALE

Contents of this course provide fundamental base for understanding elementary mathematics and their uses in solving engineering problems. Contents of this course will enable students to use basic mathematical function like logarithms, partial fractions, matrices and basic 2D, curves in solving various engineering problems of all fields.

### LEARNING OUTCOMES

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

- Apply Binomial theorem to solve engineering problems
- Apply determinants properties and Cramer's rule to solve engineering problems
- Apply dot & cross product of vectors to find the solution of engineering problems
- Use complex numbers in various engineering problems
- Apply differential calculus and higher order to solve engineering problems
- Find velocity, acceleration, errors and approximation in engineering problems with application of derivatives.

### DETAILED CONTENTS

1. Algebra -I (12 Periods)
  - 1.1 Series: AP and GP; Sum, nth term, Mean
  - 1.2 Binomial theorem for positive, negative and fractional index (without proof).  
Application of Binomial theorem.
  - 1.3 Determinants: Elementary properties of determinant of order 2 and 3, Multiplication system of algebraic equation, Consistency of equation, Cramer's rule
2. Algebra- II (12 Periods )
  - 2.1 Vector algebra: Dot and Cross product, Scaler and vector triple product.
  - 2.2 Complex number.  
Complex numbers, Representation, Modulus and amplitude Demoivre theorem, its application in solving algebraic equations, Mod. function and its properties.
3. Trigonometry (10 Periods )

- 3.1 Relation between sides and angles of a triangle: Statement of various formulae showing relationship between sides and angle of a triangle.
  - 3.2 Inverse circular functions: Simple case only
4. Differential Calculus - I (18 Periods)
- 4.1 Functions, limits, continuity, - functions and their graphs, range and domain, elementary methods of finding limits (right and left), elementary test for continuity and differentiability.
  - 4.2 Methods of finding derivative, Trigonometric functions, exponential function, Function of a function, Logarithmic differentiation, Differentiation of Inverse trigonometric function, Differentiation of implicit functions.
5. Differential Calculus - II (18 Periods)
- 5.1 Higher order derivatives, Leibnitz theorem (without proof). Simple applications.
  - 5.2 Application - Finding Tangents, Normal, Points of Maxima/Minima, Increasing/Decreasing functions, Rate, Measure, velocity, Acceleration, Errors and approximation.

### **INSTRUCTIONAL STRATEGY**

The basic instructional strategy to teach basic mathematics, Binomial theorem, trigonometry, differential equations etc. should be conceptual with real world applications of relevant branch. More numerical and theory examples can be used for clear understanding of the content.

### **MEANS OF ASSESSMENT**

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

### **RECOMMENDED BOOKS**

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
- 3 Applied Mathematics-I by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-I (A) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topic</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1.	12	20
2.	12	20
3.	10	12
4	18	24
5	18	24
<b>Total</b>	<b>70</b>	<b>100</b>

## 1.3 APPLIED PHYSICS – I

L T P  
5 - 2

### RATIONALE

Applied physics includes the study of a diversified topics related to the world around us. It aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete knowledge of physical laws, analysis and applications in various fields of engineering and technology are given prominence in this course content.

**Note: Teachers should give examples of engineering/technology applications of various concepts and principles in each topic so that students are able to learn and appreciate these concepts and principles. In all contents, SI units should be followed.**

### LEARNING OUTCOMES

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

- Identify the use of S.I. system of measurement with accuracy and how it is used in engineering
- Represent physical quantities as scalars and vectors, applying the physical laws and concepts of linear and circular motion in everyday life.
- Solve difficult problems (walking of man, horse and cart problem, flying of bird/ aircraft, etc.)
- Analyses and design banking of roads/railway tracks and apply conservation of momentum principle to Explain rocket propulsion, recoil of gun etc.
- Derive work, power and energy relationship and solve problems about work and power.
- Define work, energy and power and their units.
- Describe conservation of energy and its applications
- Understand the concept of rotational motion of a rigid body and its applications
- Apply the physical laws and concepts of gravity, its variation with longitude and latitude and its uses in space satellite etc.
- Understand the concept of elasticity, surface tension, pressure and the laws governing movement of fluids.
- Express physical work in term of heat and temperature; Measure temperature in various processes on different scales (Celsius, Kelvin, Fahrenheit etc.)
- Distinguish between conduction, convection and radiation, identify the different methods for reducing heat losses
- Understand the laws of thermodynamics, Carnot cycle and their applications.

## DETAILED CONTENTS

1. Units and Dimensions (10 Periods)
  - 1.1 Need of Measurement in engineering and science, unit of a physical quantities - fundamental and derived units, systems of units (FPS, CGS and SI units)
  - 1.2 Dimensions and dimensional formulae of physical quantities.
  - 1.3 Principle of homogeneity of dimensions
  - 1.4 Dimensional equations and their applications, conversion of numerical values of physical quantities from one system of units into another, checking the correctness of physical equations and deriving relations among various physical quantities
  - 1.5 Limitations of dimensional analysis
  - 1.6 Error in measurement, accuracy and precision of instruments, random and systematic errors, absolute error, relative error, and percentage error, Estimation of probable errors in the results of measurement (combination of errors in addition, subtraction, multiplication, division and powers), rules for representing significant figures in calculation.
  - 1.7 Application of units and dimensions in measuring length, diameter, circumference, volume, surface area etc. of metallic and nonmetallic blocks, wires, pipes etc (at least two each).
  
2. Force and Motion (10 periods)
  - 2.1 Scalar and vector quantities – examples, representation of vector, types of vectors
  - 2.2 Addition and Subtraction of Vectors, Triangle and Parallelogram law (Statement only), Scalar and Vector Product.
  - 2.3 Resolution of Vectors and its application to lawn roller.
  - 2.4 Force, Momentum, Statement and Derivation of Conservation of linear momentum, its applications such as recoil of gun.
  - 2.5 Impulse and its Applications
  - 2.6 Circular motion (Uniform and Non-uniform), definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
  - 2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (related numerical)
  - 2.8 Central force, Expression and Applications of Centripetal and centrifugal forces with examples such as banking of roads and bending of cyclist, Principle of centrifuge.
  - 2.9 Application of various forces in lifts, cranes, large steam engines and turbines

3. Work, Power and Energy (10 periods)
- 3.1 Work: and its units, examples of zero work, positive work and negative work, conservative and non-conservative force,
  - 3.2 Friction: modern concept, types, laws of limiting friction, Coefficient of friction and its Engineering Applications.
  - 3.3 Work done in moving an object on horizontal and inclined plane for rough and plane surfaces with its applications
  - 3.4 Energy and its units: Kinetic energy and potential energy with examples and their derivation, work energy theorem.
  - 3.5 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
  - 3.6 Power and its units, calculation of power in numerical problems
  - 3.7 Application of Friction in brake system of moving vehicles, bicycle, scooter, car trains etc.
- 4 Rotational Motion (10 periods)
- 4.1 Concept of translatory and rotatory motions with examples
  - 4.2 Definition of torque with examples
  - 4.3 Angular momentum, Conservation of angular momentum (quantitative) and its examples
  - 4.4 Moment of inertia and its physical significance, radius of gyration for rigid body, Theorems of parallel and perpendicular axes (statements only), Moment of inertia of rod, disc, ring and sphere (hollow and solid) (Formulae only). Concept of Fly wheel.
  - 4.5 Rotational kinetic energy, Rolling of sphere on the slant plane,
  - 4.6 Comparison of linear motion and rotational motion.
  - 4.7 Application of rotational motions in transport vehicles, and machines.
- 5 Motion of planets and satellites (08 periods)
- 5.1 Gravitational force, Kepler's law of planetary motion,
  - 5.2 Acceleration due gravity and its variation,
  - 5.3 Gravitational Potential and Gravitational potential energy,
  - 5.4 Motion of satellite, orbital velocity and time period of satellite, Total energy and Binding energy of a satellite, Escape energy and escape velocity,
  - 5.5 Types of satellites, Geo-stationary satellite, semi-synchronous, polar satellite (concept only) and their uses in science and technology,
  - 5.6 Concept of Black Holes
6. Properties of Matter (12 periods)
- 6.1 Elasticity: definition of stress and strain, different types of moduli of elasticity, Hooke's law, significance of stress strain curve

- 6.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer and its applications
  - 6.3 Surface tension: concept, its units, angle of contact, Capillary action and determination of surface tension from capillary rise method, applications of surface tension, effect of temperature and impurity on surface tension
  - 6.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law and effect of temperature on viscosity, application in hydraulic systems.
  - 6.5 Concept of fluid motion, stream line and turbulent flow, Reynold's number Equation of continuity, Bernoulli's Theorem and their applications.
7. Heat and Thermodynamics (10 periods)
- 7.1 Difference between heat and temperature
  - 7.2 Modes of transfer of heat (Conduction, convection and radiation with examples)
  - 7.3 Different scales of temperature and their relationship
  - 7.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
  - 7.5 Heat conduction in a metal rod, Temperature gradient, Concept of Co-efficient of thermal conductivity, Uses and effects of Heat conduction in Daily life.
  - 7.6 Isothermal and Adiabatic process
  - 7.7 Zeroth, First and second law of thermodynamics, Heat engine (concept Only), Carnot cycle.
  - 7.8 Application of various systems of thermometry in refrigeration and air-conditioning etc.

#### **LIST OF PRACTICALS (to perform minimum six experiments)**

- 1 To find radius of wire and its volume and the maximum permissible error in these quantities by using both vernier calipers and screw gauge.
- 2 To find the value of acceleration due to gravity on the surface of earth by using a simple pendulum.
- 3 To determine the Radius of curvature of (i) convex mirror, (ii) concave mirror by spherometer
- 4 To verify parallelogram law of forces
- 5 To study conservation of energy of a ball or cylinder rolling down an inclined plane.
- 6 To find the Moment of Inertia of a flywheel about its axis of rotation
- 7 To determine the atmospheric pressure at a place using Fortin's Barometer
- 8 To determine the viscosity of glycerin by Stoke's method
- 9 To determine the coefficient of linear expansion of a metal rod
- 10 To determine force constant of spring using Hooks law

#### **INSTRUCTIONAL STRATEGY**

Teacher may use various teaching aids like live models, charts, graphs and experimental kits etc. for imparting effective instructions in the subject. The teacher should explain about field applications before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration and animations can make the subject interesting and may

develop scientific temper in the students. Teacher must plan a tour of Science Park/planetarium available in nearby areas in order to enhance the interest in this course.

### **MEANS OF ASSEMENTS**

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva Voce

### **RECOMMENDED BOOKS**

- 1 Text Book of Physics for Class XI (Part-I, Part-II); N.C.E.R.T., Delhi
- 2 Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi
- 3 Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
- 4 B.Sc. Practical Physics by C L Arora, S. Chand Publication..
- 5 Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi
- 6 Engineering Physics by DK Bhattacharya & Poonam Tandan; Oxford University Press, New Delhi
- 7 Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
- 8 V. Rajendran, physics-I, Tata McGraw-Hill raw Hill publication, New Delhi
- 9 Arthur Beiser, Applied Physics, Tata McGraw-Hill raw Hill publication, New Delhi
- 10 Physics Volume 1, 5<sup>th</sup> edition, Halliday Resnick and Krane, Wiley publication

### TOPIC WISE DISTRIBUTION OF PERIODS AND MARKS

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	10	15
2	10	15
3	10	15
4	10	15
5	08	10
6	12	16
7	10	14
<b>Total</b>	<b>70</b>	<b>100</b>

## 1.4 APPLIED CHEMISTRY

L T P  
5 - 2

### RATIONALE

The use of various chemicals and chemical products in diverse technical and engineering fields have repeatedly proved the importance of Applied Chemistry, which enhances its role to a new peak. On the other hand, ever increasing use of such materials will compel engineers, technocrats to acquire essential applied chemistry knowledge in order to select engineering materials, which not only suit them but also provide more environmental compatibility. This situation demands principles of Applied Chemistry in diploma- engineering courses. Principles of Applied Chemistry will enable budding engineers and technocrats to develop scientific temper and appreciate physical, chemical and engineering properties of materials. Hence the subject of Applied Chemistry.

### LEARNING OUTCOMES

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

- Classify various substances based on state of aggregation
- Substantiate the laws and principles on which structure of atom is established.
- Explain and predict properties of substances.
- Explain sources of water and various characteristics of water (quantitatively).
- Explain cause and factors which can adversely affecting natural water quality and remedial measures available for water purification
- Think critically, develop and adapt water conservation techniques.
- Explain corrosion of metal and their preventive measures.
- explain chemical nature and causes of corrosion
- apply correct and efficient methods of corrosion prevention.
- explain chemistry of fuels and their relative advantages.
- select most efficient fuel for the engine and engineering applications.
- suggest how to subside air pollution caused by the use of fossil fuels
- explain the chemistry of various polymers and plastics
- verify suitability and select polymer/rubber/plastic materials for engineering applications.

### DETAILED CONTENTS

1. Atomic Structure, Periodic Table and Chemical Bonding (14 periods)
  - 1.1 Fundamental particles- mass and charges of electrons, protons and neutrons with names of the scientists who discovered these fundamental particles.
  - 1.2 Bohr's model of atom and successes and limitations of atomic theory (qualitative treatment only).
  - 1.3 Atomic number, atomic mass number isotopes and isobars.

- 1.4 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,
- 1.5 Aufbau's principle, Pauli's exclusion principle and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded).
- 1.6 Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d and f blocks (periodicity in properties - excluded)
- 1.7 Chemical bonding and cause of bonding and types such as ionic bond in NaCl sigma ( $\sigma$ ) and pi ( $\pi$ ) covalent bonds in H<sub>2</sub>, HCl, Cl<sub>2</sub>, elementary idea of hybridization in BeCl<sub>2</sub>, BF<sub>3</sub>, CH<sub>4</sub>, NH<sub>3</sub> and H<sub>2</sub>O, VSEPR, Molecular orbital Theory
- 1.8 States of Matter: Solid, Liquid & Gas, Metallic bonding- explanation with the help of electron gas (sea) model.

2. Fuels and Lubricants (18 periods)

- 2.1 Definition of fuel, classification of fuels, characteristics of good fuel, relative merits of gaseous, liquid and solid fuels
- 2.2 Calorific value-higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.
- 2.3 Coal - types of coal and proximate analysis of coal
- 2.4 Fuel rating – Octane number and Cetane number, fuel-structural influence on Octane and Cetane numbers
- 2.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas.
- 2.6 Elementary ideal on – hydrogen as future fuels, nuclear fuels.
- 2.7 Lubricants: Definition and properties, mechanism, industrial application and its function in bearings.
- 2.8 Synthetic lubricants and cutting fluids.

3. Water (14 periods)

- 3.1 Demonstration of water resources on Earth using pie chart.
- 3.2 Classification of water – soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness – mg per liter (mgL<sup>-1</sup>) and part per million (ppm) and simple numerical, pH and buffer solutions and their applications.
- 3.3 Disadvantages caused by the use of hard water in domestic and boiler feed water. Priming and foaming and caustic embrittlement in boilers.
- 3.4 Removal of hardness -Permutit process and Ion-exchange process.
- 3.5 Physio-Chemical methods for Water Quality Testing
  - a) Determination of pH using pH meter, total dissolved solids (TDS)
  - b) Testing and Estimation of- alkalinity, indicator their types and application total hardness by EDTA method and O'Hener's Method. (chemical reaction of EDTA method are excluded).
  - c) Understanding of Indian Water Quality standards as per WHO
- 3.6 Natural water sterilization by chlorine and UV radiation and reverse osmosis.
- 3.7 Municipality waste water treatment. Definition of B.O.D and C.O.D.

4. Electrochemistry (4 periods)  
Redox Reaction, Electrode Potential, Nernst equation, Electrochemical cell (Galvanic and Electro bytes); Nernst equation.
5. Corrosion and its Control (10 periods)
- 5.1 Definition of corrosion and factors affecting corrosion rate.
  - 5.2 Theories of
    - a) Dry (chemical) corrosion- Pilling Bedworth rule
    - b) Wet corrosion in acidic atmosphere by hydrogen evolution mechanism
  - 5.3 Definition of passivity and galvanic series
  - 5.4 Corrosion control:
    - a) Metal coatings – Cathodic protection, Cementation on Base Metal Steel –Application of Metal Zn (Sheradizing),Cr (Chromizing) and Al (Calorizing), Sacrificial protection and impressed current voltage
    - b) Inorganic coatings – Anodizing and phosphating,
    - c) Organic coatings - use of paints varnishes and enamels
    - d) Internal corrosion preventive measures- alloying (with reference to passivating, neutralizing and inhibition) and heat treatment (quenching, annealing)
6. Organic compounds, Polymers and Plastics (10 periods)
- 6.1 Classification of organic compounds and IUPAC Nomenclature
  - 6.2 Definition of polymer, monomer and degree of polymerization
  - 6.3 Brief introduction to addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon -66 and Bakelite)
  - 6.4 Definition of plastics, thermo plastics and thermo setting plastics with suitable examples, distinctions between thermo and thermo setting plastics
  - 6.5 Applications of polymers in industry and daily life

### LIST OF PRACTICALS

1. Estimation of total hardness of water using standard EDTA solution
2. Estimation of total alkalinity of given water sample by titrating it against standard sulfuric acid solution
3. Proximate analysis of solid fuel)
4. Estimation of temporary hardness of water sample by O' Hener's Method.
5. Determination of flash and fire point of given lubricating oil using Abel's flash point apparatus

### INSTRUCTIONAL STRATEGY

Teachers may take help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical process and reactions. In addition, students should be encouraged or motivated to study those processes in more details, which may find practical application in their future professional career.

#### **MEANS OF ASSEMENTS**

- Assignment & Quiz,
- Mid-Term and End-Term written test,
- Model Making,
- Actual Lab & Practical Work,
- Viva-voce

#### **RECOMMENDED BOOKS**

1. Chemistry in Engineering by J.C. Kuricose & J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Engineering Chemistry by P.C. Jain & Monika Jain, Dhanapat Rai Publishing Company, New Delhi.
3. Eagle's Applied Chemistry - I by S. C. Ahuja & G. H. Hugar, Eagle Prakashan, Jalandhar.
4. Engineering Chemistry – A Text Book by H. K. Chopra & A. Parmar, Narosa Publishing House, New Delhi.
5. Applied Chemistry - I by Dr. P. K Vij & Shiksha Vij, Lords Publications, Jalandhar.
6. Engineering Chemistry by Dr. Himanshu Pandey, Goel Publishing House, Meerut, India

### SUGGESTED DISTRIBUTION OF MARKS

<b>Topics</b>	<b>Time Allotted (hrs)</b>	<b>Marks Allotted (%)</b>
1.	14	20
2.	18	24
3.	14	20
4.	4	6
5.	10	15
6.	10	15
<b>Total</b>	<b>70</b>	<b>100</b>

### RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawing is their day-to-day responsibility. The subject is aimed at developing basic graphic skills in the students so as to enable them to use these skills in preparation of engineering drawings, their reading and interpretation. The emphasis, while imparting instructions, should be to develop conceptual skills in the students following BIS SP 46 – 1988.

#### Note:

- i) First angle projection is to be followed
- ii) Minimum of 18 sheets to be prepared and atleast 2 sheets on AutoCAD
- iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students

### LEARNING OUTCOMES

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

- Identify and use of different grades of pencils and other drafting instruments which are used in engineering field
- Draw free hand sketches of various kinds of objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods on drawing of objects.
- Use different types of scales and their utilization in reading and reproducing drawings of objects and maps.
- Draw 2 - dimensional view of different objects viewed from different angles (orthographic views)
- Draw and interpret complete inner hidden details of an object which are otherwise not visible in normal view
- To make projections of Solid
- Generate isometric (3D) drawing from different 2D (orthographic) views/sketches
- Identify conventions for different engineering materials, symbols, sections of regular objects and general fittings used in Civil and Electrical household appliances
- Use basic commands of AutoCAD.

## DETAILED CONTENTS

1. Introduction to Engineering Drawing (03 sheets)
  - 1.1 Introduction to drawing instruments, materials, layout and sizes of drawing sheets and drawing boards.
  - 1.2 Different types of lines in Engineering drawing as per BIS specifications
  - 1.3 Practice of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves, hexagonal, pentagon with the help of drawing instruments.
  - 1.4 Free hand and instrumental lettering (Alphabet and numerals) – upper case (Capital Letter), single stroke, vertical and inclined at 75 degree, series of 5,8,12 mm of free hand and instrumental lettering of height 25 to 35 mm in the ratio of 7:4
  
2. Dimensioning Technique (01 sheet)
  - 2.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions)
  - 2.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sunk holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches
  
3. Scales (02 sheets)
  - 3.1 Scales –their needs and importance (theoretical instructions), type of scales, definition of R.F. and length of scale
  - 3.2 Drawing of plain and diagonal scales
  
4. Orthographic Projections (06 sheets)
  - 4.1 Theory of orthographic projections (Elaborate theoretical instructions)
  - 4.2 Projection of Points in different quadrant
  - 4.3 Projection of Straight Line (1<sup>st</sup> and 3<sup>rd</sup> angle)
    - 4.3.1. Line parallel to both the planes
    - 4.3.2. Line perpendicular to any one of the reference plane
    - 4.3.3. Line inclined to any one of the reference plane.
  - 4.4 Projection of Plane – Different lamina like square, rectangular, triangular and circle inclined to one plane, parallel and perpendicular to another plane in 1<sup>st</sup> angle only
  - 4.5 Three views of orthographic projection of different objects. (At least one sheet in 3<sup>rd</sup> angle)
  - 4.6 Identification of surfaces
  
5. Projection of Solid (02 sheets)
  - 5.1. Definition and salient features of Solid
  - 5.2. Types of Solid (Polyhedron and Solid of revolution)

- 5.3 To make projections, sources, Top view, Front view and Side view of various types of Solid.
6. Sections (02 sheets)
- 6.1 Importance and salient features
- 6.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.
- 6.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
- 6.4 Orthographic sectional views of different objects.
7. Isometric Views (02 sheets)
- 7.1 Fundamentals of isometric projections and isometric scale.
- 7.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.
8. Common Symbols and Conventions used in Engineering (02 sheets)
- 8.1 Civil Engineering sanitary fitting symbols
- 8.2 Electrical fitting symbols for domestic interior installations
- \*9. Introduction to AutoCAD (02 sheets)

Basic introduction and operational instructions of various commands in AutoCAD. At least two sheets on AutoCAD of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

**\* Auto CAD drawing will be evaluated internally by sessional marks and not by final theory paper.**

## **INSTRUCTIONAL STRATEGY**

Teacher should show model of realia of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet. Focus should be on proper selection of drawing instruments and their proper use. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphic. Separate labs for practice on AutoCAD should be established.

## **MEANS OF ASSESSMENT**

- Sketches
- Drawing
- Use of software

## **RECOMMENDED BOOKS**

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar
5. Engineering Drawing I by DK Goel, GBD Publication.

## 1.6 CONSTRUCTION MATERIALS

L T P  
3 - 2

### RATIONALE

Civil Engineering diploma holders have to supervise construction of various types of civil works involving use of various materials like stones, bricks and tiles, cement and cement based products, lime, timber and wood based products, paints and varnishes, metals and other miscellaneous materials. The students should have requisite knowledge regarding characteristics, uses and availability of various building materials and skills in conducting tests to determine suitability of materials for various construction purposes. In addition, specifications of various materials should also be known (PWD/BIS) for effective quality control.

### LEARNING OUTCOME

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

- Classify rocks and identify particular type of stones
- Classify different types of bricks and BLOCKS
- Perform laboratory tests of cement to determine properties of cement
- Identify types of defects of timber
- Select paints/varnishes for various types of surfaces
- Identify and use different types of metals/alloys
- Select different materials used for wall paneling and false ceiling, such PVC, POP etc.
- Select other materials commonly used for contemporary buildings.

### DETAILED CONTENTS THEORY

1. Building Stones: (06 periods)
  - 1.1 Classification of Rocks: (General Review)
    - 1.1.1 Geological classification: Igneous, sedimentary and metamorphic rocks
    - 1.1.2 Chemical classification; Calcareous, argillaceous and siliceous rocks
    - 1.1.3 Physical classification: Unstratified, stratified and foliated rocks
  - 1.2 General characteristics of stones – Marble, Kota stone, Granite, Sand, Trap, Basalt stone, Lime stone and Slate
  - 1.3 Requirements of good building stones
  - \*\*1.4 Identification of common building stones

- 1.5 Various uses of stones in construction
  - 1.6 Quarrying of stones by blasting and its effect on environment
2. Bricks and Tiles (12 periods)
- 2.1 Introduction to bricks
  - 2.2 Raw materials for brick manufacturing and properties of good brick making earth
  - 2.3 Manufacturing of bricks
    - 2.3.1 Preparation of clay (manual/mechanically)
    - \*\*2.3.2 Moulding: hand moulding and machine moulding brick table; drying of bricks, burning of bricks, types of kilns (Bull's Trench Kiln and Hoffman's Kiln), process of burning, size and weight of standard brick; traditional brick, refractory brick, CLC, AAC, Paver blocks, clay-fly ash bricks, sun dried bricks, only line diagram of kilns
  - 2.4 Classification and specifications of bricks as per BIS: 1077
  - 2.5 Testing of common building bricks as per BIS: 3495  
Compressive strength, water absorption – hot and cold water test, efflorescence, Dimensional tolerance, soundness
  - 2.6 Tiles
    - 2.6.1 Building tiles; Types of tiles-wall, ceiling, roofing and flooring tiles
    - 2.6.2 Ceramic, terrazo and PVC tiles, : their properties and uses,
    - 2.6.3 Vitrified tiles, Paver blocks, interlocking tiles
  - 2.7 Stacking of bricks and tiles at site
3. Cement (16 periods)
- \*\*3.1 Introduction, raw materials, flow diagram of manufacturing of cement
  - 3.2 Various types of Cements, their uses and testing: Ordinary portland cement, rapid hardening cement, low heat cement, white and coloured cement, portland pozzolana cement
  - 3.3 Properties of cement
4. Timber and Wood Based Products (06 periods)
- 4.1 Identification and uses of different types of timber: Teak, Deodar, Shisham, Sal, Mango, Kail, Chir, Fir, Hollock, Champ
  - \*\*4.2 Market forms of converted timber as per BIS Code
  - 4.3 Seasoning of timber: Purpose, methods of seasoning as per BIS Code
  - 4.4 Properties of timber and specifications of structural timber
  - 4.5 Defects in timber, decay in timber
  - 4.6 Preservation of timber and methods of treatment as per BIS

- 4.7 Other wood based products, their brief description of manufacture and uses: laminated board, gypsum board, block board, fiber board, hard board, sunmica, plywood, veneers, nu-wood and study of the brand name and cost of the wood based products available in the market, Cement Panel Board, Moulded Doors.
5. Paints and Varnishes (03 periods)
- 5.1 Introduction, purpose and use of paints
- 5.2 Types, ingredients, properties and uses of oil paints, water paints and cement paints\*\*
- 5.3 Covering capacity of various paints
- 5.4 Types, properties and uses of varnishes
- 5.5 Trade name of different products.
6. Metals (03 periods)
- 6.1 Ferrous metals: Composition, properties and uses of cast iron, mild steel, HYSD steel, high tension steel as per BIS.
- 6.2 Commercial forms of ferrous, metals.
- 6.3 Aluminium & Stainless Steel.
7. Miscellaneous Materials (06 periods)
- 7.1 Plastics – Introduction and uses of various plastic products in buildings such as doors, water tanks and PVC pipes
- 7.2 Fibre Sheets and their size and uses
- 7.3 Types and uses of insulating materials for sound and thermal insulation
- 7.4 Construction chemicals like water proofing compound, epoxies, polymers
- 7.5 Water proofing, termite proofing and fire resistance materials – types and uses
- 7.6 Materials used in interior decoration works like POP, methods of doing POP, PVC paneling

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

### **PRACTICAL EXERCISES**

1. To identify the stones used in building works by visual examination
2. To determine the crushing strength of bricks, CLC, AAC and Paver Blocks.
3. To determine the water absorption of bricks and efflorescence of bricks
4. To identify various types of timbers such as: Teak, Sal, Chir, Shisham, Deodar, Kail & Hollock by visual examination only

- The students should submit a report work on the construction materials, covering water proofing material, cements, steel, paints and timber products available in the local market. They will also show the competitive study based upon the cost, brand name, sizes available in the local market.

### **INSTRUCTIONAL STRATEGY**

Teachers are expected to physically show various materials while imparting instructions. Field-visits should also be organized to show manufacturing processes and use of various materials in Civil engineering works. Students should be encouraged to collect sample of various building materials so as to create a museum of materials in the polytechnic. The emphasis should be one selection and application of materials as per the need of environment.

### **MEANS OF ASSESSMENT**

- Assignments and quiz/class tests
- Mid and end-term written tests
- Model/prototype making.

### **RECOMMENDED BOOKS**

- Sharma, SK; and Mathur, GC; "Engineering Materials;" Delhi-Jalandhar, S. Chand and Co.
- Surendra Singh; "Engineering Materials;" New Delhi, Vikas Publishing House Pvt. Ltd.
- Bahl, SK; "Engineering Materials;" Delhi, Rainbow Book Co.
- TTTI, Chandigarh "Civil Engineering Materials;" New Delhi Tata McGraw Hill Publication
- Gurcharan Singh; "Engineering materials", Delhi Standard Publishers Distributors
- SC Rangawala, "Construction Materials", Charotar Publishers
- Alam Singh, "Construction Materials"

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic No.</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1	06	14
2	12	30
3	06	14
4	06	14
5	03	07
6	03	07
7	06	14
<b>Total</b>	<b>42</b>	<b>100</b>

## 1.7 GENERAL WORKSHOP PRACTICE – I

(Common for Civil Engineering, Electrical Engineering and Chemical Engineering )

L T P

- - 8

### RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

### LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment.

### DETAILED CONTENTS (PRACTICAL EXERCISES)

**Note:** The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

1. Carpentry Shop
2. Painting and Polishing Shop
3. Electrical Shop
4. Welding Shop
5. Plumbing Shop

#### 1. CARPENTRY SHOP

##### 1.1 General Shop Talk

- 1.1.1 Name and use of raw materials used in carpentry shop: wood & alternative materials
- 1.1.2 Names, uses, care and maintenance of hand tools such as different types of Saws, C-Clamp, Chisels, Mallets, Carpenter's vices, Marking gauges, Try-squares, Rulers and other commonly used tools and materials used in carpentry shop by segregating as cutting tools, supporting tools, holding tools, measuring tools etc.
- 1.1.3 Specification of tools used in carpentry shop.
- 1.1.4 Different types of Timbers, their properties, uses & defects.
- 1.1.5 Seasoning of wood.
- 1.2. Practice
  - 1.2.1 Practices for Basic Carpentry Work
  - 1.2.2 Sawing practice using different types of saws
  - 1.2.3 Assembling jack plane — Planning practice including sharpening of jack plane cutter
  - 1.2.4 Chiselling practice using different types of chisels including sharpening of chisel
  - 1.2.5 Making of different types of wooden pin and fixing methods. Marking measuring and inspection of jobs.
- 1.3 Job Practice
  - Job I Marking, sawing, planning and chiselling and their practice
  - Job II Half Lap Joint (cross, L or T – any one)
  - Job III Mortise and Tenon joint (T-Joint)
  - Job IV Dove tail Joint (Lap or Bridle Joint)
- 1.4. Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.

## **2. PAINTING AND POLISHING SHOP**

- 2.1. Introduction of paints, varnishes, Reason for surface preparation, Advantages of Painting, other method of surface coating ie. Electroplating etc.
- 2.2. Job Practice
  - Job I: To prepare a wooden surface for painting apply primer on one side and to paint the same side. To prepare french polish for wooden surface and polish the other side.
  - Job II: To prepare metal surface for painting, apply primer and paint the same.
  - Job III: To prepare a metal surface for spray painting, first spray primer and paint the same by spray painting gun and compressor system.

The sequence of polishing will be as follows:

- i) Abrasive cutting by leather wheel
- ii) Polishing with hard cotton wheel and with polishing material

- iii) Buffing with cotton wheel or buff wheel.

### **3. ELECTRICAL SHOP**

- 3.1 Study, demonstration and identification of common electrical materials with standard ratings and specifications such as wires, cables, switches, fuses, cleats, clamps and allied items, tools and accessories.
- 3.2 Study of electrical safety measures and protective devices.  
Job I Identification of phase, Neutral and Earth wires for connection to domestic electrical appliances and their connections to three pin plugs.  
Job II Carrying out house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping.
- 3.3 Study of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc.
- 3.4 Introduction to the construction of lead acid battery and its working.  
Job III Installation of battery and connecting two or three batteries in series and parallel.
- 3.5 Introduction to battery charger and its functioning.  
Job IV Charging a battery and testing with hydrometer and cell tester

### **4. WELDING SHOP**

- 4.1 Introduction and importance of welding as compared to other material joining processes. Specifications and type of welding machines, classification and coding of electrodes, welding parameters, welding joints and welding positions. Materials to be welded, safety precautions.
- 4.2 Job Practice
  - Job I Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat).
  - Job II Practice of depositing beads on plate at different current levels. (Minimum 4 beads on M.S. plate at four setting of current level).
  - Job III Preparation of lap joint using arc welding process.
  - Job IV Preparation of T-joint using gas welding or arc welding on 100 mm x 6 mm MS Flat

### **5. PLUMBING SHOP**

- 5.1. Use of personal protective equipments, safety precautions while working and cleaning of shop.
- 5.2. Introduction and demonstration of tools, equipment and machines used in plumbing shop.
- 5.3. Introduction of various pipes and pipe fittings of elbow, nipple, socket, union etc.
- 5.4. Job Practice
  - Job 1: Preparation of job using elbow, bend and nipple

Job II: Preparation of job using Union, Tap, Plug and Socket.  
Job III: Threading practice on pipe with die

### **MEANS OF ASSESSMENT**

- Workshop jobs
- Report writing, presentation and viva voce

### **RECOMMENDED BOOKS**

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

## 2.1 APPLIED MATHEMATICS - II

L	T	P
5	-	-

### RATIONALE

Basic elements of integral calculus, differential calculus, numerical methods, differential equations included in this course will play a vital role in understanding engineering problem mathematically. This will also develop analytical as well as conceptual abilities among students.

### LEARNING OUTCOMES

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

- Calculate simple integration by methods of integration
- Evaluate the area under curves, surface by using definite integrals.
- Calculate the area and volume under a curve along areas
- Solve the engineering problems with numerical methods.
- Understand the geometric shapes used in engineering problems by co-ordinate geometry.

### DETAILED CONTENTS

#### 1. Integral Calculus - I (20 Periods)

Methods of Indefinite Integration:-

- 1.1 Integration by substitution.
- 1.2 Integration by rational function.
- 1.3 Integration by partial fraction.
- 1.4 Integration by parts.
- 1.5 Integration of special function

#### 2. Integral Calculus - II: (20 Periods)

- 2.1 Meaning and properties of definite integrals, Evaluation of definite integrals.
- 2.2 Application : Length of simple curves, Finding areas bounded by simple curves  
Volume of solids of revolution, Centre of mean of plane areas.
- 2.3 Simpsons 1/3rd and Simposns3/8th rule and Trapezoidal Rule : their application in simple cases. Numerical solutions of algebraic equations; Bisections method, Regula-Falsi method, Newton-Raphson's method(without proof), Numerical solutions of simultaneous equations; Gauss elimination method(without proof)

#### 3. Co-ordinate Geometry (2 Dimension) (18 Periods)

### 3.1 Circle

Equation of circle in standard form. Centre - Radius form, Diameter form, Two intercept form.

## 4. Co-ordinate Geometry (3 Dimension) (12 Periods)

### 4.1 Straight lines and planes in space

Distance between two points in space, direction cosine and direction ratios, Finding equation of a straight line (without proof)

## INSTRUCTIONAL STRATEGY

Basic elements of Differential Calculus, Integral Calculus and differential equations can be taught conceptually along with real engineering applications in which particular algorithm and theory can be applied. Numerical examples will be helpful in understanding the content of the subject.

## MEANS OF ASSESSMENT

- Assignments and Quiz/Class Tests
- Mid-term and End-term Written Tests
- Model/Prototype Making

## RECOMMENDED BOOKS

1. Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi
2. Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,
3. Applied Mathematics-II by Chauhan and Chauhan, Krishna Publications, Meerut.
4. Applied Mathematics-I (B) by Kailash Sinha and Varun Kumar; Aarti Publication, Meerut

## SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Periods)	Marks Allotted (%)
1.	20	28
2.	20	28
3.	18	24
4	12	20
<b>Total</b>	<b>70</b>	<b>100</b>

## 2.2 COMPUTER AIDED DRAWING

L T P

- -8

### RATIONALE

A diploma holder is expected to prepare and interpret CAD Drawings. Hence this subject.

### LEARNING OUTCOMES

On completion of this course, students will be able to:

- Know the advantages of using CAD in comparison with conventional method.
- Draw and interpret CAD drawings using drawing, editing and viewing in CAD software.
- Create 2D plans of building
- Create 3 D views from given 2D plans

### DETAILED CONTENTS

1. Introduction to Computer Aided Drafting (2D) commands of any one software (AutoCAD, ProE, Solid works, Unigraphics etc. (6 drawing sheets)
  - 1.1 Concept of AutoCAD, Tool bars in CAD software, coordinate system, snap, grid, and ortho mode (Absolute, Relative and Polar), setting of units and layout.
  - 1.2 Drawing commands – point, line, arc, circle, ellipse,
  - 1.3 Editing commands – scale, erase, copy, stretch, lengthen and explode.
  - 1.4 Dimensioning and placing text in drawing area
  - 1.5 Sectioning and hatching
  - 1.6 Inquiry for different parameters of drawing entity
  - 1.7 Create layers within a drawing
  - 1.8 Specifying Geometrical Dimensioning & tolerancing (GD&T) parameters in drawing
2. 2-D Plan of a 2-Room Building
3. Isometric Drawing by CAD using any part modeling Software (3D) (one sheet)  
Drawings of following on computer:
  - Cone
  - Cylinder
  - Cube
  - Spring
  - Isometric view of objects
4. Introduction to any part modeling software(ProE, Solid works, AutoCAD, Unigraphics , Catia etc.)  
Introduction to Sketcher: Sketch Entities, Sketch Tools, Blocks, Dimensioning

- 4.1 Part modeling (4 models)  
Part Modeling Tools:-
  - 4.1.1 Creating reference planes
  - 4.1.2 Creating Extrude features Creating Revolve Creating Swept features
  - 4.1.3 Creating Loft features
  - 4.1.4 Creating Reference - points, axis, coordinates
  - 4.1.5 Creating curves
  - 4.1.6 Creating Fillet features
  - 4.1.7 Inserting Hole types
  - 4.1.8 Creating Chamfer
  - 4.1.9 Creating Shell
  - 4.1.10 Creating Rib
  - 4.1.11 Environment& Utilities - Working with views and manipulating views.
- 4.2. Preparing 3-D view of existing 2-D plan.

### **INSTRUCTIONAL STRATEGY**

1. Teachers should show model or realia of the component/part whose drawing is to be made.
2. Emphasis should be given on cleanliness, dimensioning, & layout of sheet.
3. Teachers should ensure use of IS codes related to drawing.

### **MEANS OF ASSESSMENT**

- Drawings
- Assignments and quiz/class tests, mid-term and end-term written tests, model/prototype making
- Software installation, operation, and viva-voce

### **LIST OF RECOMMENDED BOOKS**

1. Engineering Drawing with AutoCAD 2000 by T. Jeyapooran; Vikas Publishing House, Delhi.
2. AutoCAD for Engineering Drawing Made Easy by P. NageswaraRao; Tata McGraw Hill, New Delhi.
3. AutoCAD 2000 for you by UmeshShettigar and Abdul Khader; JanathaPublishers, Udupi.
4. Auto CAD 2000 by Ajit Singh, TMH, New Delhi.
5. Instruction Manual of the software used (AutoCAD, ProE, Solidwors, Unigraphic etc.)
6. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTTR, Chandigarh.

### **Websites for Reference**

<http://swayam.gov.in>

## 2.3 APPLIED MECHANICS

L T P  
5 - 2

### RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, moments, friction, centre of gravity, laws of motion and simple machines which are required by the students for further understanding of other allied subjects. The subject enhances the analytical ability of the students.

### LEARNING OUTCOMES

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

- Interpret various types of units and their conversion from one to another.
- Analyze different types of forces acting on a body and draw free body diagrams.
- Determine the resultant of coplanar concurrent forces.
- Calculate the co-efficient of friction for different types of surfaces.
- Calculate the least force required to maintain equilibrium on an inclined plane.
- Determine the centroid/Centre of gravity of plain and composite laminar and solidbodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

### DETAILED CONTENTS

1. Introduction (06 periods)
  - 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields. Definition of Applied Mechanics.
  - 1.2 Definition, basic quantities and derived quantities of basic units and derived units
  - 1.3 Different systems of units (FPS, CGS, MKS and SI) and their conversion from one to another for density, force, pressure, work, power, velocity, acceleration
  - 1.4 Concept of rigid body, scalar and vector quantities
2. Laws of forces (12 periods)
  - 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, effects of force, characteristics of a force
  - 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of superposition

- 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
  - 2.4 Free body diagram
  - 2.5 Equilibrant force and its determination
  - 2.6 Lami's theorem (concept only)  
[Simple problems on above topics]
  - 2.7 Type of Load, supports, Beams- analysis for simply supported, cantilever beams
3. Moment (14 periods)
- 3.1 Concept of moment
  - 3.2 Moment of a force and units of moment
  - 3.3 Varignon's theorem (definition only)
  - 3.4 Principle of moment and its applications (Levers – simple and compound, steel yard, safety valve, reaction at support)
  - 3.5 Parallel forces (like and unlike parallel force), calculating their resultant
  - 3.6 Concept of couple, its properties and effects
  - 3.7 General conditions of equilibrium of bodies under coplanar forces
  - 3.8 Position of resultant force by moment  
[Simple problems on the above topics]
4. Friction (14 periods)
- 4.1 Definition and concept of friction, types of friction, force of friction
  - 4.2 Laws of static friction, coefficient of friction, angle of friction, angle of repose, cone of friction
  - 4.3 Equilibrium of a body lying on a horizontal plane, equilibrium of a body lying on a rough inclined plane.
  - 4.4 Calculation of least force required to maintain equilibrium of a body on a rough inclined plane subjected to a force:
    - a) Acting along the inclined plane Horizontally
    - b) At some angle with the inclined plane
5. Centre of Gravity (10 periods)
- 5.1 Concept, definition of centroid of plain figures and Centre of gravity of symmetrical solid bodies
  - 5.2 Determination of centroid of plain and composite lamina using moment method only, centroid of bodies with removed portion
  - 5.3 Determination of center of gravity of solid bodies - cone, cylinder, hemisphere and sphere; composite bodies and bodies with portion removed  
[Simple problems on the above topics]

6. Simple Machines (14 periods)
- 6.1. Definition of effort, velocity ratio, mechanical advantage and efficiency of a machine and their relationship, law of machines
  - 6.2. Simple and compound machine (Examples)
  - 6.3. Definition of ideal machine, reversible and self locking machine
  - 6.4. Effort lost in friction, Load lost in friction, determination of maximum mechanical advantage and maximum efficiency
  - 6.5. System of pulleys (first, second, third system of pulleys), determination of velocity ratio, mechanical advantage and efficiency
  - 6.6. Working principle and application of wheel and axle, Weston's Differential Pulley Block, simple screw jack, worm and worm wheel, single and double winch crab. Expression for their velocity ratio and field of their application  
[Simple problems on the above topics]

### **LIST OF PRACTICALS**

1. Verification of the polygon law of forces using gravesend apparatus.
2. To verify the forces in different members of jib crane.
3. To verify the reaction at the supports of a simply supported beam.
4. To find the mechanical advantage, velocity ratio and efficiency in case of an inclined plane.
5. To find the mechanical advantage, velocity ratio and efficiency of a screw jack.
6. To find the mechanical advantage, velocity ratio and efficiency of worm and worm wheel.
7. To find mechanical advantage, velocity ratio and efficiency of single purchase crab.
8. To find out center of gravity of regular lamina.
9. To find out center of gravity of irregular lamina.
10. To determine coefficient of friction between three pairs of given surface.

### **INSTRUCTIONAL STRATEGY**

Applied Mechanics being a fundamental subject, the teacher are expected to emphasize on the application of "Applied Mechanics" in various subjects so that students are able to appreciate the importance of the subject. Students should also be made conversant with the use of scientific calculator to solve numerical problems

### **MEANS OF ASSESSMENT**

- Assignments and quiz/class tests
- Mid and end-term written tests
- Model/prototype making.

## RECOMMENDED BOOKS

1. A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.
2. A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.
3. A Text Book of Applied Mechanics by RK Rajput; Laxmi Publications, New Delhi..
4. Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.
5. Test Book of Applied Mechanics by AK Upadhya, SK Kataria & Sons, New Delhi

## SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	06	8
2	12	18
3	14	20
4	14	20
5	10	14
6	14	20
<b>Total</b>	<b>70</b>	<b>100</b>

## 2.4 BASICS OF MECHANICAL & ELECTRICAL ENGINEERING

L T P  
6 - 2

### RATIONALE

A part from the common core subjects, some engineering subjects are included in the diploma course of electrical engineering. One of these subjects is Elementary Mech. Engineering, to impart some necessary knowledge and skill about mechanical nature. Inclusion of the subject is further justified by the fact that in practical field, any job of electrical and civil technician is intermingled with either civil or mechanical engineering. As such the relevant basic topics of these disciplines are included in the content of the subject.

Some study exercises along with some field work have been suggested to give feel of jobs and equipment's involved.

### LEARNING OUTCOMES

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

- Apply thermodynamics Laws.
- Use of various energy sources.
- Solve basics problems related to fuel and combustion.
- Have an idea of loading on machine components.
- Explain the application of different types of bearings.
- Explain the uses of different types of gears and springs.
- Explain the working principle of different lubrication systems.
- **Identify and take readings on various electrical equipments**
- **Determine voltage-current relationship in a DC circuit under specific physical conditions**
- **Measure resistance of an ammeter and a voltmeter**
- **Verify DC circuits (Thevenin and Norton Theorem)**
- **Verify Kirchhoff's Current and Voltage Laws in a dc circuit**
- **Find the ratio of inductance of a coil having air-core and iron-core respectively and observe the effect of introduction of a magnetic core on coil inductance**
- **Test a lead - acid storage battery**
- Measure power and power factor in a single phase R-L-C Circuit and calculation of active and reactive powers in the circuit.
- Measure voltages and currents in polyphase a.c. circuits for star and delta connections.

## SECTION A - MECHANICAL ENGINEERING DETAILED CONTENTS

### 1. Thermal Engineering (08 periods)

#### 1.1 Sources of Energy:

Definition, Concept of thermodynamic system and surroundings, Closed system, Open system, Isolated system, Thermodynamics definition of work. Zeroth law of thermodynamics

Basic ideas, conventional and nonconventional forms- Thermal, Hydel, Tidal, wind, Solar, Biomass and Nuclear and their uses.

#### 1.2 Fuels & Combustion:

Combustion of fuels- their higher and lower calorific values. Combustion equations for carbon, sulphur, hydrogen and their simple compounds. Calculation of minimum amount of air required for complete combustion.

Combustion analysis on mass basis and on volume basis. Concept of excess air in a boiler furnace combustion. Heat carried away by flue gases. Analysis of flue gases by Orsat apparatus. Simple numerical problems

Idea of specific properties of liquid fuels such as detonation, knock resistance (cetane and octane numbers), viscosity, solidification point, flash point and flame point.

### 2. Machine Components (12 periods)

Brief idea of loading on machine components.

(i) Pins, Cotter and Knuckle Joints.

(ii) Keys, Key ways and spline on the shaft.

(iii) Shafts, Collars, Cranks, Eccentrics.

(iv) Couplings and Clutches.

(v) Bearings-Plane, Bushed, Split-step, ball, Roller bearing, Journal bearing, Foot step bearing, thrust bearing, collar bearing and Special type bearings and their applications.

(vi) Gears :

Different types of gears, gear trains and their use for transmission of motion. Determination of velocity ratio for spur gear trains; spur gear, single and double helical gears, Bevel gears, Mitre wheel, worms, Rack and Pinion. Simple and compound and epicyclic gear trains and their use. Definition of pitch and pitch circle & module.

(vii) Springs:

Compression, Tension, Helical springs, Torsion springs, Leaf and Laminated springs. Their use and material.

3. Lubrication (04 periods)

Different lubrication system for lubricating the components of machines.

Principle of working of wet sump and dry sump system of lubrication. (Explain with simple line diagram). Selection of lubricant based on different application (Requirement with the help of manufacturer catalogue).

**SECTION B: ELECTRICAL ENGINEERING**

4. Overview of DC Circuits (06 periods)

- 4.1 Definition of basic terms, such as current, EMF, Potential Difference (PD); Ohm's Law and its limitations; Factors affecting resistors and capacitors; simple problems on series and parallel combinations of resistors with their wattage considerations.
- 4.2 Application of Kirchhoff's current law and Kirchhoff's voltage law to simple circuits. Star – Delta connections and their conversion.

5. DC Circuit Theorems (06 periods)

Thevenin's theorem, Norton's theorem, application of network theorems in solving D.C. circuit problems.

6. Voltage and Current Sources (04 periods)

- 6.1 Concept of voltage source, symbol and graphical representation characteristics of ideal and practical sources.
- 6.2 Concept of current sources, symbol, characteristic and graphical representation of ideal and practical current sources.

7. Electro Magnetic Induction (08 periods)

- 7.1 Concept of electro-magnetic field produced by flow of electric current, magnetic circuit, concept of magneto-motive force (MMF), flux, reluctance, permeability, analogy between electric and magnetic circuit.
- 7.2 Faraday's laws of electro-magnetic induction, principles of self and mutual induction, self and mutually induced e.m.f, simple numerical problems.
- 7.3 Concept of current growth, decay and time constant in an inductive (RL) circuit.
- 7.4 Energy stored in an inductor, series and parallel combination of inductors.

8. Batteries (06 periods)
- 8.1 Basic idea of primary and secondary cells
  - 8.2 Construction, working principle and applications of Lead-Acid, Nickel-Cadmium and Silver-Oxide batteries
  - 8.3 Charging methods used for lead-acid battery (accumulator )
  - 8.4 Care and maintenance of lead-acid battery
  - 8.5 Series and parallel connections of batteries
  - 8.6 General idea of solar cells, solar panels and their applications
  - 8.7 Introduction to maintenance free batteries
9. AC Fundamentals (10 periods)
- 9.1 Concept of alternating quantities
  - 9.2 Difference between ac and dc
  - 9.3 Concepts of: cycle, frequency, time period, amplitude, instantaneous value, average value, r.m.s. value, maximum value, form factor and peak factor.
  - 9.4 Representation of sinusoidal quantities by phasor diagrams.
  - 9.5 Equation of sinusoidal wave form for an alternating quantity and its derivation
  - 9.6 Effect of alternating voltage applied to a pure resistance, pure inductance and pure capacitance.
10. AC Circuits (14 periods)
- 10.1 Concept of inductive and capacitive reactance
  - 10.2 Alternating voltage applied to resistance and inductance in series.
  - 10.3 Alternating voltage applied to resistance and capacitance in series.
  - 10.4 Introduction to series and parallel resonance and its conditions
  - 10.5 Power in pure resistance, inductance and capacitance, power in combined RLC circuits. Power factor, active and reactive power and their significance, definition and significance of power factor.
  - 10.6 Definition of conductance, susceptance, admittance, impedance and their units
  - 10.7 Introduction to polyphase a.c. systems, advantages of polyphase system over single phase system. Relations between line and phase value of voltages and currents for star and delta connections and their phasor diagram, power in polyphase circuits.
11. Various Types of Power Plants (06 periods)

- 11.1 Brief explanation of principle of power generation practices in thermal, hydro and nuclear power stations and their comparative study. A Visit to a nearby Power Station(s) may be organized for better understanding and exposure.
- 11.2 Elementary block diagram of above mentioned power stations

### **LIST OF PRACTICALS**

1. Study and Sketch of Pins and Cottor
2. Study and Sketch of Keys and Key ways
3. Study and sketch of Couplings and Clutches
4. Study and Sketch of Bearings
5. Study and Sketch of Springs
6. Study of green energy
- 7 Study of Maintenance and safety aspects of lifts in buildings
- 8 Operation and use of measuring instruments viz voltmeter, ammeter, CRO, Wattmeter, multi-meter and other accessories
- 9 Determination of voltage-current relationship in a dc circuit under specific physical conditions and to draw conclusions.
- 10 Measurement of resistance of an ammeter and a voltmeter
- 11 Verification of dc circuits:
  - a. Thevenin's theorem,
  - b. Norton's theorem,
- 12 Observation of change in resistance of a bulb in hot and cold conditions, using voltmeter and ammeter.
- 13 Verification of Kirchhoff's Current and Voltage Laws in a dc circuit
- 14 To find the ratio of inductance of a coil having air-core and iron-core respectively and to observe the effect of introduction of a magnetic core on coil inductance
- 15 Charging and testing of a lead - acid storage battery.
- 16 Measurement of power and power factor in a single phase R-L-C. circuit and calculation of active and reactive powers in the circuit.
- 17 Verification of line to line and line to neutral voltages and current in star and delta connections.
- 18 Study of Wiring system of Public Buildings & Residential buildings.

**Note:** Visit to a nearby Power Station(s) may be arranged to demonstrate various aspects of subject.

### **INSTRUCTIONAL STRATEGY**

Teachers should lay emphasis on basic principles and use charts in class, visits to labs and industry may be arranged to demonstrate certain materials and practices.

### **MEANS OF ASSESSMENT**

- Sessional Tests
- End term Tests
- Practicals
- Viva-Voce

### **RECOMMENDED BOOKS**

1. Thermal Engineering by RK Rajput; Laxmi Publications, Delhi.
2. Theory Machines by SS Rattan; Tata McGraw Hill, New Delhi.
3. Basic Electrical Engineering by PS Dhogal, Tata McGraw-Hill Education Pvt Ltd., New Delhi.
4. Experiments in Basic Electrical Engineering by SK Bhattacharya, KM Rastogi; New Age International (P) Ltd.; Publishers New Delhi.
5. Electrical Technology by BL Theraja, S Chand and Co, New Delhi.
6. Basic Electrical Engineering by JB Gupta; SK Kataria and Sons, New Delhi.
7. Basic Electrical Engineering by Asfaque Husain, Jain Book Depot, New Delhi

### **SUGGESTED DISTRIBUTION OF MARKS**

<b>Topic</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1.	08	10
2.	12	15
3.	04	05
4.	06	08
5.	06	06
6.	04	05
7.	08	09
8.	06	08
9.	10	12
10.	14	16
11.	06	06
<b>Total</b>	<b>84</b>	<b>100</b>

## 2.5 BASICS OF INFORMATION TECHNOLOGY

L T P  
- - 6

### RATIONALE

Information technology has great influence on all aspects of life. Primary purpose of using computer is to make the life easier. Almost all work places and living environment are being computerized. The subject introduces the fundamentals of computer system for using various hardware and software components. In order to prepare diploma holders to work in these environments, it is essential that they are exposed to various aspects of information technology such as understanding the concept of information technology and its scope; operating a computer; use of various tools using MS Office/Open Office/Libre Office using internet etc., form the broad competency profile of diploma holders. This exposure will enable the students to enter their professions with confidence, live in a harmonious way and contribute to the productivity.

### Note:

**Explanation of Introductory part should be demonstrated with practical work. Following topics may be explained in the laboratory along with the practical exercises. There will not be any theory examination.**

### LEARNING OUTCOMES

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

- Identify Computer Hardware Components, Network Components and Peripherals.
- Explain the role of an Operating System.
- Install System and Application Software.
- Explain the function of the system components including Processor, Motherboard and Input-output devices.
- Use Word Processing Software to prepare document.
- Use Spreadsheet Software to create workbooks and automate calculation.
- Use Presentation Software to create interactive presentation.
- Perform fundamental tasks common to most application software including print, scan, save, edit, cut, copy, paste, format, spell and grammar check.
- Find and evaluate information on the Web.
- Install Antivirus.
- Safeguard against Online Frauds, threats and crimes.
- Use online office tools(Google suits)

## TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Introduction to Computers and Peripherals.

Components of Computer, Types of Computer, CPU, RAM, ROM, Hard disk, USB, Flash drive, CD, DVD, Blue ray, Keyboard, Mouse, Monitor, LCD, Printer, Plotter, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers.

2. Operation System and Application Software

System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/Libreoffice, Working with window, Desktop components, Menu bars, creating shortcut of program. Installation of Application softwares, Antivirus and Drivers.

3. Word Processing, Spreadsheet and Presentation

Usage and creation of word document, spreadsheets and presentation, Google Suits (Google drive, google sheet, google doc. Google presentation)

4. Internet

Basics of Networking – LAN, WAN, Wi-Fi technologies, Concept of IP Addrsses, DNS, Search Engines, e-mail, Browsing and cyber laws.

## LIST OF PRACTICAL EXERCISES

1. Identify various components, peripherals of computer and list their functions.
2. Installation of various application software and peripheral drivers
3. Installation of operating system (windows/linux/others)
4. Creation and Management (Rename, delete, search of file and folders)
5. Installation of Antivirus and remove viruses
6. Scanning and printing documents
7. Browsing, Downloading, Information using Internet
8. E-Mail ID creation, comparing, sending and receiving e-mail. Attaching a file with e-mail message.
9. Word Processing (MS Office/Open Office)
  - a) File Management
    - Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file
  - b) Page set up
    - Setting margins, tab setting, ruler, indenting
  - c) Editing a document
    - Entering text, cut, copy, paste using tool- bars
  - d) Formatting a document

- Using different fonts, changing font size and colour, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods
  - Aligning of text in a document, justification of document, inserting bullets and numbering
  - Formatting paragraph, inserting page breaks and column breaks, line spacing
  - Use of headers, footers: Inserting footnote, end note, use of comments, autotext
  - Inserting date, time, special symbols, importing graphic images, drawing tools
- e) Tables and Borders
- Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table
  - Print preview, zoom, page set up, printing options
  - Using find, replace options
- f) Using Tools like
- Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and labels
  - Using shapes and drawing toolbar,
  - Working with more than one window .

#### 10. Spread Sheet Processing (MS Office/Open Office/Libre Office)

- a) Starting excel, open worksheet, enter, edit, data, formulae to calculate values, format data, save worksheet, switching between different spread sheets
- b) Menu commands:  
Create, format charts, organise, manage data, solving problem by analyzing data. Programming with Excel Work Sheet, getting information while working
- c) Work books:  
Managing workbooks (create, open, close, save), working in work books, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations  
Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting
- d) Creating a chart:  
Working with chart types, changing data in chart, formatting a chart, use chart to analyze data  
Using a list to organize data, sorting and filtering data in list
- e) Retrieve data with query:  
Create a pivot table, customizing a pivot table. Statistical analysis of data
- f) Exchange data with other application:  
Embedding objects, linking to other applications, import, export document.

#### 11. PowerPoint Presentation (MS Office/Open Office/Libre office)

- a) Introduction to PowerPoint
  - How to start PowerPoint
  - Working environment: concept of toolbars, slide layout & templates.
  - Opening a new/existing presentation
  - Different views for viewing slides in a presentation: normal, slide sorter.
- b) Addition, deletion and saving of slides
- c) Insertion of multimedia elements
  - Adding text boxes
  - Adding/importing pictures
  - Adding movies and sound
  - Adding tables and charts etc.
  - Adding organizational chart
  - Editing objects
  - Working with Clip Art
- d) Formatting slides
  - Using slide master
  - Text formatting
  - Changing slide layout
  - Changing slide colour scheme
  - Changing background
  - Applying design template

12. Google Suits  
Using Google drive, Google shut, Google docs, Google slides.

### **INSTRUCTIONAL STRATEGY**

Since this subject is practice oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections and proficient in making use of MS Office/Open Office/Libre office/Google Suit in addition to working on internet. The student should be made capable of working on computers independently.

### **MEANS OF ASSESSMENT**

- Class Tests/Quiz
- Software Installation and Use
- Viva-Voce
- Presentation

### **RECOMMENDED BOOKS**

1. Fundamentals of Computer by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi

3. Computers Fundamentals Architecture and Organisation by B Ram, revised Edition, New Age International Publishers, New Delhi
4. Computers Today by SK Basandara, Galgotia publication Pvt Ltd. Daryaganj, New Delhi.
5. Internet for Every One by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
7. Computer Fundamentals by PK Sinha; BPB Publication, New Delhi
8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
9. On Your Marks - Net...Set...Go... Surviving in an e-world by Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi
10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar

**Reference websites**

1. [www.tutorialspoint.com](http://www.tutorialspoint.com)
2. [www.sf.net](http://www.sf.net)
3. [Gsuite.google.com](http://Gsuite.google.com)
4. [Spoken-tutorial.org](http://Spoken-tutorial.org)
5. [Swayam.gov.in](http://Swayam.gov.in)

## 2.6 GENERAL WORKSHOP PRACTICE –II

(Common for Civil Engineering, Electrical Engineering and Chemical Engineering )

L T P

- - 8

### RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hands-on experience about use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labour, safety at work place, team working and development of right attitude are the other objectives.

### LEARNING OUTCOMES

After completing the course, the students will be able to:

- Identify tools and equipment used and their respective functions.
- Identify different types of materials and their basic properties.
- Use and take measurements with the help of basic measuring tools/equipment.
- Select proper tools for a particular operation.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same.
- Follow safety procedures and precautionary measures.
- Use safety equipment and Personal Protection Equipment.

### DETAILED CONTENTS (PRACTICAL EXERCISES)

**Note:** The students are supposed to come in proper workshop dress prescribed by the institute. Wearing shoes in the workshop(s) is compulsory. Importance of safety and cleanliness, safety measures and upkeep of tools, equipment and environment in each of the following shops should be explained and practiced. The students should prepare sketches of various tools/jobs in their practical Notebook.

The following shops are included in the syllabus:

- 1 Fitting Shop
- 2 Sheet Metal Shop
- 3 Mason Shop
- 4 Machine Shop

#### 1. FITTING SHOP

- 1.1 Use of personal protective equipment and safety precautions while working.

- 1.2 Basic deburring processes.
- 1.3 Introduction to fitting shop tools, marking and measuring devices/equipment.
- 1.4 Identification of materials. (Iron, Copper, Stainless Steel, Aluminium etc.)
- 1.5 Identification of various steel sections (flat, angle, channel, bar etc.).
- 1.6 Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).

1.7 Job Practice

Job I Marking of job, use of marking tools, filing and use of measuring instruments. (Vernier caliper, Micrometer and Vernier height gauge).

Job II Filing a rectangular/square piece to maintain dimensions within an accuracy of  $\pm 0.25$  mm.

Job III Making a cut-out from a square piece of MS flat using hand hacksaw and chipping

Job IV Drilling and tapping practice on MS Flat.

## 2. SHEET METAL SHOP

2.1. Introduction to sheet metal shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material.

2.2 Introduction and demonstration of hand tools used in sheet metal shop.

2.3 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine,

2.4 Introduction and demonstration of various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.

2.5 Study of various types of nuts, bolts, rivets, screws etc.

2.6 Job Practice

Job I: Shearing practice on a sheet using hand shears.

Job II: Practice on making Single riveted lap joint/Double riveted lap Joint.

Job III: Practice on making Single cover plate chain type, zig-zag type and single rivetted Butt Joint.

## 3 MASON SHOP

3.1. Introduction and importance of Mason shop

3.2. Introduction of tools, equipment and machines used in Mason shop

3.3. Job Practice

Job I: Preparation of simple bond

Job II : Preparation of Arched bond  
Job III: Preparation of RCC structure (column and beam)

#### **4 MACHINE SHOP**

- 4.1 Study and sketch of lathe machine
- 4.2 Study and Sketch of grinders, milling machine, drilling machine and CNC machine.
- 4.3 Plain and step turning and knurling practice.
- 4.4 Study and sketch of planing/shaping machine and to plane a rectangle of cast iron.

#### **MEANS OF ASSESSMENT**

- Workshop jobs
- Report writing, presentation and viva voce

#### **RECOMMENDED BOOKS**

1. Workshop Technology I,II,III, by SK Hajra, Choudhary and AK Choudhary; Media Promoters and Publishers Pvt. Ltd. Mumbai.
2. Workshop Technology Vol. I, II, III by Manchanda; India Publishing House, Jalandhar.
3. Workshop Training Manual Vol. I, II by S.S. Ubhi; Katson Publishers, Ludhiana.
4. Manual on Workshop Practice by K Venkata Reddy; MacMillan India Ltd., New Delhi
5. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi
6. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Co., New Delhi
7. Workshop Technology by HS Bawa; Tata McGraw Hill Publishers, New Delhi.

### 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 Venturi meter and orifice meter
  - 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 venturi meter 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

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted(%)</b>
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
<b>Total</b>	<b>84</b>	<b>100</b>

## 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*

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
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
<b>Total</b>	<b>84</b>	<b>100</b>

### 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 O<sub>2</sub>, 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*

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

### 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**

<http://swayam.gov.in>

#### ***SUGGESTED DISTRIBUTION OF MARKS***

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
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
<b>Total</b>	<b>84</b>	<b>100</b>

### **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, fascia 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

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***

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
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
<b>Total</b>	<b>84</b>	<b>100</b>

### 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 Revathi Srinivas;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/](http://www.mindtools.com/page8.html) 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**

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

## 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; equipment's 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, geo flexible's, 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***

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
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
<b>Total</b>	<b>84</b>	<b>100</b>

### 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 tube wells. 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 tube wells 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 BasePeriod, 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 – Tube well, submersible and well irrigation advantages and disadvantages
  - 4.3 Sprinkler irrigation conditions favorable 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. Tube well Irrigation (09 Periods)
- 6.1 Introduction, occurrence of ground water, location and command, advantages and disadvantages, comparison with canal irrigation
  - 6.2 Tube wells, 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 tube wells (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***

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
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
<b>Total</b>	<b>70</b>	<b>100</b>

## 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***

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

## 4.5 REINFORCED CEMENT CONCRETE STRUCTURES

(RCC Structure)

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:
    - 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

  - 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

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
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
<b>Total</b>	<b>84</b>	<b>100</b>

## 4.6 ENERGY CONSERVATION

L T P  
3 - 2

### RATIONALE

The requirement of energy has increased manifold in last two decades due to rapid urbanization and growth in industrial/service sector. It has become a 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 an 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 equipment's.
- 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 Color 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](http://www.beeindia.gov.in).
- (ii) Ministry of New and Renewable Energy (MNRE), Government of India.  
[www.mnre.gov.in](http://www.mnre.gov.in).

- (iii) Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. [www.upneda.org.in](http://www.upneda.org.in).
- (iv) **Central Pollution Control Board (CPCB)**, Ministry of Environment, Forest and Climate Change, Government of India. [www.cpcb.nic.in](http://www.cpcb.nic.in).
- (v) **Energy Efficiency Services Limited (EESL)**. [www.eeslindia.org](http://www.eeslindia.org).
- (vi) Electrical India, Magazine on power and electrical products industry. [www.electricalindia.in](http://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 Layal 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 organized during the semester break starting after second year i.e. after 4<sup>th</sup> 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 5<sup>th</sup> 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 4<sup>th</sup> 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% |

## 5.1 WATER AND WASTE WATER ENGINEERING

L T P  
6 - 2

### RATIONALE

One of the basic necessities of life is water which is not easily available to a lot of people. Providing potable water at the first place then collection and disposal of waste solids and liquids are important activities of civil engineering field. This subject provides basic knowledge and skills in the field of water supply system and waste disposal system. Classroom instructions should be supplemented by field visits to show functional details of water supply and waste disposal systems. It will also be advantageous to invite professionals from field to deliver extension lectures on specialized operations.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Calculate the water requirement for a particular population
- Check and improve the quality of water by giving required treatment to water
- Calculate the size of different pipes to carry water
- Lay the network of pipes for water supply as well as sewerage in a building
- Draw the location of different appurtenances
- Carry out the disposal of sewage
- Supervise the water supply and waste water schemes

### DETAILED CONTENTS

#### A. WATER SUPPLY

1. Introduction (04 Periods)
  - 1.1 Necessity and brief description of water supply system.
  - 1.2 Sources of water – surface/sub-surface sources
2. Quantity of Water (08 Periods)
  - 2.1 Water requirement
  - 2.2 Rate of demand and variation in rate of demand
  - 2.3 Per capita consumption for domestic, industrial, public and fire fighting uses as per BIS standards (no numerical problems)
  - 2.4 Population Forecasting

3. Quality of Water (05 Periods)
- 3.1 Meaning of pure water and methods of analysis of water
  - 3.2 Physical, Chemical and bacteriological tests and their significance
  - 3.3 Standard of potable water as per Indian Standard
  - 3.4 Maintenance of purity of water
4. Water Treatment (brief introduction) (10 Periods)
- \*\*4.1 Sedimentation - purpose, types of sedimentation tanks
  - \*\*4.2 Coagulation/flocculation - usual coagulation and their feeding
  - \*\*4.3 Filtration - significance, types of filters, their suitability
  - 4.4 Necessity of disinfection of water, forms of chlorination, break point chlorine, residual chlorine, application of chlorine.
  - 4.5 Flow diagram of different treatment units, functions of (i) Aeration fountain (ii) mixer (iii) flocculator, (iv) classifier, (v) slow and rapid sand filters (vi) chlorination chamber.
5. Conveyance of Water (08 Periods)
- \*\*5.1 Different types of pipes - cast iron, PVC, steel, asbestos cement, concrete and lead pipes. Their suitability and uses, types of joints in different types of pipes.
  - 5.2 Appurtenances: Sluice, air, reflux valves, relief valves, scour valves, bib cocks, stop cocks, fire hydrants, water meters their working and uses
6. Laying of Pipes (05Periods)
- 6.1 Setting out alignment of pipes
  - 6.2 Excavation for laying of pipes and precautions to be taken
  - 6.3 Handling, lowering and jointing of pipes
  - 6.4 Testing of pipe lines
  - 6.5 Back filling
7. Building Water Supply (02 Periods)
- 7.1 Connections to water main (practical aspect only)
  - \*\*7.2 Water supply fittings (with sketches) and terminology related to plumbing

## **B. WASTE WATER ENGINEERING**

8. Introduction (05 Periods)
- 8.1 Purpose of sanitation
  - 8.2 Necessity of systematic collection and disposal of waste

- 8.3 Definition of terms in sanitary engineering
  - 8.4 Collection and conveyance of sewage
  - 8.5 Conservancy and water carriage systems, their advantages and Disadvantages
  - 8.6 (a) Surface drains (only sketches) : various types, suitability  
(b) Types of sewage: Domestic, industrial, storm water and its seasonal variation
9. Sewerage System (05 Periods)
- 9.1 Types of sewerage systems, materials for sewers, their sizes and joints
  - 9.2 Appurtenance: Location, function and construction features. Manholes, drop manholes, tank hole, catch basin, inverted siphon, flushing tanks grease and oil traps, storm regulators, ventilating shafts
10. Laying and Construction of Sewers (07 Periods)
- 10.1 Setting out/alignment of sewers
  - 10.2 Excavations, checking the gradient with boning rods preparation of bedding, handling and jointing testing and back filling of sewers/pipes.
  - 10.3 Construction of surface drains and different sections required
- 11 Sewage Characteristics (05 Periods)
- 11.1 Properties of sewage and IS standards for analysis of sewage
  - 11.2 Physical, chemical and bacteriological parameters
12. Natural Methods of Sewerage Disposal (05 Periods)
- 12.1 General composition of sewage and disposal methods
  - 12.2 Disposal by dilution
  - 12.3 Self purification of stream
  - 12.4 Disposal by land treatment
  - 12.5 Nuisance due to disposal
13. Sewage Treatment (10 Periods)
- 13.1 Meaning and principle of primary and secondary treatment and activated sludge process their flow diagrams
  - 13.2 Introduction and uses of screens, grit chambers, detritus tanks, skimming tanks, plain sedimentation tanks, primary clarifiers, secondary clarifiers, filters, control beds, intermittent sand filters, trickling filters, sludge treatment and disposal, oxidation ponds (Visit to a sewage treatment plant) Oxidation ditch, duckweed pond, Vermin culture

14. Building Drainage (03 Periods)

- 14.1 Aims of building drainage and its requirements
- \*\*14.2 Different sanitary fittings and installations
- 14.3 Traps

15. Introduction to smart water supply and waste water management (02 Periods)

\*\* A field visit may be planned to explain and show the relevant things.

### LIST OF PRACTICALS

- 1) To determine turbidity of water sample by (i) JTU (ii) NTU
- 2) To determine dissolved oxygen of given sample
- 3) To determine pH value of water
- 4) To perform jar test for coagulation
- 5) To determine BOD of given sample
- 6) To determine residual chlorine in water
- 7) To determine conductivity of water and total dissolved solids
- 8) To study the installation of following:
  - a) Water meter
  - b) Connection of water supply of building with main
  - c) Pipe valves and bends
  - d) Water supply and sanitary fittings
- 9) To study and demonstrate the joining/Periodseading of GI Pipes, CI Pipes, SWG pipes, PVC pipes and copper pipes.
- 10) To demonstrate the laying of SWG pipes for sewers
- 11) Study of water purifying process by visiting a field lab.
- 12) Demonstration of plumbing tools.
- 13) Testing of pipes (GI, CI, PVC, SWG) as per BJI standards.

### INSTRUCTIONAL STRATEGY

Before imparting the instructions in the class room, visits to water works and sewage treatment plants can go a long way for increased motivation of students for learning in the class room. As the subject is of practical nature, lecture work be supplemented by field visits from time to time. Home assignments related to collection of information, pamphlets and catalogues from hardware shop dealing water supply and sanitary fittings will be very helpful for the students.

### MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Actual Practical Performance
- Report writing of field visit

– Viva-Voce

### RECOMMENDED BOOKS

1. Elements of Public Health Engineering by Duggal, KN; S. Chand and Co. New Delhi
2. Water Supply and Sanitary Engineering by Rangwala, SC; Charotar Book Stall, Anand
3. Water Supply Engineering by Kshirsagar, SR; Roorkee Publishing House, Roorkee
4. Sewage and Sewage Treatment by Kshirsagar, SR; Roorkee Publishing House, Roorkee
5. Water Supply and Sanitary Engineering by Birdie, GS; Dhanpat Rai and Sons, Delhi
6. Water Supply Engineering by Garg, Santosh Kumar; Khanna Publishers, Delhi
7. Sewage and Waste Water Disposal Engineering by Garg, Santosh Kumar; Khanna Publishers, Delhi
8. A Laboratory Manual in Public Health Engineering by Duggal, Ajay K and Sharma, Sanjay; Galgotia Publications, 2006, New Delhi
9. 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	04	05
2	08	10
3	05	06
4	10	12
5	08	10
6	05	06
7	02	20
8	05	06
9	05	06
10	07	07
11	05	06
12	05	06
13	10	12
14	03	06
15	02	02
<b>Total</b>	<b>84</b>	<b>100</b>

## 5.2 RAILWAYS, BRIDGE AND TUNNELS

L T P  
6 - -

### RATIONALE

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

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

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

### DETAILED CONTENTS

#### PART – I: RAILWAYS

(30 Periods)

1. Introduction to Indian Railways
2. Mass Transit System: Metro, Mono-rail, Tube
3. Railway surveys: Factors influencing the railways route, brief description of various types of railway survey
4. Classification of permanent way describing its component parts
5. Rail Gauge: Definition, types, practice in India (gauges in different countries knowledge scale)
6. Rails – types of rails
7. Rail Welding and its types
8. Rail Fastenings: Rail joints, types of rail joints, fastenings for rails, fish plates, bearing plates
9. Sleepers: Functions of sleepers, types of sleepers, requirements of an ideal material for sleepers.
10. Ballast: Function of ballast, requirements of an ideal material for ballast
11. Points of Crossings and signaling: Brief description regarding different types of crossings/signaling
12. Maintenance of track: Necessity, maintenance of track, inspection of soil, track and fixtures; maintenance and boxing of ballast maintenance gauges, tools

13. Earth work and drainage: Features of rail road, bed level, width of formation, side slopes, drains, methods of construction, requirement of drainage system
14. Station and yards: purpose and types of stations and yards

**PART-II: BRIDGES**

(30 Periods)

13. Introduction

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

14. Classification of Bridges

Their structural elements and suitability:

- 14.1 According to life-permanent and temporary
- 14.2 According to deck level – Deck, through and semi-through
- 14.3 According to material –timber, masonry, steel, RCC, pre-stressed
- 14.4 According to structural form;
  - Grade Separators-Railway Road Over Bridges (ROB), Road Under Bridge (RUB)
  - Beam type –RCC, T-Beam, steel girder bridges, plate girder and box girder, balanced cantilever, Trussed bridges.
  - Arch type – open spandrel and filled spandrel barrel and rib type
  - Suspension type – unstiffened and stiffened and table (its description with sketches)
  - According to the position of highest flood level submersible and non submersible
- 14.5 IRS, IRC introduction of IRS and IRC
- 14.6 Concept of Railway ROB and RUB – Precast components of ROB, drainage problems and solutions of RUB

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

16. Piers, Abutments, Retaining walls, Wing walls and Toe walls

- 16.1 Piers-definition, parts; types –solid (masonry and RCC), open
- 16.2 Abutments and wing walls – definition, types of abutments (straight and tee), abutment with wing walls (straight, splayed, return and curved)
- 16.3 Toe walls: Importance and Functions
- 16.4 Retaining Walls: Types, functions, parts, MSE(Mechanically stabilized earth) walls

17. Bridge bearings

Purpose of bearings; types of bearings – fixed plate, rocker and roller and pin bearing, Elastomeric bearings, PTFE bearing, Sliding bearing.

18. Super structure: Components, features, cross-section and services, footpath, median crash banner, lightpole.

19. Maintenance of Bridges

19.1 Inspection of bridges

19.2 Routine maintenance

**PART - III: TUNNELS**

(24 Periods)

20. Definition and necessity of tunnels, method of tunneling, machinery used in tunneling

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

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

23. Drainage method of draining water in tunnels

24. Lighting of tunnels

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

ii) Examiners should set questions from all the parts

**INSTRUCTIONAL STRATEGY**

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

**MEANS OF ASSESSMENT**

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

- Model Making
- Report writing
- Viva-voce

## RECOMMENDED BOOKS

1. Railway Engineering by Vaswani, NK; Publishing House, Roorkee
2. Railway Engineering by Rangwala, SC; Anand, Charotar Book Stall
3. A Text Book of Railway Engineering by Deshpande, R; Poonam United Book Corporation
4. Bridge Engineering by Algia, JS; Charotar Book Stall, Anand
5. Essentials of Bridge Engineering by Victor Johnson; Oxford and IBH, Delhi
6. Bridge Engineerin” by Rangwala S.C; Charotar Book Stall, Anand
7. IRC Bridge Codes
8. MoRTH drawings for various types of bridges
9. MoRTH pocket books for bridge Engineers, 2000 (First Revision)
10. Tunnel Engineering by Subhash C Saxena; Dhanpat Rai and Sons, Delhi
11. E-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

### Websites for Reference:

<http://swayam.gov.in>

### *SUGGESTED DISTRIBUTION OF MARKS*

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	30	36
2	30	36
3	24	28
<b>Total</b>	<b>84</b>	<b>100</b>

## 5.2 SOLID WASTE MANAGEMENT

L T P

4 - -

### Objective:

Following are the objectives of this course:

- To know various sources of solid.
- To learn techniques of collection and transportation of solid waste.
- To know various methods of disposal of solid waste.
- To understand and identify different biomedical and E-waste and their subsequent disposal techniques.

### Course outcomes:

After competing this course, student will be able to:

- Identify the sources of solid waste.
- Select the relevant method of collection and transportation of solid waste.
- Suggest an action plan for composting of solid waste.
- Devise suitable disposal technique for solid waste
- Use the relevant method for disposal of Bio-medical and E-waste.

### Course Content:

- 1. Introduction (10 Periods)**
  - 1.1 Definition of solid waste, different solid waste – domestic Waste, commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste, etc.
  - 1.2 Sources of solid waste, Classification of solid waste – hazardous and non-hazardous waste.
  - 1.3 Physical and chemical characteristics of municipal solid waste.
- 2. Storage, Collection and Transportation of Municipal Solid Waste (12 Periods)**
  - 2.1 Collection, segregation, storage and transportation of solid waste.
  - 2.2 Tools and Equipment-Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community bin - like movable and stationary bin.
  - 2.3 Transportation vehicles with their working capacity -Animal carts, Auto vehicles, Tractors or Trailers, Trucks, Dumpers, Compactor vehicles. Transfer station- meaning, necessity, location.
  - 2.4 Role of rag pickers and their utility for society.
- 3. Composting of Solid Waste (10 Periods)**
  - 3.1 Concept of composting of waste, Principles of composting process. Factors affecting the composting process.
  - 3.2 Methods of composting – Manual Composting – Bangalore method, Indore Method, Mechanical Composting – Dano- Process, Vermi- composting.
- 4. Techniques for Disposal of Solid Waste (14 Periods)**

- 4.1 Solid waste management techniques – solid waste management hierarchy, waste prevention and waste reduction techniques
- 4.2 Land filling technique, Factors to be considered for site selection, Land filling methods-Area method, Trench method and Ramp method, Leachate and its control, Biogas from landfill, Advantages and disadvantages of landfill method, Recycling of municipal solid waste
- 4.3 Incineration of waste: Introduction of incineration process, Types of incinerators - Flash, Multiple chamber Incinerators, Products of incineration process with their use, Pyrolysis of waste – Definition, Methods

## **5. Biomedical and E-waste management**

**(10 Periods)**

- 5.1 Definition of Bio medical Waste.
- 5.2 Sources and generation of Biomedical Waste and its classification
- 5.3 Bio medical waste Management technologies.
- 5.4 Definition, varieties and ill effects of E- waste,
- 5.5 Recycling and disposal of E- waste.

### **MEANS OF ASSESSMENT**

- Assignments and quiz/class tests
- Mid-term and end-term written tests
- Presentations
- Site Visit/ Report Writing
- Viva-voce

### **Suggested learning resources:**

1. Gupta O.P, Elements of Solid Hazardous Waste Management, Khanna Book Publishing Co., Delhi Ed. 2018
2. Bhide, A. D., Solid Waste Management, Indian National Scientific Documentation Centre, New Delhi.
3. George Techobanoglous, Kreith, Frank., Solid Waste, McGraw Hill Publication, New Delhi.
4. Sasikumar, K., Solid Waste Management, PHI learning, Delhi.
5. Hosetti, B.B., Prospect and Perspectives of Solid Waste Management, New Age International Publisher.

### **Websites for Reference:**

<http://swayam.gov.in>

**SUGGESTED DISTRIBUTION OF  
MARKS**

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	10	18
2	12	22
3	10	18
4	14	24
5	10	18
<b>Total</b>	<b>56</b>	<b>100</b>

## 5.4 SOIL MECHANICS AND FOUNDATION ENGINEERING

L T P  
6 - 2

### RATIONALE

Civil Engineering diploma engineers are required to supervise the construction of roads, pavements, dams, embankments, and other Civil Engineering structures. As such the knowledge of basic soil engineering is the pre-requisite for these engineers for effective discharge of their duties. This necessitates the introduction of Soil and Foundation Engineering subject in the curriculum for Diploma Course in Civil Engineering.

The subject covers only such topics which will enable the diploma engineers to identify and classify the different types of soils, their selection and proper use in the field for various types of engineering structures.

The emphasis will be more on teaching practical aspect rather than theory.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Identify and classify various types of soils
- Select particular type of foundation according to loading of structure
- Determine shear strength of soil
- Carry out compaction of soils as per density
- Calculate bearing capacity of soil
- Calculate liquid limit and plastic limit of soil
- Calculate maximum dry density of soil and optimum moisture content of soil
- Perform various tests of the soil
- Apply different techniques for improving the engineering properties of soil.

### DETAILED CONTENTS

1. Introduction (03 Periods)
  - 1.1 Importance of Soil Studies in Civil Engineering
  - 1.2 Geological origin of soils with special reference to soil profiles in India: residual and transported soil, alluvial deposits, lake deposits, local soil found in UP, dunes and loess, glacial deposits, black cotton soils, conditions in which above deposits are formed and their engineering characteristics.
  - 1.3 Names of organizations dealing with soil engineering work in India, soil map of India

2. Physical Properties of Soils (06 Periods)
  - 2.1 Constituents of soil and representation by a phase diagram
  - 2.2 Definitions of void ratio, porosity, degree of saturation, water content, specific gravity, unit weight, bulk density/bulk unit weight, dry unit weight, saturated unit weight and submerged unit weight of soil grains and correlation between them
  - 2.3 Simple numerical problems with the help of phase diagrams
  
3. Classification and Identification of Soils (06 Periods)
  - 3.1. Particle size, shape and their effect on engineering properties of soil, particle size classification of soils
  - 3.2 Gradation and its influence on engineering properties
  - 3.3 Relative density and its use in describing cohesionless soils
  - 3.4 Behavior of cohesive soils with change in water content, Atterberg's limit - definitions, use and practical significance including numerical problems
  - 3.5 Field identification tests for soils
  - 3.6 Soil classification system as per IS 1498; basis, symbols, major divisions and sub divisions, groups, plasticity chart; procedure for classification of a given soil
  
4. Flow of Water Through Soils (05 Periods)
  - 4.1 Concept of permeability and its importance
  - 4.2 Darcy's law, coefficient of permeability, seepage velocity and factors affecting permeability
  - 4.3 Comparison of permeability of different soils as per Indian Standards
  - 4.4 Measurement of permeability in the laboratory
  - 4.5 Simple numerical problems
  
5. Effective Stress (Concept only) (05 Periods)
  - 5.1 Stresses in subsoil
  - 5.2 Definition and meaning of total stress, effective stress and neutral stress
  - 5.3 Principle of effective stress
  - 5.4 Importance of effective stress in engineering problems
  
6. Deformation of Soils (06 Periods)
  - 6.1 Meaning, conditions/situations of occurrence with emphasis on practical significance of:

- a) Consolidation and settlement
  - b) Creep
  - c) Plastic flow
  - d) Heaving
  - e) Lateral movement
  - f) Freeze and thaw of soil
- 6.2 Definition and practical significance of compression index, coefficient of consolidation, degree of consolidation.
- 6.3 Meaning of total settlement, uniform settlement and differential settlement; rate of settlement and their effects
- 6.4 Settlement due to construction operations and lowering of water table
- 6.5 Tolerable settlement for different structures as per IS
- 6.6 Simple numerical problems
7. Shear Strength of Soil (10 Periods)
- 7.1 Concept and Significance of shear strength
- 7.2 Factors contributing to shear strength of cohesive and cohesion less soils, Coulomb's law
- 7.3 Determination of shearing strength by direct shear test, unconfined compression test and vane shear test. Drainage conditions of test and their significance
- 7.4 Stress and strain curve, peak strength and ultimate strength, their significance
- 7.5 Examples of shear failure in soils
- 7.6 Numerical problems
8. Compaction (06 Periods)
- 8.1 Definition and necessity of compaction
- 8.2 Laboratory compaction test (standard and modified proctor test as per IS) definition and importance of optimum water content, maximum dry density; moisture dry density relationship for typical soils with different compactive efforts
- 8.3. Compaction control; Density control, measurement of field density by core cutter method and sand replacement method, moisture control, Proctor's needle and its use, thickness control, jobs of an embankment supervisor in relation to compaction
9. Soil Exploration (08 Periods)
- 9.1 Purpose and necessity of soil exploration
- 9.2 Reconnaissance, methods of soil exploration, Trial pits, borings (auger, wash, rotary, percussion to be briefly dealt)

- 9.3 Sampling; undisturbed, disturbed and representative samples; selection of type of sample; thin wall and piston samples; area ratio, recovery ratio of samples and their significance, number and quantity of samples, resetting, sealing and preservation of samples.
- 9.4 Presentation of soil investigation results
- 10 Bearing Capacity of soil (14 Periods)
- 10.1 Concept of bearing capacity
- 10.2 Definition and significance of ultimate bearing capacity, net safe bearing capacity and allowable bearing pressure
- 10.3 Guidelines of BIS (IS 6403) for estimation of bearing capacity
- 10.4 Factors affecting bearing capacity
- 10.5 Concept of vertical stress distribution in soils due to foundation loads, pressure bulb
- 10.6 Applications of SPT, unconfined compression test and direct shear test in estimation of bearing capacity
- 10.7 Plate load test (no procedure details) and its limitations
- 10.8 Simple numerical problems on bearing capacity.
11. Foundation Engineering (10 Periods)
- Concept of shallow and deep foundation; types of shallow foundations: combined, isolated, strip, mat, and their suitability. Factors affecting the depth of shallow foundations, deep foundations, type of piles and their suitability; pile classification on the basis of material, pile group and pile cap.
12. Ground improvement techniques (05 Periods)
- Pre-loading, vibro compaction, stone columns, soil nailing, grouting, sand drain.

## **PRACTICAL EXERCISES**

1. To determine the moisture content of a given sample of soil
2. Auger Boring and Standard Penetration Test
  - a) Identifying the equipment and accessories
  - b) Conducting boring and SPT at a given location
  - c) Collecting soil samples and their identification
  - d) Preparation of boring log and SPT graphs
  - e) Interpretation of test results

3. Extraction of Disturbed and Undisturbed Samples
  - a) Extracting a block sample
  - b) Extracting a tube sample
  - c) Extracting a disturbed samples for mechanical analysis.
  - d) Field identification of samples
  
4. Field Density Measurement (Sand Replacement and Core Cutter Method)
  - a) Calibration of sand
  - b) Conducting field density test at a given location
  - c) Determination of water content
  - d) Computation and interpretation of results
  
5. Liquid Limit and Plastic Limit Determination:
  - a) Identifying various grooving tools
  - b) Preparation of sample
  - c) Conducting the test
  - d) Observing soil behavior during tests
  - e) Computation, plotting and interpretation of results
  
6. Mechanical Analysis
  - a) Preparation of sample
  - b) Conducting sieve analysis
  - c) Computation of results
  - d) Plotting the grain size distribution curve
  - e) Interpretation of the curve
  
7. Laboratory Compaction Tests (Standard Proctor test)
  - a) Preparation of sample
  - b) Conducting the test
  - c) Observing soil behavior during test
  - d) Computation of results and plotting
  - e) Determination of optimum moisture and maximum dry density
  
8. Direct Shear Test
9. Permeability Test
10. Demonstration of Unconfined Compression Test
  - a) Specimen preparation
  - b) Conducting the test
  - c) Plotting the graph
  - d) Interpretation of results and finding/bearing capacity
  
11. Demonstration of Vane shear Test

## **INSTRUCTIONAL STRATEGY**

The teacher while imparting instructions are expected to lay greater emphasis on the practical aspects rather than theory and mathematical treatment. To bring clarity regarding concepts and principles involved, teachers should organize demonstrations in the laboratories and fields. It is necessary to create understanding that soils fail either under shear or settlement due to heavy loads. This can be shown by making use of photographs on working models of such failures. Efforts should be made in the practical classes that students perform practical exercises individually. Conduct of viva examination at the end of each practical work will develop clear understanding about the concepts and principles related to this subject.

## **MEANS OF ASSESSMENT**

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

## **RECOMMENDED BOOKS**

1. Soil Mechanics and Foundations by Punmia, BC; Standard Publishers, Delhi
2. Soil Mechanics and Foundations Engineering by Bharat Singh and Shamsheer Prakash; Nem Chand and Bros, Roorkee,
3. Soil Sampling and Testing - A Laboratory Manual by Duggal, AK., Ramana, TR., Krishnamurthy, S; Galgotia Publications, Delhi
4. BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)
5. Shallow Foundations by NITTTR, Chandigarh
6. Video films on Geo-technical Laboratory Practices by Vinod Kumar; NITTTR, Chandigarh
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***

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	03	04
2	06	07
3	06	07
4	05	07
5	05	06
6	06	07
7	10	12
8	06	07
9	08	09
10	14	16
11	10	12
12	05	06
<b>Total</b>	<b>84</b>	<b>100</b>

## 5.5 SURVEYING – II

L T P  
4 - 8

### RATIONALE

The important functions of a 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 knowledge and skill in theodolite surveying, tachometry surveying, curves and use of minor and modern instruments have been included in this subject.

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, students will be able to:

- Interpolate contours on a given sheet of paper
- Align a proposed road
- Draw a contour plan of an area
- Calculate earth work for a road from a contour map
- Prolong a line with theodolite
- Conduct closed traversing
- Measure horizontal and vertical angles
- Set out simple circular curve
- Read Total Station, EDM and Auto level

### DETAILED CONTENTS

#### 1. Contouring (08 Periods)

Concept of contours, purpose of contouring, contour interval and horizontal equivalent, factors effecting contour interval, characteristics of contours, methods of contouring: Direct and indirect, use of stadia measurements in contour survey, interpolation of contours; use of contour map, Drawing cross section from a contour map; marking alignment of a road, railway and a canal on a contour map, computation of earth work and reservoir capacity from a contour map

2. Theodolite Surveying (14 Periods)

Working of a transit vernier theodolite, axes of a theodolite and their relation; temporary adjustments of a transit theodolite; concept of transiting, swinging, face left, face right and changing face; measurement of horizontal and vertical angles. Prolonging a line (forward and backward) measurement of bearing of a line; traversing by included angles and deflection angle method; traversing by stadia measurement, theodolite triangulation, plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected), errors in theodolite survey and precautions taken to minimize them; limits of precision in theodolite traversing. Height of objects – accessible and non-accessible bases

3. Tacho-metric surveying (08 Periods)

Tachometry, Instruments to be used in tachometry, methods of tachometry, stadia system of tachometry, general principles of stadia tachometry, examples of stadia tachometry and Numerical problems.

4. Curves (10 Periods)

4.1 Simple Circular Curve

Need and definition of a simple circular curve; Elements of simple circular curve - Degree of the curve, radius of the curve, tangent length, point of intersection (Apex point), tangent point, length of curve, long chord deflection angle, Apex distance and Mid-ordinate. Setting out of simple circular curve:

a) By linear measurements only:

- Offsets from the tangent
- Successive bisection of arcs
- Offsets from the chord produced

b) By tangential angles using a theodolite

4.2 Transition Curve

Need (centrifugal force and super elevation) and definition of transition curve; requirements of transition curve; length of transition curve for roads; by cubic parabola; calculation of offsets for a transition curve; setting out of a transition curve by tangential offsets only

4.3 Vertical curve

Setting out of a vertical curve

5. Introduction to the use of Modern Surveying equipment and techniques such as (08 Periods)

a) EDM or Distomat

- b) Planimeter (Digital)
  - c) Total station
  - d) Introduction to remote sensing and GPS
  - e) Auto level
  - f) Digital theodolite
6. Total station- installation, calibration concept of coordinate system (04 Periods)
7. Analysis of data, plotting, Remote sensing , GIS & GPS concept and application in various fields (04 Periods)

**NOTE:** No sketch of the instruments may be asked in the examination

### **PRACTICAL EXERCISES**

#### **I. Contouring**

- i) Preparing a contour plan by radial line method by the use of a Tangent Clinometer/Tachometer
- ii) Preparing a contour plan by method of squares
- iii) Preparing a contour plan of a Road/Railway track/Canal by taking cross sections.

#### **II. Theodolite**

- i) Taking out the Theodolite, mounting on the tripod and placing it back in the box
- ii) Study of a transit vernier theodolite; temporary adjustments of theodolite
- iii) Reading the vernier and working out the least count, measurement of horizontal angles by repetition and reiteration methods
- iv) Measurement of vertical angles and use of tachometric tables
- v) Measurement of magnetic bearing of a line
- vi) Running a closed traverse with a theodolite (at least five sides) and its plotting
- vii) Height of objects with and without accessible bases

#### **III. Curves**

- i) Setting out of a simple circular curve with given data by the following methods
  - a) Offsets from the chords produced
  - b) One theodolite method

#### **IV. Minor instruments**

- i) Demonstration and use of minor instruments like Ceylon Ghat Tracer, Tangent Clinometer, Pentagraph, Abney level etc.

- ii) Use of planimeter for computing areas
- V. Demonstration of digital instruments Periodic field visits to Survey of India and other government agencies.
- VI. To plot an area with the help of Total Station

### **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

### **MEANS OF ASSESSMENT**

- Mid-term and end-term written tests
- Actual Practical Performance
- Viva-Voce

### **RECOMMENDED BOOKS**

1. A Text Book of Surveying by Kocher, CL; Katson Publishing House Ludhiana,
2. Surveying and Leveling by Kanetkar, TP and Kulkarni, SV; AVG Parkashan, Pune
3. Surveying and Leveling-Vol.2 by Kanetkar, TP and Kulkarni, SV; AVG Prakashan, Pune
4. Surveying and Leveling by Punima, BC; Standard Publishers Distributors, Delhi
5. Surveying-II by Mahajan, Sanjay; Satya Prakashan, Delhi
6. 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**

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	08	14
2	14	25
3	08	14
4	10	18
5	08	14
6	04	08
7	04	07
<b>Total</b>	<b>56</b>	<b>100</b>

## 5.6 WASTE WATER & IRRIGATION ENGINEERING DRAWING

<b>L</b>	<b>T</b>	<b>P</b>
-	-	6

### RATIONALE

Diploma holders in Civil Engineering are expected to supervise construction of water supply and wastewater treatment works and irrigation structures. This subject aims at imparting skills for preparing water supply and waste water and irrigation engineering drawings to develop competencies for reading the drawings, and their execution in their field.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Draw the drawings of traps, manholes and inspection chambers
- Draw the drawing of water supply plan of building
- Draw the sewerage plan of buildings
- Draw the drawing of channel (L-section and cross-section)
- Draw and demonstrate cross-section of an earthen dams
- Draw layout plan of a canal head works
- Read and interpret the Public Health and Irrigation Engineering Drawings

### DETAILED CONTENTS

#### Drawings Exercises

#### PART A

### WATER SUPPLY AND WASTE WATER ENGINEERING DRAWING

1. Drains and Sewers
  - 1.1 Cross section of standard types of open drains (circular, V-shaped and U-shaped) with their foundations
  - 1.2 Cross section of earthen ware and RCC sewer pipes
  - 1.3 Cross sections of masonry sewers (circular and egg shaped)
2. Traps, manholes and inspection chamber

- 2.1 Detailed section of floor trap and gully trap
- 2.2 Detailed plan and section of an inspection chamber
- 2.3 Detailed plan and section of a manhole
  
3. Septic Tank and Soak Pit  
  
Detailed plan and cross sections of a domestic septic tank for 10 users. Draw detailed X-section of an empty soak pit and filled soak.
  
4. Bath room and W.C connections:
  - 4.1 Cross-section through the external wall of lavatories at ground and first floor showing the one and two pipe system and the connections of the lavatory to inspection chamber
  - 4.2. Plan of a bathroom showing positions of lavatory, bath tub, wash-basin, taps and showers
  
5. Study of drawing of two storied building showing details of one pipe and two pipes systems with sanitation system.
  
6. Practice of reading water supply and sanitary engineering working drawings (PWD/urban Development agencies) including hot water and cold water supply system of a two room set.

## **PART B**

### **B) IRRIGATION ENGINEERING DRAWING:**

1. Typical cross-section of a channel
  - L-section of a channel for given data
  - Typical cross section of an unlined and lined channel in cutting, partly cutting and partly filling and fully in filling with given design data.
  
2. Layout plan of a canal head works
  
3. Draw the typical L-section of a weir
  
4. Draw the X-section of an Earthen Dam
  - i) Homogeneous
  - ii) Zoned type
  - iii) Diaphragm type
  
5. Cross section of a tube well with pump house.

6. Layout and cross section of rain water harvesting system.

**Important Note: i) Use of BIS: 456-2000 is permitted in the examination  
ii) Paper should be set from Part A and Part B of equal marks**

### **INSTRUCTIONAL STRATEGY**

Teachers are expected to develop skills in preparation and interpretation of water supply and waste water engineering drawings as per BIS codes of practice. Attention must be paid towards line work, specifications writing, dimensioning, proportioning and accuracy for industrial unit at different intervals of time. Reading and interpreting actual field drawings should also be practiced so as to develop necessary competency in the students.

### **MEANS OF ASSESSMENT**

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

### **RECOMMENDED BOOKS**

4. Civil Engineering Drawing by Loyal JS ; Satya Parkashan, New Delhi
5. Civil Engineering Drawings by Chandel RP
6. Civil Engineering Drawing by Kumar NS; IPH, New Delhi
7. Civil Engineering Drawing by Malik RS and Meo GA ; Asian Publishing House, New Delhi
8. Civil Engineering Drawing by S.K. Garg; Khanna Publishers.
9. e-books/e-tools/relevant software to be used as recommended by AICTE/UBTE/NITTTR, Chandigarh.

### **Websites for Reference:**

<http://swayam.gov.in>

## 5.7 Universal Human Values

L-T-P  
2-0-1

### Course Objectives

This introductory course input is intended

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature

Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.

### Course Methodology

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or value prescriptions.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their pre-conditionings and present beliefs.

### The syllabus for the lectures is given below:

- After every two lectures of one hour each, there is one hour practice session.
- The assessment for this subject is as follows:
- Sessions Marks (Internal): 20
- Practical Marks (External): 30
- Total Marks: 50

### UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority

5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

### **UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself!**

1. Understanding human being as a co-existence of the sentient 'I' and the material the Body'
2. Understanding the needs of Self ('I') and 'Body' - *Sukh* and *Suvidha*
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure *Sanyam* and *Swasthya*  
-Practice Exercises and Case Studies will be taken up in Practice Sessions.

### **UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship**

1. *Understanding Harmony in the family – the basic unit of human interaction*
2. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*;  
a. Trust (*Vishwas*) and Respect (*Samman*) as the foundational values of relationship
3. Understanding the meaning of *Vishwas*; Difference between intention and competence
4. Understanding the meaning of *Samman*, Difference between respect and differentiation; the othersalient values in relationship
5. Understanding the harmony in the society (society being an extension of family): *Samadhan*, *Samridhi*, *Abhay*, *Sah-astitvaas* comprehensive Human Goals
6. Visualizing a universal harmonious order in society- Undivided Society (*AkhandSamaj*), Universal Order (*SarvabhaumVyawastha* )- from family to world family!  
-Practice Exercises and Case Studies will be taken up in Practice Sessions.

### **UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence**

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
3. Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence  
-Practice Exercises and Case Studies will be taken up in Practice Sessions.

### **UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics**

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. Competence in professional ethics:

- a) Ability to utilize the professional competence for augmenting universal human order
  - b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
  - c) Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
  6. Strategy for transition from the present state to Universal Human Order:
    - a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
    - b) At the level of society: as mutually enriching institutions and organizations
  7. To inculcate Human Values among Students: The Role of self, Parents and Teachers  
-Practice Exercises and Case Studies will be taken up in Practice Sessions.

**Practical Session also Includes Different Yogic Exercises and Meditation Session**

**INSTRUCTIONAL STRATEGY**

The content of this course is to be taught on conceptual basis with plenty of real world examples.

**MEANS OF ASSESSMENT**

- Assignments and quiz/class tests,
- Mid-term and end-term written tests
- Practical assessment

**Reference Material**

The primary resource material for teaching this course consists of

- a. The text book (Latest Edition)
  - R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.
- b. The teacher's manual (Latest Edition)
  - R.R Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.

In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:

1. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers.
3. Sussan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *limits to Growth*, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.

8. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.

**Relevant websites, movies and documentaries**

1. Value Education websites, <http://uhv.ac.in>, <http://www.aktu.ac.in>
2. Story of Stuff, <http://www.storyofstuff.com>
3. Al Gore, *An Inconvenient Truth*, Paramount Classics, USA
4. Charlie Chaplin, *Modern Times*, United Artists, USA
5. IIT Delhi, *Modern Technology—the Untold Story*
6. Case study Hevade Bazar Movie
7. RC Shekhar, *Ethical Contradiction*, Trident New Delhi
8. *Gandhi A., Right Here Right Now*, Cyclewala Production

***SUGGESTED DISTRIBUTION OF MARKS***

<b>Unit</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	08	20
2	08	20
3	08	20
4	08	20
5	10	20
<b>Total</b>	<b>42</b>	<b>100</b>

## SURVEY CAMP

**10 Days Duration**

### PURPOSE

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

### LEARNING OUTCOMES

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

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

#### **Task:**

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

The students may be assigned an undulated area of about 1.5 to 2.00 sq.km. with level difference of 15m consisting of good number of physical features such as buildings, roads, bridges, culverts, railway tracks, electric lines etc. They are required to prepare the topographic map of above areas showing various features along with contours using a suitable contour interval. They will mark a road alignment of given gradient connecting any two stations on the map consisting some horizontal and vertical curves and will prepare estimate of earthwork and submit the detailed technical report indicating therein practical difficulties faced during surveying for the features like ridge, line, valley lines, saddle cliffs etc.

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

### MEANS OF ASSESSMENT

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

## 6.1 QUANTITY SURVEYING AND VALUATION

L T P  
6 - -

### RATIONALE

Diploma holders in Civil Engineering are supposed to prepare material estimates for various Civil Engineering works namely; buildings, irrigation works, public health works and roads etc. In addition, they must have basic knowledge regarding analysis of rates, contracting, principles of valuation. Therefore, this subject has great importance for diploma holders in Civil Engineering.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain different units of measurement for different items
- Calculating quantities of materials and prepare the material chart
- Prepare detailed and abstract of estimates from drawings
- Prepare tender document of different civil engineering items by using C.S.R. rates with premium
- Use principles of valuation for valuation of a building

### DETAILED CONTENTS

1. Introduction to quantity surveying and its importance. Duties of quantity surveyor (04 Periods)
2. Types of estimates (08 Periods)
  - 2.1 Preliminary estimates
    - Plinth area estimate
    - Cubic content estimate
  - 2.2 Detailed estimates

- Definition, Type of detailed estimate- Detail estimate you new work, Revised Estimate, Supplementary estimate, Maintenance and Repair estimate
- Stages of preparation – details of measurement and calculation of quantities and abstract

3. Measurement (08 Periods)
  - 3.1 Units of measurement for various items of work as per BIS:1200
  - 3.2 Rules for measurements
  - 3.3 Different methods of taking out quantities – centre line method and long wall and short wall method
  
4. Preparation of Detailed and Abstract Estimates from Drawings by following CSR rates for: (08 Periods)
  - 4.1 A small residential building with a flat roof comprising of
    - Two rooms with W.C., bath, kitchen and verandah
  - 4.2 Earthwork for unlined channel
  - 4.3 WBM road and pre-mix carpeting
  - 4.4 Single span RCC slab culvert
  - 4.5 Earthwork for plain and hill roads
  - 4.6 RCC work in beams, slab, column and lintel, foundations
  - 4.7 10 users septic tank
  
5. Calculation of quantities of materials for (05 Periods)
  - 5.1 Cement mortars of different proportion
  - 5.2 Cement concrete of different proportion
  - 5.3 Brick/stone masonry in cement mortar of different proportion
  - 5.4 Plastering, pointing and painting
  - 5.5 D.P.C. and flooring
  - 5.6 Steel in beam, slab, column, foundation
  
6. Analysis of Rates (08 Periods)
  - 6.1 Steps involved in the analysis of rates. Requirement of material, labour, sundries, contractor's profit and overheads
  - 6.2 Analysis of rates for finished items when data regarding labour, rates of material and labour is given:

- Earthwork in excavation in hard/ordinary soil and filling with a concept of lead and lift along with lead diagram
- RCC in roof slab/beam/lintels/columns
- Brick masonry in cement mortar
- Cement Plaster
- White washing, painting- RCC foundation

### 6.3 C.C Flooring

Standard schedule of rates, full rates and labour rates

## 7 Contractor ship (08 Periods)

- Meaning of contract
- Essentials of a contract
- Types of contracts, their advantages, dis-advantages and suitability, system of payment
- Single and two cover-bids; tender, tender forms and documents, tender notice, submission of tender and deposit of earnest money, security deposit, retention money, maintenance period
- Classification and types of contracting firms/construction companies

## 8 Preparation of Tender Document based on Common Schedule Rates (CSR) (12 Periods)

- Introduction to CSR and calculation of cost based on premium on CSR
- Exercises on writing detailed specifications of different types of building works from excavation to foundations, superstructure and finishing operation
- Exercises on preparing tender documents for the following
  - a) Earth work
  - b) Construction of a small house as per given drawing
  - c) RCC works
  - d) Pointing, plastering and flooring
  - e) White-washing, distempering and painting
  - f) Wood work including polishing
  - g) Sanitary and water supply installations
  - h) False ceiling, aluminum (glazed) partitioning
  - i) Tile flooring including base course
  - j) Preparation of comparative statement for item rate contract.

## 9. Valuation (06 Periods)

- a) Purpose of valuation, principles of valuation

- b) Definition of various terms related to valuation like depreciation, sinking fund, salvage and scrap value, market value, fair rent, year's purchase etc.
- c) Methods of valuation (i) replacement cost method (ii) rental return method

### INSTRUCTIONAL STRATEGY

This is an applied engineering subject. Teachers are expected to provide working drawings for various Civil Engineering works and students be asked to calculate the quantities of materials required for execution of such works and use of relevant software for preparing estimates. Teachers should conceptualize making analysis of rates for different items of works. It will be advantageous if students are given valuation reports for reading.

### MEANS OF ASSESSMENT

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

### RECOMMENDED BOOKS

1. Estimating, Costing and Valuation (Civil) by Pasrija, HD, Arora, CL and S. Inderjit Singh; New Asian Publishers, Delhi,
2. Estimating and Costing by Rangwala, S.C;Charotar Book Stall, Anand
3. Estimating and Costing by Dutta, BN
4. Estimating and Costing by Mahajan Sanjay; Satya Parkashan, 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	04	05
2	08	10
3	08	10
4	20	24
5	08	10
6	08	10
7	08	10
8	12	14
9	06	07
<b>Total</b>	<b>84</b>	<b>100</b>

## 6.2 CONSTRUCTION MANAGEMENT, ACCOUNTS AND ENTERPRENURESHIP DEVELOPMENT

L T P  
5 - -

### RATIONALE

This is an applied civil engineering subject. The subject aims at imparting basic knowledge about construction planning and management, site organization, construction labour, control of work progress, inspection and quality control, accidents & safety and accounts.

### LEARNING OUTCOME

After undergoing the subject, students will be able to:

- State functions of various aspects of controlling construction job/project
- Explain pre-tender stage and contract stage
- Prepare bar charts for simple construction work
- Prepare scheduling techniques i.e. PERT and CPM
- Prepare job layout of building
- Comply with various labor laws
- Analyze and support in effective functioning of organization
- Inspect quality at various stages of the construction
- Control accidents and safety concerns
- Prepare measurement books and bill of quantities
- Knowledge of scope and benefit of Entrepreneurship
- Know about the various program running in India, state Govt.
- Know about leadership qualities

### DETAILED CONTENTS THEORY

#### CONSTRUCTION MANAGEMENT

1. Introduction (06 Periods)
  - 1.1 Significance of construction management
  - 1.2 Main objectives of construction management and overview of the subject
  - 1.3 Functions of construction management, planning, organizing, staffing, directing, controlling and coordinating, meaning of each of these with respect to construction job.
  - 1.4 Classification of construction into light, heavy and industrial construction

- 1.5 Stages in construction from conception to completion
  - 1.6 The construction team: owner, engineer, architect and contractors, their functions and inter-relationship
  - 1.7 Resources for construction industry
2. Construction Planning (08 Periods)
- 2.1 Importance of construction planning
    - Stages of construction planning
      - Pre-tender stage
      - Contract stage
    - Contracts and e-tendering
      - Different types of contracts
      - Penalties and Arbitration
  - 2.2 Scheduling construction works by bar charts
    - Definition of activity, identification of activities though
    - Preparation of bar charts for simple construction work
      - Preparation of schedules for labour, materials, machinery and finances for small works
    - Limitations of bar charts
  - 2.3 Scheduling by network techniques
    - Introduction to network techniques; PERT and CPM, differences between PERT and CPM terminology
3. Organization (02 Periods)
- 3.1 Types of organizations: Line, line and staff, functional and their characteristics
4. Site Organization (06 Periods)
- 4.1 Principle of storing and stacking materials at site
  - 4.2 Location of equipment
  - 4.3 Preparation of actual job layout for a building
  - 4.4 Organizing labour at site
5. Construction Labour (06 Periods)
- 5.1 Conditions of construction workers in India, wages paid to workers
  - 5.2 Important provisions of the following Acts:
    - Labour Welfare Fund Act 1936 (as amended)
    - Payment of Wages Act 1936 (as amended)
    - Minimum Wages Act 1948 (as amended)

- Acts relating to Labour Safety
- 6. Control of Progress (08 Periods)
  - 6.1 Methods of recording progress
  - 6.2 Analysis of progress
  - 6.3 Taking corrective actions keeping head office informed
  - 6.4 Cost time optimization for simple jobs - Direct and indirect cost, variation with time, cost optimization
- 7. Inspection and Quality Control (07 Periods)
  - 7.1 Need for inspection and quality control
  - 7.2 Principles of inspection
  - 7.3 Stages of inspection and quality control for
    - Earth work
    - Masonry
    - RCC
    - Sanitary and water supply services
- 8. Accidents and Safety in Construction (08 Periods)
  - 8.1 Accidents – causes and remedies
  - 8.2 Safety measures for
    - Excavation work
    - Drilling and blasting
    - Hot bituminous works
    - Scaffolding, ladders, form work
    - Demolitions
  - 8.3 Safety campaign and safety devices, safety training
  - 8.4 Fire safety

### **ACCOUNTS**

- 9. Public Work Accounts (10 Periods)
  - 9.1 Introduction, technical sanction, allotment of funds, re-appropriation of funds bill, contractor ledger, measurement book running and final account bills complete, preparation of bill of quantities (BOQ), completion certificate & report, hand receipt, acquittance roll. Muster Roll labour, casual labour roll-duties and responsibility of different cadres, budget-stores, returns, account of stock, misc. P.W. advances T & P – verification, survey report, road metal material charged direct to works, account - expenditure & revenue head, remittance and deposit head, definition of cash, precaution in custody of cash

book, imprest account, temporary advance, treasury challan, preparation of final bills. Students must learn to prepare accounts register.

#### 9.2 Filling of PWD accounts forms

10. Entrepreneurship (09 Periods)  
Definition and concept, role and significance, risk and awards, Requirement of an entrepreneur development, Programmes Existing in India, Forms of business enterprises, sole proprietorship-partnership-private limited- cooperatives.  
Industrial legislation and taxes:
- GST
  - Income Tax
  - Excise duty
  - Laboure's

### **INSTRUCTIONAL STRATEGY**

This is highly practice-based course and efforts should be made to relate process of teaching with direct experiences at work sites. Participation of students should be encouraged in imparting knowledge about this subject. To achieve this objective the students should be taken to different work sites for clear conception of particular topics, such as site organization, inspection of works at various stages of construction and working of earth moving equipment

### **MEANS OF ASSESSMENT**

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

### **RECOMMENDED BOOKS**

1. Civil Engineering Management by Wakhlo, ON ; Light and Life Publishers, New Delhi
2. Construction Equipment and its Planning and Application by Verma, Mahesh
3. Management in Construction Industry by Dharwadker, PP; Oxford and IBH Publishing Company, New Delhi
4. Construction Planning and Management by Gahlot PS; Dhir, BM; Wiley Eastern Limited, New Delhi
5. MS Project – Microsoft USA
6. Primavera Manual by Sh. Vinod Kumar; NITTTR, Chandigarh.

7. 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***

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	06	08
2	08	10
3	02	04
4	06	08
5	06	12
6	08	12
7	07	10
8	08	12
9	10	12
10	09	12
<b>Total</b>	<b>70</b>	<b>100</b>

## 6.3 DESIGN OF STEEL STRUCTURES

L T P  
6 - -

### RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise steel construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials. This subject thus deals with elementary design principles by Limit State Method as per BIS code of practice IS: 800:2007

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Explain structural properties of steel and its designation as per Indian Standards
- Select different types of bolted and welded joints
- Analyze and design single and double angle section struts and I section compression members
- Explain different types of trusses, their different components and usability
- Analyze and design of simply supported steel beams
- Select various types of plate girders
- Supervise fabrication and erection of steel structure like trusses, columns and girders

### DETAILED CONTENTS

1. Structural Steel and Sections: (06 Periods)
  - 1.1 Properties of structural steel
  - 1.2 Designation and classification of structural steel sections as per IS handbook and IS: 800: 2007
  - 1.3 Tubular Sections
2. Riveted Connections (10 Periods)

Types of Rivet, Permissible stresses in rivets, types of riveted joints, specifications as per IS800, Failure of riveted joint, strength and efficiency of riveted joint, Design of Riveted Connection only axially loaded member (No staggered rivetting)
3. Bolt Connections: (10 Periods)

Types of bolt, permissible stresses in bolt, types of bolted joints, specifications for bolted joints as per IS 800. Failure of a bolted joint. Assumptions in the theory of bolted joints. Strength and efficiency of a bolted joint. Design of bolted joints for axially loaded members ( No Staggered bolts).

4. Welded connections: (10Periods)  
Types of welds and welded joints, advantages and disadvantages of welded joints design of fillet and butt weld for axially loaded members
5. Tension Members (10 Periods)  
Analysis and design of single and double section tension members and their rivetted and welded connections with gusset plate as per IS:800-2007. Introduction to Lug Angle and Tension splice.
6. Compression Members (10 Periods)  
Angle struts, type of section used, effective length, radius of gyration, slenderness ratio and its limits, permissible compressive stress Analysis and design of single and double angle sections compression members subjected to axial load. Introduction to analysis and design of axially loaded column. Introduction to lacing and battening (No numerical problem on lacing and battening)
7. Roof Trusses (08 Periods)  
Form of trusses, pitch of roof truss, spacing of trusses, spacing of purlins, connection between purlin and roof covering. Connection between purlin and principal rafter (no design, only concept)
8. Column Bases (08 Periods)  
Types of column bases i.e. slab base, gusseted base. Design of slay base and concrete block. Introduction to gusseted base (no numerical problems on gusseted base). Introduction to beam columns design of simple built up beams (Symmetrical I section with cover plates only)
9. Beams (08 Periods)  
Analysis and design of single section simply supported laterally restrained steel beams. Introduction to plate girder and functions of various elements of a plate girder
10. Fabrication and erection of steel structures like trusses, columns and girders (04 Periods)

**Important Note:**

Use of IS: 800 and Steel Tables are permitted in examination.

**INSTRUCTIONAL STRATEGY**

Teachers are expected to give simple problems for designing various steel 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 fabrication and erection of steel structures. IS:800 may be referred along with code for relevant clauses

### MEANS OF ASSESSMENT

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

### RECOMMENDED BOOKS

1. Design of Steel Structures by Duggal SK; Standard Publishers, Delhi
2. Steel Structures Design and Drawing by Birinder Singh; Kaption Publishing House, Ludhiana
3. Design of Steel Structures by Ram Chandra; Standard Publishers, Delhi
4. Design of Steel Structures by S Ramamurthan
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*

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	06	70
2	10	12
3	10	12
4	10	12
5	10	12
6	10	12
7	08	10
8	08	10
9	08	10
10	04	03
<b>Total</b>	<b>84</b>	<b>100</b>

## 6.4 STEEL STRUCTURES DRAWINGS

L T P  
- - 4

### RATIONALE

Diploma holders in Civil Engineering are required to supervise the construction of steel structures. Thus one should be able to read and interpret structural drawings of steel 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

- Read and interpret steel structural drawing
- Prepare the detailed drawings of toe joint, ridge joint, details of purlins and roof sheets
- Prepare and draw slab base connection, gusseted base connection grillage base connection for single section steel columns
- Draw column beam connections
- Prepare drawings of plate girder from given design data
- Prepare the drawing and demonstrate steel roof truss
- Draw the structural drawing sheets using CAD Software

### DETAILED CONTENTS

#### Steel Structures Drawings:

- Structural drawing from given data for following steel structural elements.
- (i) Drawing No. 1: Roof Truss – Drawing of Fink Roof Truss with details of joints, fixing details of purlins and roof sheets.
  - (ii) Drawing No.2 : Column and Column Bases - Drawing of splicing of steel columns. Drawings of slab base, gusseted base and grillage base for single section steel columns.
  - (iii) Drawing No.3 : Column Beam Connections
    - (a) Seated and Framed Beam to Beam Connections
    - (b) Seated and Framed Beam o Column Connections
  - (iv) Drawing No. 4 : Plate Girder (Bolted)  
Plan and Elevation of Plate Girder with details at supports and connection of stiffness, flange angles and cover plate with web highlighting curtailment of plates.
  - (v) Drawing No. 5 : Draw atleast one sheet using CAD software

### MEANS OF ASSESSMENT

- Assignments and quiz/class tests

- Mid-term and end-term written tests
- Model Making
- Drawing sheets
- Software installation and operation
- Viva-voce

### **RECOMMENDED BOOKS**

1. Civil Engineering Drawing by Layal JS; Satya Parkashan, New Delhi
2. Civil Engineering Drawings by Chandel RP
3. Civil Engineering Drawing by Kumar; NS; IPH, New Delhi
4. Civil Engineering Drawing by Malik RS and Meo GA; Asian Publishing House, New Delhi
5. Steel Structures Design and Drawing by Singh Birinder; Kaption Publishing House, New Delhi
6. e-books/e-tools/relevant software to be used as recommended by AICTE/NITTTR, Chandigarh.

### **Websites for Reference:**

<http://swayam.gov.in>

## 6.5 SOFTWARE APPLICATIONS IN CIVIL ENGINEERING

L T P  
- - 8

### RATIONALE

Computer applications plays a very vital role in present day life, more so, in the professional life of engineer. In order to enable the students use the computers effectively in problem solving, this course offers applications of various computer software's in Civil Engineering.

### LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Draw 2D drawings on AutoCAD viz. plan, section and elevation of a residential building
- Use various Civil Engineering software

### DETAILED CONTENTS

#### PRACTICAL EXERCISES

1. Introduction and use of AutoCAD for making 2D Drawings and develop plan, section and elevation of a residential building
2. Demonstration of various Civil Engineering software's like STAAD-Pro/Revit/MSProject Primavera Project Planner, Auto CIVIL or any other equivalent software

#### Note:

- i) Polytechnics may use any other software available with them for performing these exercises
- ii) If the above software's are not available in the institution, demonstration of the abovesaid software should be arranged outside the institute.

#### MEANS OF ASSESSMENT

- Mid-term and end-term written tests
- Presentations
- Software installation and operation
- Viva-voce

## 6.6 ENVIRONMENTAL MANAGEMENT

L T P  
5 - -

### RATIONALE

The study of different types of environmental pollutions has already been dealt in the previous paper. Due to vast Civil Engineering developmental activities, the environment degradation is going on, to assess the impact on the environment as well as to manage the environment, the need of the paper felt necessary. The contents of this paper have been developed to cater the above need.

### LEARNING OUTCOMES

- i) To create awareness about harmful effects of pollution
- ii) To Take preventive steps for controlling the pollution
- iii) To help the students to acquire knowledge with reference to various sources of pollution and planning of remedial measures to control pollution.

### DETAILED CONTENTS

#### 1. ENVIRONMENTAL INDICATORS: (10 Periods)

Indicators of Ecological Environment, Indicators and Biodiversity, Indicators for Economic, Social and Aesthetic Environment. Uses of the Indicators for Public, Decision Makers, Judicial System, Researchers and other Groups. Development of the Indicators using procedure like basic data gathering identifying the critical factor and data distribution.

#### 2. PROTECTION OF ENVIRONMENT (10 Periods)

Clean Environment, Need and Importance of Clean Environment, Sustainable Development, Need for Environmental Protection: Control of environmental pollution, Land and water management, Nature living resource conservation, Development of non-polluting sources of energy, Environmental education and awareness.

#### 3. LAND USE, POLLUTION AND ABUSE (05 Periods)

Land use, land use and environmental quality, land use and natural disasters, soil degradation problems: Erosion, Salinization and Waterlogging, Soil Pollution, Management Planning for Land Use and Environmental Improvement.

#### 4. MINING, DEFORESTATION AND THEIR EFFECTS (03 Periods)

Deforestation: Major Causes and its Effects, Benefits from Forests, Effects of Deforestation, Forest Management Strategies, Mining: Mining Operations, Impact of Mining on Environment.

#### 5. ENVIRONMENT IMPACT ASSESSMENT (E. I. A.): (05 Periods)

Impact of Environmental Management Processes on Biological System including man. EIA of developmental projects like residential and commercial complexes, dams, reservoirs, canals, railways, highways, tunnels, bridges, etc.

**6. HAZARDS AND ACCIDENT PREVENTIONS: (10 Periods)**

Terminology relating to chemical hazards, classification of chemicals, hazards and hazardous chemicals, Hazards associated with manufacturing storage and handling of chemicals, Hazards associated with particulate matter specially from cement, metallurgical industries and thermal power station, I.S. and other codes of safety for operational hazards in laboratories and industries.

Hazardous chemical manufacturing, storage and impact rules 1989, Hazardous waste management and handling rules 1989.

**7. DISASTER MANAGEMENT: (5 Periods)**

Disaster, Risk assessment studies, Examples of disasters such as Bhopal Gas (MIC) leakage episode and other, formation of crisis group, Disaster management of dams, Reservoirs, High rise building in earthquake prone areas, bridges, etc.

**8. MEASURING TECHNOLOGIES: (07 Periods)**

Measuring sampling techniques for quantification of various parameters under various conditions of air, water and land systems; Physical, chemical and biological parameters.

**9. TREATMENT TECHNOLOGIES: (10 Periods)**

Standards based on B.I.S./Pollution Control Board, Water Treatment for domestic use, Industrial water treatment, Domestic waste water treatment, Industrial waste water treatment, Radioactive waste control and Air pollution control.

**10. AIR AND WATER POLLUTION CONTROL ACTS : (5 Periods)**

Classification of polluting/Non polluting Agencies. Procedure for getting N.O.C. and Consent. Calculation of Cess on industrial water consumption, Environmental Audit/Statement. Rules and regulations related to starting any new industry and undertaking and new developmental projects by government and non-government agencies.

Ministries of environment at central and state levels. Constitution, composition and functions of Central Board and State Boards for the prevention of pollution

The Water (Prevention and Control of pollution) Act, 1974. The Air (Prevention and Control of Pollution) Act, 1981, The Environmental Protection Act (1986).

**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 DeepPublications, 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 andSons, New Delhi.
8. E-books/e-tools/relevant software to be used as recommended by AICTE/ BTE /NITTTR, Chandigarh.

### Websites for Reference:

<http://swayam.gov.in>

### *SUGGESTED DISTRIBUTION OF MARKS*

<b>Topic No.</b>	<b>Time Allotted (Periods)</b>	<b>Marks Allotted (%)</b>
1	10	14
2	10	12
3	5	06
4	3	06
5	5	06
6	10	14
7	5	10
8	7	08
9	10	14
10	5	10
<b>Total</b>	<b>70</b>	<b>100</b>

## 6.7 PROJECT WORK

L T P  
- - 10

### *RATIONALE*

Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period.

### LEARNING OUTCOMES

After undergoing the project work, students will be able to:

Apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place the learner for project oriented practical training in actual work situation for the stipulated period with a view to:

- Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study
- Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- Develop firsthand experience and confidence amongst the students to enable them to use and apply polytechnic/ institute-based knowledge and skills to solve practical problems related to the world of work.
- Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

### General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training cum project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular

basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

**Some of the projects are listed below for the benefit of the students:**

1. Study and detailed estimate of different component of modern residential and commercial building
2. Preparation of detailed estimate for low cost two room set residential building
3. Review/ and existing for various parameters as per green building, Raling system building
4. Design of rain water harvesting for a given building
5. Analysis of accidents prone area in your city and remedial measure for them
6. Case study of safety practices in a multi-storied buildings under constructions
7. Concrete Mix Design
8. Case study of repair and maintenance of a given building
9. Preparation of DNIT of a given building for Civil Engineering works
10. Detailed estimate for installing plumbing fixtures
11. Preparing a standard measurement book of a given building
12. Construction of concrete road by using latest techniques
13. Water supply scheme for a govt approved colony
14. Construction estimates of shopping complex
15. Analysis and design of Effluent Treatment Plant (ETP) for an industry
16. Design of soak pit with septic tank for 100 users
17. Design and estimate of two room set building
18. Design of concrete mix by using fly ash
19. Study of setting up of an interlocking pavers fabrication plant
20. Preparation of different Civil Engineering models e.g. beam, one way, two way slab, column etc.
21. Reinforcement detailing as per IS:13920
22. Design of car parking in your polytechnic
23. To prepare analysis of rates for non -schedule items e.g. aluminium door, windows, work stations etc.
24. Study of retrofitting of a given Civil Engineering works.
25. Survey of your polytechnic by using total station.
26. Traffic volume study and analysis on different roads in a city
27. Case study of a flyover with regard to its various construction components
28. Study and preparation of detailed project report of ready mix concrete (RMC) unit
29. Study and preparation of detailed project report of prefabricated/prestressed concrete components unit
31. Construction of a small concrete road consisting of following activities
  - Survey and preparation of site plan
  - Preparation of drawings i.e. L-Section and X-Section
  - Estimating earth work
  - Preparation of sub grade with stone ballast
  - Laying of concrete

- Testing of slump, casting of cubes and testing
  - Material estimating and costing with specifications
  - Technical report writing
32. Water Supply system for a locality
- Surveying
  - Design of water requirements and water distribution system
  - Preparation of drawing of overhead tank
  - Material estimating and costing
  - Specifications
  - Technical report writing
33. Construction of shopping complex by detailing of RCC drawings, estimating and costing of material
34. Design of small residential building including structural members, specifications, estimating and costing of materials, report writing and municipal drawings for water supply and sewerage system

There is no binding to take up the above projects as it is only a suggestive list of projects.

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get “Overall Good grade” failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared “not eligible to receive diploma”. It is also important to note that the students must get more than six “goods” or above “good” grade in different performance criteria items in order to get “Overall Good” grade.

	Range of maximum marks	Overall grade
i)	More than 80	Excellent
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

### Important Notes

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.
2. The criteria for evaluation of the students have been worked out for 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.

- 3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.**
- 4. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.**

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work

## 10. RESOURCE REQUIREMENT

### 10.1 PHYSICAL RESOURCES

#### (A) Space requirement

Norms and standards laid down by All India Council for Technical Education (AICTE) are to be followed to work out space requirement in respect of class rooms, tutorial rooms, drawing halls, laboratories, space required for faculty, student amenities and residential area for staff and students.

#### (B) Equipment requirement:

Following Laboratories are required for Diploma Programmed in Civil Engineering:

- Communication Laboratory
- Applied Physics Laboratory
- Applied Chemistry Laboratory
- Engineering Drawing
- Electrical Engineering Laboratory
- Applied Mechanics Laboratory
- Basics of IT/Computer Laboratory
- Carpentry Shop
- Painting and Polishing Shop
- Electrical Shop
- Welding Shop
- Fitting and Plumbing Shop
  
- Sheet Metal Shop
- Mason Shop
- Machine Shop
- Construction Material Testing
  - a. Concrete Laboratory
  - b. Roads and Solids Laboratory
- Survey Equipment and Stores
- Fluid Mechanics and Irrigation Laboratory
- Civil Engineering Fabrication and Erection Shop
- Environmental Engineering Laboratory , Energy Conservation Lab

**EQUIPMENT REQUIRED FOR CIVIL AND ENVIRONMENTAL ENGINEERING**

<b>Sr. No.</b>	<b>Description</b>	<b>Qty</b>	<b>Total Price (Rs)</b>
<b>COMMUNICATION LABORATORY</b>			
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	Miscellaneous	LS	1,500
<b>APPLIED PHYSICS LABORATORY</b>			
1.	Vernier calipers Working length 160 mm, Internal and external dia with locking arrangement	12	2,000
2.	Screw Gauges Working length 15 mm, pitch 0.5 mm, least count .005 mm	12	2,000
3.	Spherometers Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm.	12	2,000
4.	Mirrors (convex, concave)	5 Each	1,500
5.	Pendulum Setup	02	4,000

6.	Gravesend's Apparatus	02	3,000
7.	Inclined Plane Setup	02	2,000
8.	Flywheel Setup	02	4,000
9.	Prism	05	1,500
10.	Spectrometer	02	25,000
11.	DC Ammeters Moving coil Weston-type ammeter with ebonite stand	10	3,500
12.	DC Milliammeter's	2	1,000
13.	DC Microammeters	2	700
14.	DC voltmeters	10	700
15.	DC Millivoltmeters	10	2,000

<b>Sr. No.</b>	<b>Description</b>	<b>Qty</b>	<b>Total Price (Rs)</b>
16.	Sensitivity Galvanometer	2	800
17.	Student Galvanometers	10	4,000
18.	Demonstration type DC Ammeters Range; 0 to 1 Amp.	2	1,000
19.	D type DC Voltmeter Range: 0 to 1 Volt	2	1,000
20.	D type Galvanometers Sensitivity: 20 microamperes per scale division,	8	8,000
21.	Resistance boxes (dial type) assorted	8	8,000
22.	Rheostats	10	4,000
23.	Miscellaneous items (Spring, Pan, Glycerin, Optic fiber, Ferromagnetic material)	LS	2,000
24.	Fortin's Barometer (Wall type)	2	20,000
25.	Stokes's Apparatus	2	10,000
26.	Gunther's Apparatus	2	16,000
27.	Resonance Tube Apparatus with accessories and Tuning fork set	2	14,000
28.	Sodium Lamp setup with Biprism	2	10,000
29.	Ohmic resistance coil	10	5,00
30.	Slide wire bridge	2	8,000
31.	PN Junction diode Apparatus	2	10,000
32.	Laser (as per requirement)	1	1,00,000
33.	Numerical aperture setup	1	25,000
34.	Miscellaneous	LS	3,000

<b>APPLIED CHEMISTRY LABORATORY</b>			
1.	Digital Balance	1	80,000
2.	Burette 50ml	30	3,000
3.	Pipette 25ml	60	4,000
4.	Beakers 100ml	60	4,000
5.	Burette stand	30	30,000
6.	Glazed tile	30	1,000
7.	Conical flask 50ml (Titration flask)	60	4,000
8.	Standard (Measuring) flask (to prepare standard solution) 250ml/100ml	30	6,000
9.	Abel's Flash Point apparatus	2	10,000
10.	(1/10)°C thermometer	06	6,000

Sr. No.	Description	Qty	Total Price (Rs)
11.	Candles	20	100
12.	Crucible with lid	06	2,000
13.	Muffle furnace	1	18,000
14.	Dedicators	06	8,000
15.	Pair of tongue (small and big)	24 (small) 2 (big)	2,000
16.	Chemicals <ul style="list-style-type: none"> <li>- EDTA-1 kg</li> <li>- Eriochrome Black-T(solo chrome black T)-200g</li> <li>- Buffer solution (NH<sub>3</sub> - 2.5 liter, NH<sub>4</sub>Cl – 1 kg)</li> <li>- Zinc sulphate- 500g</li> <li>- H<sub>2</sub>SO<sub>4</sub>- 2.5 liter</li> <li>- Phenolphthalein indicator (as per requirement)</li> <li>- Methyl orange indicator (as per requirement)</li> <li>- Charcoal (as per requirement)</li> <li>- Kerosene- 1 liter</li> </ul>	LS	20,000

17.	- Miscellaneous	- LS	2,000
<b>- ENGINEERING DRAWING</b>			
1.	- Drawing Boards (700 x - 500mm)	60	25,000
2.	- Draughtsman Tables	60	1,80,000
3.	- Draughtsman Stools	60	40,000
4.	- Computer Aided Drawing - (CAD) Software	30  Use r	5,00,000
5.	- Model of different wooder - joints	1	1,000
6.	- Model of different screw - threads	1	1,000
7.	- Model of various locking - devices	1	1,000
8.	- Model of various joints	1	1,000
9.	- Cut section Model of - various couplings	1	3,000
10.	- Miscellaneous	LS	5,000
<b>- ELECTRICAL ENGINEERING LABORTORY</b>			
1.	- Voltmeter	5	7,500

2.	Ammeter	5	10,000
3.	CRO	1	15,000
4.	Wattmeter	5	10,000
5.	Multimeter	1	4,000
Sr. No.	Description	Qty	Total Price (Rs)
6.	Resistive load	1	4,000
7.	Regulated supply	1	8,000
8.	Signal generator	1	5,000
9.	Rheostat	2	2,500
10.	Lead acid battery	1	4,000
11.	Cables, Coils, Lamp (as per requirements)	LS	1,500
12.	Resistance, Inductor, Capacitor (as per requirements)	LS	1,500
13.	Miscellaneous	LS	1,500
<b>APPLIED MECHANICS LABORATORY</b>			
1.	Polygon law of forces apparatus	1	2,000
2.	Jib crane	1	4,000
3.	Apparatus for reaction at supports	1	5,000
4.	Inclined plane and friction apparatus	1	2,500
5.	Screw jack	1	1,000
6.	Worm and worm wheel	1	3,500
7.	Single Purchase Winch Crab	1	4,000
8.	Miscellaneous	LS	1,000
<b>BASICS OF IT LABORATORY/COMPUTER LABORATORY</b>			
1.	Computer System with latest configuration	30	8,00,000

2.	Printer (MFP)	1	25,000
3.	Printer (Laser)	1	35,000
4.	Plotter	1	75,000
5.	Digitizer	1	50,000
6.	Antivirus Software	LS	10,000
7.	Internet Facility on Computers	LS	2,00,000
8.	LCD Projector	1	35,000
9.	UPS	60	1,20,000
10.	Software (latest windows, latest MS Office)	1	1,00,000
11.	Scanner	1	10,000
12.	Auto CAD	L.S.	
13.	Auto Civil	L.S.	
14.	STAAD Pro	L.S.	
15.	Primavera/MS Project	L.S.	
16.	Revit	L.S.	
17.	BIM	L.S.	
18.	Miscellaneous	LS	5,000

#### **CARPENTRY SHOP**

1	Work benches fitted with carpenter vices	5	20,000
2.	Circular saw grinder	1	6,000
<b>Sr. No.</b>	<b>Description</b>	<b>Qty</b>	<b>Total Price (Rs)</b>
3.	Wood cutting band saw-vertical	1	10,000
4.	Bench grinder	1	5,000
5.	Drilling machine	1	8,000
6.	Wood turning lathe	1	40,000
7.	Wood Planner	1	20,000
8.	Tool accessories measuring and marking Instruments	25	25,000
9.	Band saw blade brazing unit	1	10,000
10.	Miscellaneous	LS	1,500

<b>PAINTING AND POLISHING SHOP</b>			
1.	Spray gun with hose pipe	1	1,000
2.	Paint brushes	20	2,000
3.	Paint/Varnish	LS	2,000
4.	Air Compressor with 2 hp motor	1 set	10,000
5.	Miscellaneous	LS	2,000
<b>ELECTRICAL SHOP</b>			
1.	Tool kit (Plier, Screw driver, Knife, Steel rule, hammer, scriber, pincer steel tape etc.)	20	20,000
2.	Fuses, Switches, Plugs, Sockets, Ceiling rose, Wires, cleats, Clamps, Test lamp, Tester.( as per requirement)		8,000
3.	Electric Iron	1	1,500
4.	Electric kettle	1	1,500
5.	Ceiling fan/table fan	1	2,500
6.	Desert cooler	1	5,000
7.	Lead acid battery	2	8,000
8.	Battery Charger	1	6,000
9.	Miscellaneous		3,000
<b>WELDING SHOP</b>			
1.	Electrical welding transformer set with accessories	3	30,000

2.	Gas Cutting Unit	1	3,000
3.	Work benches with vices	3	5,000
4.	Welding generator set	1	10,000
5.	Oxy acetylene welding set with accessories	1	7,000
6.	Acetylene generating set	1	6,000
7.	Electric welder tool kit	10	10,000
8.	Projection welding machine	1	15,000
9.	Brazing equipment with accessories	1	10,000
10.	Soldering irons	3	1,000
11.	Pedestal grinder	1	10,000
<b>Sr. No.</b>	<b>Description</b>	<b>Qty</b>	<b>Total Price (Rs)</b>
12.	Metal spraying gun	1	10,000
13.	Spot welder	1	25,000
14.	TIG welding set	1	1,00,000
15.	MIG welding set	1	1,00,000
16.	Welding Partition Screen	5	2,500
17.	Miscellaneous	LS	3,000
<b>FITTING AND PLUMBING SHOP</b>			
1.	Work benches with vices (4 vices on each bench)	5	30,000
2.	Marking tables with scribes	4	24,000
3.	Surface plates	5	20,000
4.	Accessories like calipers, V blocks, height, gauges steel rules and scribes	25	50,000
5.	Tool kits – taps, dies, drills	25	40,000
6.	Tool kits – chisels, hammers, files, hacksaw	25	25,000
7.	Drilling machine	2	12,000
8.	Pipe vice	4	1,000
9.	Chain wrenches	5	1,250
10.	Ring spanner set	5	600
11.	Pipe die set 2”	2 set	1,000
12.	Pipe bending device	1	5,000
13.	Various plumbing fittings	LS	2,000
14.	Miscellaneous	LS	1,500

<b>SHEET METAL SHOP</b>			
1.	Hammers	8	3,000
2.	Mallets (Hard & Soft)	5	2,000
3.	Sheet and wire Ganges	LS	8,00
4.	Shearing Machine	1	20,000
5.	Bar folding Machine	1	20,000
6.	Burring machine	1	10,000
7.	Various sheet (black plain, galvanized iron, corrugated, Aluminum)	1 Each	1,000
8.	Hand Shears/Snippers	4	2,000
9.	Nuts, Bolts, Rivets, Screw	LS	5,00
10.	Miscellaneous	LS	1,000

<b>Sr. No.</b>	<b>Description</b>	<b>Qty</b>	<b>Total Price (Rs)</b>
<b>MASON SHOP</b>			
1.	Mason Trowel	10	1,000
2.	Concrete Finishing Trowel	10	1,000
3.	Gauging Trowel	10	1,000
4.	Margin Trowel	10	1,000
5.	Pointing Trowel	10	1,000
6.	Round Trowel	10	1,000
7.	Mason/Brick Hammer	10	3,000
8.	Comb hammer	10	3,000
9.	Blocking chisel	10	1,000
10.	Plumb bob	10	500
11.	Spirit level	10	1,000
12.	Straight Edge	10	1,000

13.	Jointer	10	1,000
14.	Masonry Pan	10	1,500
15.	Steel Measuring Tape	10	500
16.	Miscellaneous (Bricks, Blocks, Stones, Sand, Cement)	10	3,000
<b>MACHINE SHOP</b>			
1.	Centre lathes	10	6,00,000
2.	Grinder	1	10,000
3.	Universal milling machine	1	1,25,000
4.	Shaper	2	1,20,000
5.	Plainer	2	1,20,000
6.	Work bench	3	10,000
7.	Precision instruments	1	10,000
8.	Hand tools and accessories	2	8,000
9.	CNC trainer lathe	1	4,00,000
10.	Miscellaneous	LS	5,000

Sr. No.	Description	Qty
<b>CONSTRUCTION MATERIALS TESTING</b>		
<b>A. CONCRETE LABORATORY</b>		
1.	Compression testing machine (100 T. Capacity)	1
2.	Vibration machine	1
3.	Electrically heated oven (Thermostatically controlled)	1
4.	Blaine Air permeability Apparatus (for testing fineness of cement)	2
5.	Vicat's Apparatus	4
6.	Le Chatelier's soundness apparatus (to determine quantity of free lime in cement)	2
7.	Slump Cone (to determine the workability of concrete)	2
8.	Compaction factor apparatus (to determine the workability of concrete)	1
9.	Vee-Bee apparatus (to determine the workability of concrete)	1
10.	Plateform weighing machine	1
11.	Concrete cube moulds	12 each
12.	Concrete mixers	1
13.	Sieve shaker	1
14.	Set of sieves	2 Set
15.	Beam mould	2
16.	Impact testing machine	2
17.	Needle vibrator	1Each
18.	Flakiness index apparatus	2
19.	Elongation index apparatus	2
20.	Bar bending and cutter apparatus	2 Set
21.	Bulk density apparatus	2
22.	Wire basket	4
23.	Riffle sampler	2
24.	Table vibrator	2
25.	Concrete test hammer	1
26.	Ultrasonic pulse velocity apparatus	1
<b>B. ROADS AND SOILS LABORATORY</b>		
1.	Ring and Ball apparatus (with heating mantle)	1
2.	CBR apparatus with loading machine	1
3.	Flash point and fire point apparatus (Cleaveland type)	1
4.	Los angles Abrasion testing machine apparatus	1

<b>Sr. No.</b>	<b>Description</b>	<b>Qty</b>
5.	Water bath (Thermostatically controlled)	1
6.	Aggregate impact value testing apparatus with automatic blow counter	2
7.	Penetration value apparatus with timer	1
8.	Viscometer Capillary type	1
9.	Ductility machine	1
10.	Direct shear test apparatus	1
11.	Drying oven(Thermostatically controlled)	1
12.	Electronic balance	1
13.	Standard penetration test equipment	1
14.	Soil exploration equipment (Augers etc)	1
15.	Sand replacement method apparatus	2
16.	Liquid limit and plastic limit apparatus	2 Each
17.	Compaction apparatus using light compaction (Proctor Test)	2
18.	Grain size distribution test apparatus (sieve set)	2 Set
19.	Sieve shaker	2
20.	Permeability apparatus	1
21.	Proctor penetrometer	1
22.	Core cutter apparatus	2
23.	Rapid moisture meter	2
24.	Pycnometer with burette	6
25.	Liquid limit apparatus (Cone penetrometer method)	2
<b>SURVEY EQUIPMENT AND STORES</b>		
1.	Plane Table with stand and accessories	16
2.	Dumpy level, quick setting level and engineers level i) Dumpy level - 8 ii) Quick setting level - 8 iii) Engineer' level - 1	17
3.	Transit theodolite (Vernier type)	12
4.	Prismatic compass	15
5.	Planimeter	5
6.	Leveling staves (All aluminum)	5
7.	Total Station	2
8.	Ranging rods	60
9.	Pentagraph	2
10.	Optical square	5
11.	Abney level	5
<b>Sr. No.</b>	<b>Description</b>	<b>Qty</b>

12.	Tangent clinometer (Indian Pattern)	5
13.	Mirror stereoscope	1
14.	Telescopic Alidade	2
15.	Prismatic binoculars	1
16.	Metric chain/non-metrics	10
17.	Metallic taps/Fibre glass/Invar tape	20
18.	Tentage, camp equipment and other misc. items and instruments	L.S
19.	Modern survey equipment	L.S
20.	Theodolite (Digital) Distomat	1
21.	Electronics Distance Measurement (EDM)	1
22.	Total Station	1
23.	GPS Hands Instrument	1
<b>FLUID MECHANICS AND IRRIGATION LABORATORY</b>		
1.	Hydraulic Bench	2
2.	Impact of Jet apparatus	1
3.	Flow measurement apparatus by Venturimeter and Orificemeter	1
4.	Pipe Friction apparatus	1
5.	Orifice and Mouthpiece apparatus	1
6.	Bernoulli's Theorem apparatus	1
7.	Flow over a notch apparatus	1
8.	Losses in pipe bends apparatus	1
9.	Reynold's apparatus	1
10.	Working models of: <ul style="list-style-type: none"> <li>- Pelton wheel Turbine</li> <li>- Francis</li> <li>- Reciprocating</li> <li>- Centrifugal pump</li> <li>- Hydraulic Ram</li> <li>- Kaplan turbine</li> </ul>	1 Each

<b>Sr. No.</b>	<b>Description</b>	<b>Qty</b>
11.	Manometers of different types and pressure gauges like: <ul style="list-style-type: none"> <li>- Piezometer - 6</li> <li>- Differential Manometers (Double column type manometer) - 10</li> <li>- Universal manometers (Single column type manometer) -2</li> <li>- Inclined tube manometer - 2</li> <li>- Bourden pressure gauges - 2</li> <li>- Compound Gauges (Vacuum and pressuregauge combined) - 2</li> </ul> This apparatus should be purchased along with hydraulic bench as the design of these apparatus depend upon the design of Hydraulic bench	24
12.	Current meter	1
13.	Centrifugal pump test Rig.	1
14.	Submergible pump set apparatus	1
15.	Misc. Tools etc.	L.S
<b>CIVIL ENGINEERING FABRICATION AND ERECTION SHOP</b>		
1.	Masonry erection tools, such as iron pans, trowels, plumb bobs, showels, sets pick axes, corner squares etc.	10
2.	Carpenter's tool such as tenon saw, planes screw drivers, chisel sets, sets marking gauges, pliers, hammers, augers, bevel squares, files, drills etc.	10
3.	Plumber tools, plumbing vice, die and tap sets, pipe wrenches of different sets sizes, pipe cutters, spanner sets, hammer plier.	5
4.	Centering, shuttering and scaffolding (for an ordinary residential building)	1 Set
5.	Pipes and pipe fittings, valves, gully traps, GI grating, manhole, cover traps, WC pan with foot rest, flushing cistern, urinal pan with cistern, taps, wash basin, water meter etc.	L.S
6.	Hoisting and conveying equipment tripod, hoist, pulleys, ladders, ballis etc. Compressed air equipment with accessories - 1	L.S
7.	Steel fabrication equipment with fabricating small trusses, reinforcement cages, small girder, column beam connections, column truss connection	1 Set
8.	Floor grinding/polishing machine, spray guns etc.	L.S

<b>Sr. No.</b>	<b>Description</b>	<b>Qty</b>
<b>ENVIRONMENTAL ENGINEERING LABORATORY</b>		

1.	Lovibond comparator (for color determination)	1
2.	Colorimeter (for color determination)	1
3.	Centrifuge	1
4.	Turbidimeter	1
5.	pH meter	1
6.	Jar test apparatus (Flocculator)	1
7.	Dissolved oxygen meter	1
8.	B.O.D incubator	1
9.	Water bath with digital controller	1
10.	Hot air oven	1
11.	Hot plate	2
12.	Bacteriological incubator	1
13.	Colony counter	1
14.	Water sampler	1
15.	Water analysis kit	1
16.	Water distills	1
17.	Conductivity meter	1
18.	Electronic balance	1
19.	Chemical Balance	1
20.	Inverted microscope	1
21.	Model of oxidation ditch	1
22.	Working model of Trickling Filter	1
23.	Misc. items like noise measurement apparatus etc.	L.S

<b>ENERGY CONSERVATION LABORATORY</b>			
1	Clamp meter	02	5000
2	Multimeter	02	2000
3	Power Analyzer	01	20000
4	Different types of lamps (LS) <input type="checkbox"/> 60 W lamp, 230 V, 100 V – 200 W lamp – 500 W lamp <input type="checkbox"/> 100 W lamp, 110 V, 150 V	10	500
5	Lux meter	02	5000
6	Centrifugal pump, 1 kW	1	15,000
7	Standard window A.C.	01	20000

8	Anemometer	02	5000
9	Thermometer	03	2000
10	Flow meter	02	10000
11	Pumping set with at least two pumps of different capacity.	1 set	10000
12	Pressure gauge fitted on discharge lines	1 set	2000
13	Variable Frequency Drive	02	50000
14	A small compressor with a small network of pipe line fitted with suitable pipeline, pressure gauge, safety valve and loading /unloading pressure switch.	1	3000
15	Stop watch	2	1000
16	Small blower (1.5 kW motor) with inlet and outlet ducts of approximately one meter length on both sides	1	10000
17	Black Box (for checking lamp efficacy including stand and luxmeter)	1	25000

**NOTE:**

In addition to the above, laboratories in respect of physics, chemistry, Computer Centre etc will be required for effective implementation of the course. Provision for photocopiers, PC facilities along with LCD Projection System etc. has also to be made.

## **(C) Furniture Requirement**

Norms and standards laid down by AICTE be followed for working out furniture requirement for this course.

### **10.2 Human Resources Development:**

Weekly work schedule, annual work schedule, student teacher ratio for various group and class size, staffing pattern, work load norms, qualifications, experience and job description of teaching staff workshop staff and other administrative and supporting staff be worked out as per norms and standards laid down by the AICTE.

## **11. EVALUATION STRATEGY**

### **11.1 INTRODUCTION**

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching- learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation.

The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

#### **Formative Evaluation**

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning teaching-learning process. It provides corrective steps to be taken to account for curricular as well as co-curricular aspects.

#### **Summative Evaluation**

It is carried out at the end of a unit of instruction like topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students.

In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

## 11.2 STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work (Laboratory, Workshop, Field Exercises)
- Project Work
- Professional Industrial Training

### A. Theory

Evaluation in theory aims at assessing students' understanding of concepts, principles and procedures related to a course/subject, and their ability to apply learnt principles and solve problems. The formative evaluation for theory subjects may be caused through sessional /class-tests, home-assignments, tutorial-work, seminars, and group discussions etc. For end-term evaluation of theory, the question paper may comprise of three sections.

#### **Section-I**

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-I should be of the order of 20 percent of the total marks and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension and at the most application domains only.

#### **Section-II**

It should contain short answer/completion items. The weightage to this section should be of the order of 40 percent of the total marks. Again, no choice should be given in section-II

#### **Section-III**

It may contain two to three essay type questions. Total weightage to this section should be of the order of 40 percent of the total marks. Some built-in, internal choice of about 50 percent of the questions set, can be given in this section

**Table II : Suggested Weightage to be given to different ability levels**

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent

Application	20-30 percent
Higher than application i.e., Analysis, Synthesis and Evaluation	Up to 10 percent

**B. Practical Work**

Evaluation of student's performance in practical work (Laboratory experiments, Workshop practical/field exercises) aims at assessing students' ability to apply or practice learnt concepts, principles and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions and work-related attitudes. Formative and summative evaluation may comprise of weightages to performance on task, quality of product, general behavior and it should be followed by viva-voce.

**C. Project Work**

The purpose of evaluation of project work is to assess students' ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce.

**D. Professional Industrial Training**

Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situation. The formative and summative evaluation may comprise of weightages to performance in testing, general behavior, quality of report and presentation during viva-voce.

## **12. RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION**

This curriculum document is a Plan of Action and has been prepared based on exhaustive exercise of curriculum planning and design. The representative sample comprising selected senior personnel (lecturers and HODs) from various institutions and experts from industry/field have been involved in curriculum design process.

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. class-room, laboratory, library and field and execute them in right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated students' behavior as in the curriculum document. It is important for the teachers to understand curriculum document holistically and further be aware of intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions which may help the teachers in planning and designing learning experiences effectively. These are indicative in nature and teachers using their creativity can further develop/refine them. The designers of the programme suggest every teacher to read them carefully, comprehend and start using them.

### **(A) Broad Suggestions:**

1. Curriculum implementation takes place at programme, course and class-room level respectively and synchronization among them is required for its success. The first step towards achieving synchronization is to read curriculum document holistically and understand its rationale and philosophy.
2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The principals have a great role to play in its dissemination and, percolation up to grass-root level. Polytechnics, in turn are supposed to prepare institutional academic plan.
3. HOD of every Programme Department along with HODs and in charges of other departments are required to prepare academic plan at department level referring to institutional academic plan.
4. All lecturers/Senior lecturers are required to prepare course level and class level lesson plans referring departmental academic plan.

### **(B) Course Level Suggestions**

Teachers are educational managers at class room level and their success in achieving course level objectives lies in using course plan and their judicious execution which is very important for the success of programme by achieving its objectives.

Polytechnic teachers are required to plan various instructional experiences viz. theory lecture, expert lectures, lab/workshop practical's, guided library exercises, field visits, study tours, camps etc. In addition, they have to carry out progressive assessment of theory, assignments, library, practical and field experiences. Teachers are also required to do all these activities within a stipulated period of time. It is essential for them to use the given time judiciously by planning all above activities properly and ensure execution of the plan effectively.

Following is the gist of suggestions for subject teachers to carry out T-L process effectively:

1. Teachers are required to prepare a course plan, taking into account departmental academic plan, number of weeks available and courses to be taught.
2. Teachers are required to prepare lesson plan for every theory class. This plan may comprise of contents to be covered, learning material for execution of a lesson plan. They may follow steps for preparing lesson plan e.g., drawing attention, state instructional objectives, help in recalling pre-requisite knowledge, deliver planned subject content, check desired learning outcomes and reinforce learning etc.
3. Teachers are required to plan for expert lectures from field/industry. Necessary steps are to plan in advance, identify field experts, make correspondence to invite them, take necessary budgetary approval etc.
4. Teachers are required to plan for guided library exercises by identification of course specific experience requirement, setting time, assessment, etc. The assignments and seminars can be thought of as terminal outcome of library experiences.
5. Concept and content-based field visits may be planned and executed for such content of course which is abstract in nature and no other requisite resources are readily available in institute to impart them effectively.
6. There is a dire need for planning practical experiences in right perspective. These slots in a course are the avenues to use problem-based learning/activity learning/ experiential learning approach effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.
7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of proper quality question paper, assessment of answer sheets immediately and giving constructive feedback to every student
8. The student-centered activities may be used to develop generic skills like task management, problem solving, managing self, collaborating with others etc.

9. Where ever possible, it is essential to use activity- b a s e d learning rather than relying on delivery based conventional teaching all the time.
10. Teachers may take initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.
11. Students be made aware about issues related to ecology and environment, safety, concern for wastage of energy and other resources etc.
12. Students may be given relevant and well thought out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.
13. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes and other relevant field organizations in the state.

### **13. LIST OF PARTICIPANTS**

**The following experts have participated in workshop for Developing the Curricula Structure and Contents of Civil and Environmental Engineering for UP State on 6 August, 2021 at IRDT, Kanpur:**

1. Sh. Vinod Kumar Dwivedi, Lecturer Civil Engineering Manyavar Kashiram Government Polytechnic, Kannauj
2. Sh. Lokendra Narayan Tripathi, Lecturer Civil Engineering Government Polytechnic, Orai, Jalaun
3. Imran Khan, Lecturer Civil Engineering, Government Polytechnic, Unnao
4. Sh. Raj Kumar Gupta, Associate Professor, Civil Engineering ,BBDEC, Lucknow