

NSQF ALIGNED CURRICULUM

DIPLOMA IN CIVIL ENGINEERING

**PUNJAB STATE BOARD OF TECHNICAL EDUCATION
&
INDUSTRIAL TRAINING**



Developed By
Curriculum Development Center
National Institute of Technical Teachers Training & Research
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FOREWORD

An important issue generally debated amongst the planners and educators world over is how technical education can contribute to sustainable development of the societies struggling hard to come in the same bracket of standard of life as that of the developed nations. The rapid industrialization and globalization has created an environment for free flow of information and technology through fast and efficient means. This has led to shrinking of the world, bringing people from different cultures and environments together and giving rise to the concept of world turning into a global village. In India, a shift has taken place from the license-based closed economy to knowledge and market based 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, Punjab to revise the existing curricula of diploma programmes as per the needs of the industry and making them National Skill Qualification Framework (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 effective implementation of its curricula. Howsoever best the curriculum document is designed, if it 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 that the polytechnics 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 get the faculty members regularly trained and upskilled. So that it can infuse the much needed dynamism in the system. They are welcome to reach NITTTR Chandigarh whenever they want to train the faculty members and get the curricula revised.

Director
National Institute of Technical Teachers
Training & Research, Chandigarh

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- vi) Faculty from different departments of NITTTR, Chandigarh for content updation.

Coordinator

1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN CIVIL ENGINEERING

- 1) Name of the Programme : Diploma Programme in Civil Engineering
- 2) Duration of the Programme : Three years (Six Semesters)
- 3) Entry Qualification : Matriculation or equivalent NSQF Level as prescribed by State Board of Technical Education, Punjab
- 4) Intake : As prescribed by the Board
- 5) Pattern of the Programme : Semester Pattern
- 6) NSQF Level : Level - 5
- 7) Ratio between theory and Practice : 37 : 63
- 8) Industrial Training:
Six weeks of industrial training is included after IV semester during summer vacation
- 9) Ecology and Environment :
As per Govt. of India directives, a subject on Environmental Studies has been incorporated in the curriculum.
- 10) Energy Conservation:
An Energy Conservation Awareness Camp has been included in the curriculum to sensitize the students about significance and various aspects of energy conservation. Concepts of Energy Conservation have also been included in the subject of Environmental Studies.
- 11) Entrepreneurship Development:
An Entrepreneurial Awareness Camp and a full subject on Generic Skills and Entrepreneurship Development have been incorporated in the curriculum.
- 12) Camps on “Traffic Awareness and Road Safety” have been added in semester I & II under Student Centered Activities.
- 13) “Drugs Use and Abuse Awareness Camp” have been added in IIIrd Semester under Student Centered Activities.

14) Personality Development

A camp focusing on personality development of students has been incorporated in the curriculum.

15) Student Centred Activities:

A provision of 3-6 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. Such activities will comprise of co-curricular activities such as expert lectures, games, hobby classes like photography, painting, singing etc. seminars, declamation contests, educational field visits, NCC, NSS and other cultural activities etc.

16) Project works

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

2. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN CIVIL ENGINEERING

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

a) Wage employment in:

- i) Centre and state Government Departments/Public sector /private construction companies/Boards/ Corporations etc.
- 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) Testing laboratories
- v) 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) Contracts of repair and maintenance of buildings, renovations, POP work, texture work, false ceiling, specialized flooring etc.
- v) Anti - termite treatment contracts
- vi) Erection job
- vii) Construction material suppliers/marketing
- viii) Preparation of computer aided design and drafting jobs
- ix) Estimating and costing jobs/bill maker
- x) Surveyor/loss assessment/valuation of buildings etc.
- xi) A small enterprise like precast elements/hume pipes/water proofing chemicals, RCC pipes, hollow blocks, shuttering etc.

After first year, the NSQF Level – 3 pass out students have avenues to work as semi-skilled employee. Similarly, after second year, the NSQF Level – 4 pass out students have wide scope to work as skilled employee in construction industry.

3. LEARNING OUTCOMES OF DIPLOMA PROGRAMME IN CIVIL ENGINEERING

After due completion of the course, a diploma holder will be able to:

1. Communicate effectively in English with others
2. Apply basic principles of mathematics to solve engineering problems
3. Apply basic principles of physics and chemistry to solve engineering problems
4. Prepare computerized reports, presentations using IT tools and computer application software
5. Prepare and interpret drawings of engineering components
6. Use cutting tools and tooling for fabrication of jobs by following safe practices during work
7. Use appropriate procedures for preventing environmental pollution and energy conservation
8. Use basic concepts and principles of fluid mechanics as applied to civil engineering practices.
9. Apply concepts of mechanics to solve Engineering problems
10. 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 and GIS.
11. Use various types of construction materials as per their suitability and uses, availability and cost.
12. Supervise various building construction works from substructure to superstructure and their finishing operations
13. Prepare, read and interpret building drawings
14. Supervise production, placement and quality control of concrete operations
15. Carry out layout plan of water supply, sewerage and sanitary systems and monitor quality of water
16. Supervise constructional aspects pertaining to irrigation structures
17. Analyse and design simple structural elements
18. Prepare, read and interpret public health and irrigation engineering drawings
19. Analyse and design simple structural elements of R.C.C.
20. Supervise constructional aspects pertaining to highway engineering

21. Prepare, read and interpret R.C.C. drawings
22. Prepare topographical plan of an area
23. Prepare computerized reports, presentations using IT tools and computer application software of civil engineering
24. Supervise constructional aspects pertaining to railways, bridges and tunnels
25. Analyse and use various types of soils for foundation purpose
26. Plan and execute given task/projects as a team member or leader
27. Analyse and design simple structural elements of steel
28. Prepare material estimates as per CSR, costing, valuation and tender documents as per given drawings.
29. Apply basic principles of construction management techniques and accounts in civil engineering
30. Carry out repair and maintenance of buildings as per requirement
31. Apply all the knowledge and skills gained through various courses in solving live problems/projects in the field
32. Explore interest and passion in their professional stream and in areas other than professional stream

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOMES OF THE PROGRAMME

The following curriculum areas have been derived from learning outcomes:

Sr. No.	Learning Outcomes	Curriculum Areas/Subjects
1.	Communicate effectively in English with others	– English and Communication Skills
2.	Apply basic principles of mathematics to solve engineering problems	– Applied Mathematics
3.	Apply basic principles of physics and chemistry to solve engineering problems	– Applied Physics – Applied Chemistry
4.	Prepare computerized reports, presentations using IT tools and computer application software	– Basics of Information Technology
5.	Prepare and interpret drawings of engineering components	– Engineering Drawing
6.	Use cutting tools and tooling for fabrication of jobs by following safe practices during work	– General Workshop Practice
7.	Use appropriate procedures for preventing environmental pollution and energy conservation	– Environmental Studies
8.	Use basic concepts and principles of fluid mechanics as applied to civil engineering practices.	– Fluid Mechanics
9.	Apply concepts of mechanics to solve Engineering problems	– Applied Mechanics
10.	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 and GIS.	– Surveying – Modern Surveying
11.	Use various types of construction materials as per their suitability and uses, availability and cost.	– Construction Material

12.	Supervise various building construction works from substructure to superstructure and their finishing operations	– Building Construction
13.	Prepare, read and interpret building drawings	– Building Drawing
14.	Supervise production, placement and quality control of concrete operations	– Concrete Technology
15.	Carry out layout plan of water supply, sewerage and sanitary systems and monitor quality of water	– Water Supply and Waste Water Engineering
16.	Supervise constructional aspects pertaining to irrigation structures	– Water Resources Engineering
17.	Analyse and design simple structural elements	– Structural Mechanics
18.	Prepare, read and interpret public health and irrigation engineering drawings	– Public Health & Water Resources Engineering Drawing
19.	Analyse and design simple structural elements of R.C.C.	– Reinforced Concrete Design
20.	Supervise constructional aspects pertaining to highway engineering	– Highway Engineering
21.	Prepare, read and interpret R.C.C. drawings	– R.C.C. Drawings
22.	Prepare topographical plan of an area	– Survey Camp
23.	Prepare computerized reports, presentations using IT tools and computer application software of civil engineering	– Computer Applications in Civil Engineering
24.	Supervise constructional aspects pertaining to railways, bridges and tunnels	– Railways, Bridges and Tunnels
25.	Analyse and use various types of soils for foundation purpose	– Soil and Foundation Engineering
26.	Plan and execute given task/projects as a team member or leader	– Generic Skills and Entrepreneurship Development
27.	Analyse and design simple structural elements of steel	– Steel Structures Design
28.	Prepare material estimates as per CSR, costing, valuation and tender documents as per given drawings.	– Quantity Surveying & Valuation
29.	Apply basic principles of construction management techniques and accounts in civil engineering	– Construction Management & Accounts

30.	Plan and execute minor projects related to civil engineering	– Minor Project Work
31.	Apply all the knowledge and skills gained through various courses in solving live problems/projects in the field	– Major Project Work
32.	Explore interest and passion in their professional stream and in areas other than professional stream	– Programme Elective – Open Elective

5. ABSTRACT OF THE CURRICULUM AREAS

a) Humanities and Social Science Courses

1. English and Communication Skills
2. Generic Skills and Entrepreneurship Development
3. Environmental Studies

b) Basic/Applied Science Courses

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

c) Engineering Science Courses

7. Basics of Information Technology
8. Engineering Drawing
9. General Workshop Practice
10. Applied Mechanics
11. Introduction to CAD

d) Core Courses in Engineering/Technology

12. Construction Material
13. Fluid Mechanics
14. Surveying
15. Structural Mechanics
16. Building Construction
17. Building Drawing
18. Concrete Technology
19. Water Supply and Waste Water Engineering
20. Water Resources Engineering
21. Modern Surveying
22. Public Health & Water Resources Engineering Drawing
23. Reinforced Concrete Design

- 24. Highway Engineering
- 25. R.C.C. Drawings
- 26. Survey Camp
- 27. Railways, Bridges and Tunnels
- 28. Soil and Foundation Engineering
- 29. Quantity Surveying & Valuation
- 30. Steel Structures Design
- 31. Earthquake Resistant Building Construction
- 32. Steel Structures Drawing
- 33. Computer Applications in Civil Engineering
- 34. Construction Management & Accounts
- e) Electives**
 - 35. Program Electives
 - 36. Open Electives
- f) Project Work, Seminar and Industrial Training**
 - 29. Minor Project Work
 - 30. Major Project Work
 - 31. Industrial Training

6. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Hours per week in Various Semesters					
		I	II	III	IV	V	VI
1.	English and Communication Skills	5	5	-	-	-	-
2.	Applied Mathematics	4	3	-	-	-	-
3.	Applied Physics	5	4	-	-	-	-
4.	Applied Chemistry	5	-	-	-	-	-
5.	Basics of Information Technology	2	-	-	-	-	-
6.	Engineering Drawing	6	-	-	-	-	-
7.	General Workshop Practice	6	-	-	-	-	-
8.	Environmental Studies	-	2	-	-	-	-
9.	Applied Mechanics	-	5	-	-	-	-
10.	Construction Material	-	6	-	-	-	-
11.	Introduction to CAD	-	6	-	-	-	-
12.	Fluid Mechanics	-	-	6	-	-	-
13.	Surveying	-	-	8	-	-	-
14.	Structural Mechanics	-	-	5	-	-	-
15.	Building Construction	-	-	5	-	-	-
16.	Building Drawing	-	-	6	-	-	-
17.	Open Elective (Offline/MOOCs)	-	-	2	-	-	-
18.	Generic Skills and Entrepreneurship Development	-	-	-	3	-	-
19.	Concrete Technology	-	-	-	6	-	-
20.	Water Supply and Waste Water Engineering	-	-	-	5	-	-
21.	Water Resources Engineering	-	-	-	3	-	-
22.	Modern Surveying	-	-	-	6	-	-
23.	Public Health & Water Resources Engineering Drawing	-	-	-	4	-	-
24.	Minor Project Work	-	-	-	6	-	-
25.	Reinforced Concrete Design	-	-	-	-	3	-
26.	Highway Engineering	-	-	-	-	6	-
27.	R.C.C. Drawings	-	-	-	-	4	-
28.	Survey Camp	-	-	-	-	2	-
29.	Railways, Bridges and Tunnels	-	-	-	-	3	-
30.	Soil and Foundation Engineering	-	-	-	-	7	-
31.	Quantity Surveying & Valuation	-	-	-	-	7	-

32.	Steel Structures Design	-	-	-	-	-	3
33.	Earthquake Resistant Building Construction	-	-	-	-	-	2
34.	Steel Structures Drawing	-	-	-	-	-	4
35.	Computer Applications in Civil Engineering	-	-	-	-	-	4
36.	Construction Management & Accounts	-	-	-	-	-	3
37.	Programme Elective	-	-	-	-	-	3
38.	Major Project Work	-	-	-	-	-	14
39.	Student Centred Activities	2	4	3	2	3	2
Total		35	35	35	35	35	35

STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN CIVIL ENGINEERING

FIRST SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	*English and Communication Skills – I	3	2	4	20	10	30	50	3	20	3	70	100
1.2	*Applied Mathematics - I	4	-	4	50	-	50	50	3	-	-	50	100
1.3	*Applied Physics – I	3	2	4	20	10	30	50	3	20	3	70	100
1.4	*Applied Chemistry	3	2	4	20	10	30	50	3	20	3	70	100
1.5	*Basics of Information Technology	-	2	1	-	40	40	-	-	60	3	60	100
1.6	*Engineering Drawing – I	-	6	3	-	50	50	50	3	-	-	50	100
1.7	*General Workshop Practice – I	-	6	3	-	50	50	-	-	50	3	50	100
#Student Centred Activities including Traffic Awareness & Road Safety Camp(1)		-	2	-	-	-	-	-	-	-	-	-	-
Total		13	22	23	110	170	280	250	-	170	-	420	700

* Common course with other diploma programmes

SCA 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 other activities to promote experiential learning.

SECOND SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*English and Communication Skills - II	3	2	4	20	10	30	50	3	20	3	70	100
2.2	*Applied Mathematics – II	3	-	3	50	-	50	50	3	-	-	50	100
2.3	* Applied Physics - II	2	2	3	20	10	30	50	3	20	3	70	100
2.4	*Environmental Studies	2	-	2	50	-	50	50	3	-	-	50	100
2.5	+Applied Mechanics	3	2	4	20	10	30	50	3	20	3	70	100
2.6	Construction Material	2	4	4	20	10	30	50	3	20	3	70	100
2.7	Introduction to CAD	-	6	3	-	50	50	-	-	50	3	50	100
#Student Centred Activities including Traffic Awareness & Road Safety Camp(1I)		-	4	-	-	-	-	-	-	-	-	-	-
Total		15	20	23	180	90	270	300	-	130	-	430	700

* Common Course with other diploma programmes

+ Common with diploma programmes in Mechanical Engineering, Production and Industrial Engg. and Automobile Engineering

SCA 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 other activities to promote experiential learning.

THIRD SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	Fluid Mechanics	2	4	4	20	10	30	50	3	20	3	70	100
3.2	Surveying	2	6	5	10	20	30	50	3	20	3	70	100
3.3	Structural Mechanics	3	2	4	20	10	30	50	3	20	3	70	100
3.4	Building Construction	3	2	4	20	10	30	50	3	20	3	70	100
3.5	Building Drawing	-	6	3	-	50	50	50	3	-	-	50	100
3.6	Open Elective (Offline/MOOCs)	2	-	2	50	-	50	50	3	-	-	50	100
# Student Centred Activities including Energy Conservation Awareness Camp Drug Use and Abuse Awareness Camp		-	3	-	-	-	-	-	-	-	-	-	-
	Total	12	23	22	120	100	220	300	-	80	-	380	600

SCA 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 other activities to promote experiential learning.

FOURTH SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	*Generic Skills and Entrepreneurship Development	3	-	3	50	-	50	50	3	-	-	50	100
4.2	Concrete Technology	2	4	4	20	10	30	50	3	20	3	70	100
4.3	Water Supply and Waste Water Engineering	3	2	4	20	10	30	50	3	20	3	70	100
4.4	Water Resources Engineering	3	-	3	50	-	50	50	3	-	-	50	100
4.5	Modern Surveying	2	4	4	20	10	30	50	3	20	3	70	100
4.6	Public Health & Water Resources Engineering Drawing	-	4	2	-	50	50	50	3	-	-	50	100
4.7	Minor Project Work	-	6	3	-	50	50	-	-	50	3	50	100
# Student Centred Activities including Entrepreneurial Awareness Camp		-	2	-	-	-	-	-	-	-	-	-	-
	Total	13	22	23	160	130	290	300	-	110	-	410	700

* Common course with other diploma programmes

SCA 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 other activities to promote experiential learning.

Industrial Training - After examination of 4th Semester, the students shall go for training in a relevant industry/field organisation for a minimum period of 6 weeks and shall prepare a diary. It shall be evaluated during 5th semester by his/her teacher for 50 marks. The students shall also prepare a report at the end of training and shall present it in a seminar, which will be evaluated for another 50 marks. This evaluation will be done by HOD and lecturer in charge – training in the presence of one representative from training organizations.

FIFTH SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
					INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
-	Industrial Training during vacations after 4 th Semester	-	-	2	-	50	50	-	-	50	3	50	100
5.1	Reinforced Concrete Design	3	-	3	50	-	50	50	3	-	-	50	100
5.2	Highway Engineering	2	4	4	20	10	30	50	3	20	3	70	100
5.3	R.C.C. Drawings	-	4	2	-	50	50	50	3	-	-	50	100
5.4	Survey Camp	-	2	1	-	50	50	-	-	50	3	50	100
5.5	Railways, Bridges and Tunnels	3	-	3	50	-	50	50	3	-	-	50	100
5.6	Soil and Foundation Engineering	3	4	5	20	10	30	50	3	20	3	70	100
5.7	Quantity Surveying & Valuation	3	4	5	20	10	30	50	3	20	3	70	100
# Student Centred Activities including Personality Development Awareness Camp		-	3		-	-	-	-	-	-	-	-	-
	Total	14	21	25	160	180	340	300	-	160	-	460	800

Note: Survey camp will be held either in the beginning of 5th semester or after it for minimum 10 days in a sub mountainous area.

SCA 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 other activities to promote experiential learning

SIXTH SEMESTER

SR. NO.	SUBJECTS	STUDY SCHEME Hrs/Week		Credits	MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
		INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT								
		L/T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	Steel Structures Design	3	-	3	50	-	50	50	3	-	-	50	100
6.2	Earthquake Resistant Building Construction	2	-	2	50	-	50	50	3	-	-	50	100
6.3	Steel Structures Drawing	-	4	2	-	50	50	50	3	-	-	50	100
6.4	Computer Applications in Civil Engineering	-	4	2	-	50	50	-	-	50	3	50	100
6.5	Construction Management & Accounts	3	-	3	50	-	50	50	3	-	-	50	100
6.6	Programme Elective	3	-	3	50	-	50	50	3	-	-	50	100
6.7	Major Project Work	-	14	4	-	50	50	-	-	50	3	50	100
# Student Centred Activities		-	2	-	-	-	-	-	-	-	-	-	-
	Total	11	24	19	200	150	350	250	-	100	-	350	700

SCA 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 other activities to promote experiential learning

6.6 Programme Electives (Any one of the following):

6.6.1 Repair and Maintenance of Buildings

6.6.2 Basics of Green Buildings

6.6.3 Pre-stressed Concrete

1.1 ENGLISH AND COMMUNICATION SKILLS – I

L	P
3	2

RATIONALE

Communication skills play 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.

LEARNING OUTCOMES

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

- Pronounce properly.
- Overcome communication barriers.
- Write legibly and effectively.
- Listen in proper prospective.
- Read various genres adopting different reading techniques.
- Converse logically.

DETAILED CONTENTS

- | | | |
|-----|---|----------|
| 1. | Basics of Communication | (12 hrs) |
| 1.1 | Definition and process of communication | |
| 1.2 | Introduction to types of communication - formal and informal, oral and written, verbal and non-verbal | |
| 1.3 | Objectives of communication | |
| 1.4 | Essentials of communication | |
| 1.5 | Introduction to channels of communication- formal (upward, downward, diagonal, horizontal), informal (grapevine, consensus) | |
| 1.6 | Barriers to communication | |
| 2. | Functional Grammar and Vocabulary | (12 hrs) |
| 2.1 | Parts of speech | |
| 2.2 | Article | |
| 2.3 | Tenses | |
| 2.4 | Subject verb agreement sentences | |
| 2.5 | Active and passive voice | |
| 2.6 | Synonyms and antonyms | |
| 2.7 | Pair of words | |
| 2.8 | Correction of incorrect sentences | |

3. Listening (04 hrs)
- 3.1 Meaning of listening
 - 3.2 Listening and hearing
 - 3.3 Importance of listening
 - 3.4 Active listening – Meaning and strategies
 - 3.5 Methods to improve listening skills
4. Speaking (03 hrs)
- 4.1 Importance
 - 4.2 Methods to improve speaking
5. Reading (12 hrs)
- 5.1 Meaning
 - 5.2 Techniques of reading: skimming, scanning, intensive and extensive reading
 - 5.3 Comprehension, vocabulary enrichment and grammar exercises based on following readings:
- Section - I
- My Struggle for an Education – Booker T. Washington
 - Abraham Lincoln's letter to his son's headmaster – Abraham Lincoln
 - Gateman's Gift – R.K Narayan
 - The Selfish Giant - Oscar Wilde
- Section - II
- Say Not, the Struggle Nought Availeth – A H Clough
 - Stopping by Woods on a Snowy Evening – Robert Frost
 - Where the Mind is Without Fear – Rabindranath Tagore
6. Writing (02 hrs)
- 6.1 Significance and effectiveness of writing
 - 6.2 Paragraph writing – Word choice, sentence formation and construction of paragraph.

LIST OF PRACTICALS

1. Self and peer introduction
2. Newspaper reading
3. Just a Minute session – extempore
4. Situational conversation and role play
5. Language learning using open source software.

6. Greetings for different occasions
7. Improving pronunciation through tongue twisters.

INSTRUCTIONAL STRATEGY

Open source software should be used to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Revathi, Srinivas, "Communicating Effectively in English, Book-I", Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, "Developing Communication Skills (2nd Edition)", Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, "Oxford Practice Grammar", Oxford University Press, London
4. Chadha, R. K., "Communication Techniques and Skills", Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, "High School English Grammar and Composition", S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, "Communication Skills", Oxford University Press, New Delhi

WEBSITES FOR REFERENCE

1. [http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html)
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	12	12
2	12	12
3	04	6
4	03	3
5	12	15
6	02	2
Total	45	50

1.2 APPLIED MATHEMATICS - I

L	P
4	-

RATIONALE

Contents of this course provide fundamental base for understanding engineering problems and their solution algorithms. Contents of this course will enable students to use basic tools like binomial theorem, partial fractions, etc. for solving complex engineering problems with exact solutions in a way which involve less computational task. The analytical capabilities will enable the students to solve problems in engineering field.

LEARNING OUTCOMES

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

- Apply Complex Number and its representation for two dimensional designing and related calculations.
- Apply the basic concepts of permutation and combination to find out various ways or arrangements possible for a particular problem.
- Apply binomial theorem to find approximate value of certain expressions and extracting roots of certain expressions.
- Apply basics concepts of partial fractions to simplify the concept of rational expression.
- Solve engineering problems that are in matrix format by applying the basic understanding of matrices and their properties,
- Solve problems related to height, distance, elevation by making use of trigonometry.
- Write the equation of straight line and circle by using coordinate geometry.
- Optimize the utilization of resources by applying concepts of linear programming.

DETAILED CONTENTS

- | | | |
|-----|--|----------|
| 1. | Algebra | (20 hrs) |
| 1.1 | Complex Numbers: Complex number, representation, modulus and amplitude. | |
| 1.2 | Partial fractions (linear factors, repeated linear factors, non-reducible quadratic factors excluding repeated factors). | |

- 1.3 Meaning of ${}^n P_r$ & ${}^n C_r$ (mathematical expression). Binomial theorem (without proof) for positive integral index (expansion and general form); binomial theorem for any index (expansion without proof), first and second binomial approximation with applications to engineering problems.
- 1.4 Introduction to Matrices and Determinants – Addition, subtraction and multiplication (upto 3×3 matrices), Determinants, simple properties, Cramer Rule.
2. Trigonometry (15 hrs)
 - 2.1 Introduction to T ratios, T-Ratios of Allied angles (without proof), Sum, Difference formulae and their applications (without proof). Product formulae (Transformation of product to sum, difference and vice versa). T-Ratios of multiple angles, sub-multiple angles ($2A$, $3A$, $A/2$).
 - 2.2 Applications of Trigonometric terms in engineering problems such as to find an angle of elevation, height, distance etc.
3. Co-ordinate Geometry (18 hrs)
 - 3.1 Cartesian and Polar coordinates (two dimensional), conversion from Cartesian to Polar coordinates and vice-versa
 - 3.2 Slope of a line, equation of straight line in various standard forms (without proof); (slope intercept form, intercept form, one-point form, two-point form, symmetric form, normal form, general form), intersection of two straight lines, concurrency of lines, angle between straight lines.
 - 3.3 General equation of a circle and its characteristics. To find the equation of a circle, given:
 - * Centre and radius
 - * Three points lying on it
 - * Coordinates of end points of a diameter
4. Operations Research (7 hrs)
 - 4.1 Linear Programming Problems formulations.
 - 4.2 Graphical Method

INSTRUCTIONAL STATREGY

Basic of algebra, trigonometry, coordinate geometry, operations research can be taught in the light of their applications in the field of engineering and technology. By laying more emphasis on applied part, teacher can also help in providing a good continuing education base to the students.

RECOMMENDED BOOKS

1. Grewal, BS, "Elementary Engineering Mathematics", Khanna Publishers, New Delhi
2. Sabharwal, SS & Dr Sunita Jain, "Applied Mathematics, Vol. I & II", Eagle Parkashan, Jalandhar
3. Sastry, SS, "Engineering Mathematics, Vol I & II", Prentice Hall of India Pvt. Ltd.,
4. Pal, Srimanta and Subodh C. Bhunia, "Engineering Mathematics", Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	20	16
2.	15	12
3.	18	16
4	7	06
Total	60	50

1.3 APPLIED PHYSICS – I

L	P
3	2

RATIONALE

Applied physics includes the study of a large number of diverse topics all related to things that go on in 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 will behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the 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 appreciate learning of these concepts and principles. In all contents, SI units should be followed.

LEARNING OUTCOMES

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

- Select units of various physical quantities for use in engineering solutions.
- Represent physical quantities as scalar and vector.
- Use the concepts of force and motion to solve problems.
- Solve problems related to friction, work, power and energy,
- Comprehend properties of matter.
- Comprehend modes of heat transfer.
- Make measurements with accuracy.

DETAILED CONTENTS

- | | | |
|-----|--|---------|
| 1. | Units and Dimensions | (9 hrs) |
| 1.1 | Physical quantities Units - fundamental and derived units, systems of units (FPS, CGS and SI units) | |
| 1.2 | Dimensions and dimensional formulae of physical quantities (area, volume, velocity, acceleration, momentum, force, impulse, work, power, energy, surface tension, stress, strain) | |
| 1.3 | Principle of homogeneity of dimensions | |
| 1.4 | Dimensional equations and their applications, conversion of units from one system to another for density, force, pressure, work, power, velocity and acceleration. Checking of dimensional equations | |
| 1.5 | Limitations of dimensional analysis | |

2. Force and Motion (10 hrs)
 - 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
 - 2.4 Force, Momentum, Statement of Conservation of linear momentum, its applications
 - 2.5 Impulse and its Applications
 - 2.6 Circular motion, definition of angular displacement, angular velocity, angular acceleration, frequency, time period.
 - 2.7 Relation between linear and angular velocity, linear acceleration and angular acceleration (Only Formula), Angular momentum and torque (definition only)
 - 2.8 Concept of centripetal and centrifugal forces and their applications with examples such as banking of roads
3. Work, Power and Energy (8 hrs)
 - 3.1 Work: and its units, examples of zero work, positive work and negative work
 - 3.2 Friction: concept, types, laws of limiting friction
 - 3.3 Energy and its units: Kinetic energy and gravitational potential energy with examples and their derivation
 - 3.4 Principle of conservation of mechanical energy for freely falling bodies, examples of transformation of energy.
 - 3.5 Power and its units, calculation of power in numerical problems
4. Properties of Matter (9 hrs)
 - 4.1 Elasticity: definition of stress and strain, Moduli of elasticity (Only definition, No derivation) , Hooke's law, significance of stress strain curve
 - 4.2 Pressure: definition, its units, atmospheric pressure, gauge pressure, absolute pressure
 - 4.3 Surface tension: concept, its units, angle of contact, applications of surface tension, effect of temperature on surface tension
 - 4.4 Viscosity and coefficient of viscosity: Terminal velocity, Stoke's law

5. Thermometry (9 hrs)
- 5.1 Difference between heat and temperature
 - 5.2 Modes of transfer of heat (Conduction, convection and radiation with examples)
 - 5.3 Different scales of temperature and their relationship
 - 5.4 Expansion of solids, liquids and gases, coefficient of linear, surface and cubical expansions and relation amongst them
 - 5.5 Concept of Co-efficient of thermal conductivity

LIST OF PRACTICALS (to perform minimum 8 experiments)

1. To find volume of solid sphere using a vernier caliper.
2. To find internal diameter and depth of a beaker using a vernier caliper and hence find its volume.
3. To find the diameter of wire using a screw gauge
4. To determine the thickness of glass strip using a spherometer
5. To verify parallelogram law of forces
6. To study conservation of energy of a ball or cylinder rolling down an inclined plane.
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 STATREGY

Teacher may use various teaching aids like 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 can make the subject interesting and develop scientific temper in the students.

RECOMMENDED BOOKS

1. “Text Book of Physics for Class XI (Part-I, Part-II)”, N.C.E.R.T., Delhi
2. “Applied Physics, Vol. I and Vol. II”, TTTI Publications, Tata McGraw Hill, Delhi
3. Verma, HC, “Concepts in Physics Vol. I & II”, Bharti Bhawan Ltd. New Delhi
4. “Comprehensive Practical Physics, Vol, I & II”, JN Jaiswal, Laxmi Publications (P) Ltd., New Delhi
5. Naik, PV, “Engineering Physics”, Pearson Education Pvt. Ltd, New Delhi
6. Banwait, RA & R, Dogra, “Applied Physics I & II”, Eagle Parkashan, Jalandhar
7. Bhattacharya, DK & Poonam Tandan, “Engineering Physics”, Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	9	10
2.	10	12
3.	8	8
4.	9	10
5.	9	10
Total	45	50

1.4 APPLIED CHEMISTRY

L P

3 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 diploma holders to develop scientific temper and appreciate importance of chemistry. Hence the subject of Applied Chemistry.

LEARNING OUTCOMES

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

- Interpret both qualitative and quantitative aspects of simple chemical substances.
- Substantiate the laws and principles on which structure of atom is established.
- Understand types of bonds in chemical substance and their influence on the properties of chemical substances.
- Prepare solution of required concentrations.
- Understand qualitatively and quantitatively pH and buffer solutions.
- Significance of pH and buffer solutions and their industrial applications (in the process such as electrolysis, electrochemical machining of materials etc).
- Explain cause and factors adversely affecting natural water quality and remedial measures available for water purification to achieve water quality standards required for domestic, agricultural and industrial applications.
- Appreciate and practice the water conservation techniques.
- Identify and classify the substance based on the electric behavior.
- Realize the laws/principles efficiently used in development of electrochemical cells towards the greener energy.
- Identify most efficient fuel for the engine and engineering applications.
- Understand the elementary idea of polymers and plastics
- Distinguish different type of plastics and their applications.

DETAILED CONTENTS

1. Basic Concept of Chemistry (2 hrs)
 - 1.1 Symbols of elements and valency, writing of chemical formulae of simple compounds.
 - 1.2 Calculation of molecular masses of CaCO_3 , NaCl , CuSO_4 , NaOH , Ca(OH)_2 , H_2SO_4 , $\text{C}_2\text{H}_2\text{O}_4$. (Atomic mass of elements should be provided)
2. Atomic Structure and Chemical Bonding (8 hrs)
 - 2.1 Bohr's model of atom (qualitative treatment only).
 - 2.2 Atomic number, atomic mass number isotopes and isobars.
 - 2.3 Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance,
 - 2.4 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).
 - 2.5 Chemical bonding and cause of bonding and types of chemical bonding; Ionic bond (example NaCl) and Covalent bond (sigma (σ) and pi (π) bonds) with examples of H_2 , O_2 , N_2 and CH_4 Metallic bonding.
3. Solutions (05 hrs)
 - 3.1 Definition of solution, solute and solvent with examples
 - 3.2 Methods to express the concentration of solution- molarity (M) and molality (m), mass percentage, volume percentage and mole fraction and related simple numericals.
 - 3.3 Arrhenius concept of acids and bases. pH of solution, simple numericals on pH and industrial applications of pH.
 - 3.4 Definition of buffer solution and types of buffer solutions with examples and industrial applications of buffers solutions.
4. Water (10 hrs)
 - 4.1 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^{-1}) and part per million (ppm) and simple numericals.
 - 4.2 Disadvantages caused by the use of hard water in domestic industry and boiler feed water.
 - 4.3 Removal of hardness -Permutit process and Ion-exchange process.
 - 4.4 Drinking water and characteristics of drinking water.
 - 4.5 Natural water sterilization by chlorine and UV radiation and reverse osmosis (elementary idea).

5. Electro Chemistry (6 hrs)
 - 5.1 Electronic concept of oxidation, reduction and redox reactions
 - 5.2 Definition of terms: electrolytes, non-electrolytes with suitable examples
 - 5.3 Faradays laws of electrolysis and simple numerical problems.
 - 5.4 Industrial Application of Electrolysis – Electroplating.
 - 5.5 Application of redox reactions in electrochemical cells (qualitative idea only excluding reactions) - commercial dry cell (Primary) and elementary idea of secondary cell (Only lead storage battery)

6. Chemistry of Fuels and Lubricants (12 hrs)
 - 6.1. Definition of fuel, classification of fuels (primary and secondary), characteristics of good fuel.
 - 6.2 Calorific value-higher calorific value, lower calorific value, determination of calorific value of solid or liquid fuel using Bomb calorimeter and numerical examples.
 - 6.3 Coal - proximate analysis of coal
 - 6.4 Fuel rating – Octane number and Cetane number, fuel-structural influence on Octane and Cetane numbers
 - 6.5 Gaseous fuels – chemical composition, calorific value and applications of natural gas (CNG), LPG, producer gas, water gas and biogas. (preparation/manufacture excluded)
 - 6.6 Definition of Lubricant and characteristics of good lubricant
 - 6.7 Classification of lubricants –liquid lubricants, solid lubricants, semi-solid lubricants with examples
 - 6.8 Properties of lubricant: Physical properties –viscosity and viscosity index, cloud point and pour point, flash point and fire point, oiliness. Chemical properties- Total Acid Value or Number (TAV or TAN), carbon residue, saponification value.

7. Polymers and Plastics (02 hrs)
 - 7.1 Definition of polymer, monomer and degree of polymerization
 - 7.2 Brief introduction of plastics - thermo plastics and thermo setting plastics with suitable examples (PVC, PS, PTFE, Nylon 6, Nylon 66, bakelite) distinction between thermo and thermo setting plastics
 - 7.3 Applications of polymers in industry and daily life
 - 7.4 Introduction to nano materials and nano technology

LIST OF PRACTICALS

1. Preparation of standard solution of oxalic acid.
2. To determine strength of given sodium hydroxide solution by titrating against standard oxalic acid solution using phenolphthalein indicator.
3. To determine TDS in given sample of water.

4. To prepare Mohr's salt from ferrous sulfate and ammonium sulfate.
5. Determination of pH of given solution using pH meter.
6. Estimation of total alkalinity of given water sample by titrating it against standard sulfuric acid solution.
7. Gravimetric estimation of moisture in the given coal sample (proximate analysis).
8. Gravimetric estimation of ash content in the given coal sample (proximate analysis).
9. Determination of viscosity of given liquid using Redwood viscometers
10. To construct simple Daniel cell and measure its e.m.f. using voltmeter.
11. To estimate hardness of water using EDTA method.

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.

RECOMMENDED BOOKS

1. Kuricose, J.C. and J. Rajaram, "Chemistry in Engineering", Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. Jain, P.C. & Monika Jain, "Engineering Chemistry", Dhanapat Rai Publishing Company, New Delhi.
3. Ahuja, S. C. and G. H. Hugar, "Eagle's Applied Chemistry (I and II)", Eagle Prakashan, Jalandhar.
4. Rao, C N R, "Understanding Chemistry", Universities Press (India) Pvt Ltd., 2011
5. Chopra, H. K. & A. Parmar, "Engineering Chemistry – A Text Book", Narosa Publishing House, New Delhi.
6. Pandey, Dr. Himanshu, "Engineering Chemistry", Goel Publishing House, Meerut, India.

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (Out of 50)
1.	02	03
2.	08	08
3.	05	06
4.	10	12
5.	06	06
6.	12	12
7.	02	03
Total	45	50

1.5 BASICS OF INFORMATION TECHNOLOGY

L P
- 2

RATIONALE

Information technology has great influence on all aspects of life. 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 office automation tools using MS Office/Open Office/Libre Office, and internet concepts. This exposure will enable the students to enter their professions with confidence.

LEARNING OUTCOMES

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

- Identify computer hardware components, network components and peripherals.
- Install application and utility software.
- Use word processing software to prepare document.
- Use spreadsheet software to create workbook and automate calculation.
- Use presentation software to create interactive presentation.
- Browse information on the Web.

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.

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Basic Concepts of IT and Its Application

Information Technology concept and scope, applications of IT.

2. Computer Hardware:

Block diagram of a computer, components of computer system, CPU, Memory, Input devices; keyboard, Scanner, mouse etc; Output devices; VDU, LCD, Printers etc. Primary and Secondary Memory: RAM, ROM, tracks and sectors, optical disk (CD , DVD & Blue Ray Disk.), USB/Flash Drive, HDD, SSD

3. Software Concepts and Programming:

System software, Application software, Virtualization software and Utility software, Introduction of Operating System, Installation of Application software, Features of OPEN OFFICE/MSOFFICE(MS word, Excel, PowerPoint).

Flow chart using algorithm development, Input Output statement, Control structures

4. Internet Concepts:

Basics of Networking – LAN, WAN, PAN, MAN, and sharing of printers and other resources, Concept of IP addresses, introduction of internet, applications of internet like: e-mail and browsing, concept of search engine and safe searching. Various browsers like Internet explorer/Microsoft Edge, Mozilla Firefox, WWW (World Wide Web), hyperlinks, introduction to Anti-virus.

LIST OF PRACTICAL EXERCISES

1. Given a PC, identify its basic hardware components, network components and peripherals. List their functions .
2. Installation of various application software and utility software.
3. Installation of I/O devices like scanner, printer and plotter.
4. Practice on various features/functions of Windows Operating System..

Word Processing (MS Word/Open Office Writer/Libre Office Writer)

5. Creating/opening, saving and printing a document
6. Editing and formatting a document
7. Setting paragraph and page margins.
8. Adding header, footer and page numbering
9. Creating, inserting and formatting a table.
10. Spell checker, inserting date, time, special symbols, importing graphic images, drawing tools.

Spread Sheet Processing (MS Excel/Open Office Calc/Libre Office Calc)

11. Creating/opening, saving and printing a worksheet.
12. Editing and formatting of worksheets including changing colour, size, font, alignment of text and cell formatting.
13. Using statistical functions like sum, avg, min, max, if, count and countif, lookup.
14. Creating and formatting a chart, Using charts to analyse data. Use of filters.

Presentation Software (MS Power Point/Open Office Impress/Libre Office Impress)

15. Creating, saving, opening and printing a presentation.
16. Different views of a slide.
17. Using slide layout and template.
18. Editing and formatting slides by adding titles, subtitles, text, background, watermark, table, charts, images and sound.
19. Viewing the slide show with slide transition, animation effect, timing and order.

Programming

20. Printing of name 100 times using loop statement.

Internet and its Applications

21. Creating an e mail account. Sending and receiving e-mail.
22. Browsing and down loading of information from internet.
23. Surfing different websites like institute website, State Board PSBTE website, DTE website, NITTTR, Chandigarh website, AICTE website, various search engines like google, bing etc.

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 in addition to working on internet. The student should be made capable of working on computers independently.

RECOMMENDED BOOKS

1. Arora, Vipin, “Computer Fundamentals and Information Technology”, Eagle Parkashan, Jalandhar
2. Sinha, PK, “Computer Fundamentals”, BPB Publication, New Delhi
3. RajaramanV, “Fundamentals of Computer”, Prentice Hall of India Pvt. Ltd., New Delhi
4. Saxena, Sanjay, “MS Office for Everyone”, Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. Leon and Leon, “Fundamentals of Information Technology”, Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi

1.6 ENGINEERING DRAWING - I

L P
- 6

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 16 sheets to be prepared and at least 3 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
- 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-CUM- PRACTICAL EXERCISES

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 (1st and 3rd 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 1st angle only
- 4.5 Three views of orthographic projection of different objects. (At least one sheet in 3rd angle)
- 4.6 Identification of surfaces
- 5. Sections (02 sheets)
 - 5.1 Importance and salient features
 - 5.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.
 - 5.3 Convention sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
 - 5.4 Orthographic sectional views of different objects.
- 6. Isometric Views (02 sheets)
 - 6.1 Fundamentals of isometric projections and isometric scale.
 - 6.2 Isometric views of combination of regular solids like cylinder, cone, cube and prism.
- 7. Common Symbols and Conventions used in Engineering (02 sheets)
 - 7.1 Civil Engineering sanitary fitting symbols
 - 7.2 Electrical fitting symbols for domestic interior installations
- *8. Introduction to Computer Aided Drafting (03 sheets)

Basic introduction and operational instructions of various commands in Computer Aided Drafting. At least three 2 D drawings using Computer Aided Drafting of cube, cuboid, cone, pyramid, truncated cone and pyramid, sphere and combination of above solids.

*** Computer aided 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.

RECOMMENDED BOOKS

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

1.7 GENERAL WORKSHOP PRACTICE – I

L P
- 6

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practical. General workshop practical included in the curriculum in order to provide hands-on practical knowledge of different tools and basic manufacturing processes. Basic knowledge of workshop technology and practical in various workshops develop the attitude of team working, safety awareness and development of right attitude. This subject provides miniature industrial environment in the educational institute.

LEARNING OUTCOMES

After completing the course the students will be able to:

- Identify shop wise tools and equipment, their types, specifications and use with proficiency.
- Identify different types of materials, their uses and to maintain tools, equipment etc.
- Use and take measurements with the help of basic measuring tools/instrument.
- Select proper tools for a particular operation and use hand tools in different workshops with predefined outcome.
- Select materials, tools, and sequence of operations to make a job as per given specification/drawing.
- Prepare simple jobs independently and inspect the same according to drawing.
- Operate various tools and equipment in different workshops with predefined outcome, performance, standards.
- Follow the safety procedures and precautionary measures in different workshop with zero accidents.

DETAILED CONTENTS-CUM- PRACTICAL EXERCISES

Note: The students are supposed to come in proper workshop uniform 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 workshops will be explained for conduct of practical. The students should prepare sketches of various tools/jobs sequence of operations etc. in their practical notebook.

The following shops are included in the syllabus:

1. Welding Shop – I
2. Fitting Shop – I
3. Sheet Metal Shop – I
4. Electric Shop-I
5. Carpentry Shop – I
6. Smithy Shop – I or Additive Manufacturing Shop- I

1. WELDING SHOP – I

- a. Safety precautions of concerned shop and use of Personal Protective Equipment (PPE).Introduction and importance of welding as compared to other material joining processes. Classification of welding processes. Specifications and type of welding machines, welding parameters, welding methods, welding joints and welding positions. Classification and coding of electrodes and functions of electrode coating ingredients.
- b. Demonstration of hand tools, arc welding machines, equipment and materials to be welded.
- 1.3 Jobs to be prepared:

Job I	Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat) and Practice of depositing beads at different current levels. (Minimum 4 beads on M.S. flat at four different setting of current level).
Job II	Making a lap joint using arc welding (SMAW) on MS Flat.
Job III	Making a butt joint using arc welding (SMAW) on MS Flat. (100 mm long).
Job IV	Making a T shape Joint using arc welding (SMAW)on M.S. Flat (100mm x 6 mm).

2. FITTING SHOP – I

- 2.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE).Introduction, functions, classification, specification and use of various types of holding, cutting, marking and measuring tools used in fitting shop like-Bench vice, V block, C clamp, Ball peen hammer, scriber, punches, files, hacksaw, surface plate, try square, calipers, steel rule, Vernier calliper, Micrometre and Vernier height gauge etc. Identification of materials like-Iron, Copper, Stainless Steel, Aluminium etc.), Identification of various steel sections like-flat, angle, channel, bar etc.). Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping and Filing).

2.2 Demonstration of various types of holding, cutting, marking and measuring tools used in fitting shop.

2.3 Jobs to be prepared:

- Job I To make a rectangular job by performing the operations: Sawing, Marking, filing on MS work piece (75 x 50 x 6 mm) by making sides at 90 degree and surface flatness at 180 degrees and to maintain dimensions within an accuracy of ± 0.25 mm.
- Job II To make a job by performing the operations: Sawing, Marking, corner circular/radius filing on MS work piece (75 x 50 x 6 mm) by measuring dimensions with the help of Vernier Calipers within the tolerance of ± 0.1 mm.
- Job III To Make 'V' type cut-out profile from a square piece of MS flat using hand hacksaw, filing, marking and measuring operations.

3. SHEET METAL SHOP – I

3.1. Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction and functions of various types of tools used in sheet metal shop: - snips, hand shearing, measuring tools, marking tools, striking tools and bending tools including types of stakes. Introduction and importance to different types of joints and fasteners used in sheet metal work. Introduction and purpose of different metals used in sheet-metal work-black iron, galvanized iron, aluminium and stainless steel. Introduction of different types of Rivets, types of riveted joints, advantages, disadvantages and applications.

3.2 Demonstration of various types of holding, cutting, marking and bending tools used in fitting shop. demonstration of various raw materials used in sheet metal shop e.g. black-iron sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheet etc.

3.3 Jobs to be prepared:

- Job I Shearing and bending practice on a sheet using hand shears/snips and stakes.
- Job II To fabricate different types of sheet metal joint such as lap joint-single seam/double seam.
- Job III To fabricate riveted lap joint (chain or zig zag type).
- Job IV To fabricate single cover plate chain type, zig-zag type and single rivetted butt Joint.

4. ELECTRIC SHOP - I

4.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction, functions and specifications of different

types of tools, wires, cables, switches, fuses, cleats, clamps, allied items, and accessories used in Electric shop. Introduction to battery charger and its functioning. Introduction to common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Introduction to lead acid battery and nickel cadmium battery.

- 4.2 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. Demonstration of common electrical appliances such as auto electric iron, electric kettle, ceiling/table fan, desert cooler etc. Demonstration of lead acid battery and nickel cadmium battery.

4.3 Job Practice:

Job I Identification of phase, neutral, earth wires for connection to domestic electrical appliances and their connections to three pin plugs.

Job II Practice in making series and parallel circuit. Make one lamp control by one switch circuit.

Job III Practice on house wiring circuits using fuse, switches, sockets, ceiling rose etc. in batten or P.V.C. casing-caping, conduit and concealed wiring.

Job IV Installation of battery and connecting two or three batteries in series and parallel.

Job V Charging a battery and testing with hydrometer and cell tester

5. CARPENTRY SHOP – I

- 5.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to wood, timber their properties, uses & defects and their joints. Seasoning of wood and its advantages. Introduction, specifications and function of various types of tools used in carpentry (such as different types of Saws, C-Clamp, Chisels, Carpenter's vice, Mallets, Marking gauges, Scriber, Try-square, Steel tape, Wooden plane, Metallic Jack plane, Rulers) by segregating as cutting tools, supporting tools, holding tools, measuring tools etc. Types of wooden joints. Techniques/method of sharpening of jack plane cutter/blade.

- 5.2 Demonstration of wood/timber, seasoning, various types of tools used in carpentry shop. Types of wooden joints.

5.3 Jobs to be Prepared :

Job 1 To make a rectangular wooden piece involving operations like-planing, marking, sawing and measuring.

Job II Iron jack plane blade/cutter sharpening and Chisel sharpening practice.

Job III To make a Half Lap Joint (cross, L or T shape – any one)

Job IV To make a Mortise and Tenon joint (T- shape Joint)

6. SMITHY SHOP – I

6.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to Smithy shop, different types of Hearths, its purpose, specifications, uses, types of various tools and equipment used in hand forging by segregating as cutting tools, supporting tools, holding tools, measuring tools etc. Types of fuel used and maximum temperature obtained, types of raw materials used in Smithy Shop , uses of Fire Bricks and Clays in Forging workshop.

6.3 Demonstration of different fuels used and maximum temperature obtained. Use of fire brick and clay in forging/ smithy shop. Practice of firing of hearth/Furnace, Temperature Control of Fire. Demonstration of different basic Smithy/Forging operations such as Cutting, Upsetting, Drawing down, Setting down, Necking, Bending, Fullering, Swaging, Punching and Drifting. Demonstration of Simple Heat treatment processes like Tempering, Normalizing Hardening etc

6.3 Jobs to be prepared:

Job I Making a job of square shape from a M.S. rod by forging method.

Job II Making a square shape L hook from M.S. rod.

Job III Making a ring from MS rod by cold or hot forging process

Job IV Making a job using drawing down operation on round or flat section.

6. ADDITIVE MANUFACTURING SHOP - I

6.1 Safety precautions of concerned shop and use of Personal Protective Equipment (PPE). Introduction to digital design, Computer Aided Drafting (2D drawing) and Computer Aided Design (3D modelling), various CAD packages, basic 2D and 3D commands, basic geometrical shapes (both regular and irregular) etc. Introduction to Additive Manufacturing, identification of different types of materials used, applications and advantages. Identification of different types of geometrical shapes: regular shapes like sphere, prisms, pyramids, solids of revolution, irregular shapes like I section, L section, C section and T section etc.

6.2 Demonstration of 3D CAD package including software interphase, basic commands for drawing, editing, modelling etc., fabrication of 3D models, saving in .PRT file, conversion to .STL file, error identification and its rectification, working of 3D printer, 3D printing of simple components.

6.3 Jobs to be performed

Job I: 3D modelling of basic right regular geometrical shapes:

Prisms: Triangular, square. Rectangular, pentagonal and hexagonal

Pyramids: Triangular, square. Rectangular, pentagonal and hexagonal

Job II: 3D modelling of solids of revolution: Sphere, cylinder, cone and torus

Job III: 3D modelling of special shapes like I section, L section, C section and T section

Job IV: 3D modelling of machined parts using various 3D commands.

Note :

1. Workshop instructors will guide and help the students throughout the practical class in order to explain and complete the job according to syllabus and for providing necessary facilities to the students during performance of practical by observing the safety precautions
2. The Workshop Superintendent or Foreman Instructor or Foreman will demonstrate and deliver the theoretical instructions with regard to introduction, functions, classification and specification of tools, instruments, equipment, apparatus etc. of all the topics covered in the syllabus.
3. The Workshop Superintendent or Foreman Instructor will also conduct the mid-term test and final practical exam of this subject.

RECOMMENDED BOOKS

1. Singh, Swaran, “Workshop Practice”, S. K. Kataria and Sons, New Delhi.
2. Bawa, H.S., “Workshop Practice”, Tata McGraw Hill Publishers, New Delhi.
3. Hajra, SK, “Workshop Technology I,II, III”, Choudhary and AK Choudhary Media Promoters and Publishers Pvt. Ltd. Mumbai.
4. Manchanda, “Workshop Technology Vol. I, II, III”, India Publishing House, Jalandhar.
5. Raghuwanshi, B.S., “Workshop Technology”, Dhanpat Rai and Co., New Delhi

TRAFFIC AWARENESS & ROAD SAFETY CAMP(I)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety by obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of Distt. Traffic police. There will be no exam for this camp.

1. Road safety Scenario
2. School bus and traffic management
3. Awareness of Traffic Signs
4. Speeding Limit
5. Always Wear your Shields
6. Overtaking
7. Awareness through Hoardings
8. Walking & Safe cycling

2.1 ENGLISH AND COMMUNICATION SKILLS - II

L	P
3	2

RATIONALE

Communication skills play 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.

LEARNING OUTCOMES

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

- Make proper oral presentations.
- Speak confidently.
- Debate properly.
- Write accurate official/business letters.
- Respond to telephone calls effectively.
- Overcome communication barriers.

DETAILED CONTENTS

1. Functional Grammar and Vocabulary (12 hrs)

Theory and Practical exercises on following:

- 1.1 One word substitution
- 1.2 Functional Grammar and Vocabulary
- 1.3 Prefixes and Suffixes
- 1.4 Punctuation
- 1.5 Narration
- 1.6 Idioms and Phrases

2. Reading (9 hrs)

Comprehension, Vocabulary enrichment and grammar exercises based on the following readings:

Section-I

- The Last Leaf - O' Henry
- Sparrows - K A Abbas
- The Postmaster - Rabindra Nath Tagore

Section-II

- Night of the Scorpion - Nissim Ezekiel
- All the World is a Stage - William Shakespeare
- Success – Emily Dickenson
- Daffodils – William Wordsworth

3. Writing (24 hrs)

- 3.1 Writing Resume and Cover letter
- 3.2 Correspondence: Business and Official
- 3.3 Report Writing – Introduction and features of good report.
- 3.4 Press Release
- 3.5 Memos and Circulars
- 3.6 Notices (lost, found, and auction)
- 3.7 Agenda and Minutes of Meetings
- 3.8 Filling-up different forms such as bank form and on-line form for placement etc.
- 3.9 Precis Writing
- 3.10 E mail writing

LIST OF PRACTICALS

1. Group discussion on some current topic of interest.
2. Small speech using voice modulation.
3. Debate
4. Manners and Etiquette
5. Power point presentation
6. Telephonic conversation: General etiquette for making and receiving calls.
7. Mock interviews

INSTRUCTIONAL STRATEGY

Open source software should be used to help the students in developing listening skills. Student centred activities such as group discussions, role play should be used to ensure active participation of students in the classroom.

RECOMMENDED BOOKS

1. Revathi, Srinivas, “Communicating Effectively in English, Book-I”, Abhishek Publications, Chandigarh.
2. Mohan, Krishna & Meera Banerji, “Developing Communication Skills (2nd Edition)”, Published by Macmillan Publishers India Ltd; New Delhi.
3. Eastwood, John, “Oxford Practice Grammar”, Oxford University Press, London

4. Chadha, R. K., “Communication Techniques and Skills”, Dhanpat Rai Publications, New Delhi.
5. Wren & Martin, “High School English Grammar and Composition”, S. Chand & Company Ltd., Delhi.
6. Kumar, Sanjay & Pushp Lata, “Communication Skills”, Oxford University Press, New Delhi

WEBSITES FOR REFERENCE

1. [http://www.mindtools.com/ page 8.html](http://www.mindtools.com/page 8.html)
2. <http://www.letstalk.com.in>
3. <http://www.englishlearning.com>
4. <http://learnenglish.britishcouncil.org/en/>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	12	12
2	9	12
3	24	26
Total	45	50

2.2 APPLIED MATHEMATICS – II

L P
3 -

RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of differential calculus, integral calculus and differential equations have been included in this course. This will develop analytical abilities to apply in engineering field and will provide continuing educational base to the students.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Apply differential calculus to solve max/min and related rate measure problems.
- Apply concepts of definite integrals to calculate the area of a curve bounded by axes.
- Evaluate complex integrals in a simpler way by applying definite integral.
- Solve engineering problems by making use of ordinary differential equations.

DETAILED CONTENTS

1. Differential Calculus (18 hrs)
 - 1.1 Definition of function; Introduction to limit and continuity (definition only).
 - 1.2 Standard differentiation of algebraic, trigonometric, inverse trigonometric functions, logarithmic function and exponential function.
 - 1.3 Differentiation of sum, product and quotient of functions, Differentiation of function of a function, differentiation of implicit functions and parametric functions.
 - 1.4 Logarithmic differentiation and successive differentiation (excluding nth order).
 - 1.5 Application of differential calculus in:
 - (a) Rate Measures
 - (b) Maxima and minima (single variable functions) using second order derivative only
 - (c) Equation of tangent and normal to a curve (for explicit functions only)

2. Integral Calculus (22 hrs)
- 2.1 Indefinite integrals, Integration as inverse operation of differentiation with simple examples.
- 2.2 Standard integrals and related simple problems
- 2.3 Simple integration by substitution, by parts and by partial fractions (for linear factors only)
- 2.4 Evaluation of definite integrals (simple problems)
 Evaluation of $\int_0^{\pi/2} \sin^n x \, dx$, $\int_0^{\pi/2} \cos^n x \, dx$, $\int_0^{\pi/2} \sin^m x \cos^n x \, dx$
 using formulae without proof (m and n being positive integers only).
- 2.5 Applications of integration for evaluation of area bounded by a curve and axes (Simple problems).
3. Differential Equations (5 hrs)
- 3.1 Definition, order, degree of ordinary differential equations.
- 3.2 Formation of differential equation (up to 2nd order). Solution of Differential equations with Variable separation and Linear Differential equations.

INSTRUCTIONAL STATREGY

Basic elements of Differential Calculus, Integral Calculus, and Differential Equations can be taught in the light of their applications in the field of engineering and technology. By laying more stress on applied part, teachers can also help in providing continuing education base to the students.

RECOMMENDED BOOKS

1. Grewal, BS, "Elementary Engineering Mathematics", Khanna Publishers, New Delhi
2. Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar
3. Sabharwal, SS & Dr Sunita Jain, "Applied Mathematics, Vol. I & II", Eagle Parkashan, Jalandhar

4. Engineering Mathematics, Vol I, II & III by V Sundaram et al, Vikas Publishing House (P) Ltd., New Delhi
5. Sastry, SS, “Engineering Mathematics, Vol I & II”, Prentice Hall of India Pvt. Ltd.,
6. Pal, Srimanta and Subodh C. Bhunia, “Engineering Mathematics”, Oxford University Press, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	18	20
2	22	25
3	5	05
Total	45	50

2.3 APPLIED PHYSICS – II

L	P
2	2

RATIONALE

Applied physics includes the study of a large number of diverse topics related to things that go in the world around us. It aims to give an understanding of this world both by observation and prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology

LEARNING OUTCOMES

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

- Apply the concept of wave motion
- Illustrate laws of reflection and refraction of light.
- Comprehend the phenomenon related to electrostatics
- Comprehend the terms and laws related to electricity and magnetism.
- Make use of laser for engineering applications.

DETAILED CONTENTS

1. Wave motion and its Applications (6 hrs)
 - 1.1 Wave motion, transverse and longitudinal wave motion with examples, sound and light waves, relationship among wave velocity, frequency and wave length and its application
 - 1.2 Free, forced and resonant vibrations with examples
 - 1.3 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time and their applications
 - 1.4 Ultrasonics – Introduction and applications.

2. Optics (6 hrs)
 - 2.1 Laws of reflection and refraction, refractive index, lens formula for thin lenses, power of lens, magnification
 - 2.2 Total internal reflection and its applications, Critical angle and conditions for total internal reflection
 - 2.3 Simple and compound microscope, astronomical telescope in normal adjustment, magnifying power (Only formula).

3. Electrostatics (6 hrs)
 - 3.1 Coulombs law, unit of charge,
 - 3.2 Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference
 - 3.3 Capacitor and its working principle, Capacitance and its units. Capacitance of parallel plate capacitor (No derivation), Series and parallel combination of capacitors (numericals)
 - 3.4 Dielectric and its effect on capacitance, dielectric break down

4. Electricity and Magnetism (9 hrs)
 - 4.1 Electric Current and its Unit, Direct and alternating current,
 - 4.2 Resistance and its Units, Specific Resistance, Conductance, Specific Conductance, Series and Parallel combination of Resistances. Factors affecting Resistance, Superconductivity (concept only)
 - 4.3 Ohm's law and its verification
 - 4.4 Kirchhoff's laws, Wheatstone bridge principle
 - 4.5 Heating effect of current, Electric power, Electric energy and its units (related numerical problems)
 - 4.6 Introduction to magnetism, Types of magnetic materials. Dia, para and ferromagnetic materials with their properties,
 - 4.7 Magnetic field and its units, magnetic lines of force, magnetic flux and their units
 - 4.8 Concept of electromagnetic induction, Faraday's Laws and Lenz's law, Galvanometer and its use.

5. Modern Physics (3 hrs)
 - 5.1 Lasers: its characteristics, spontaneous and stimulated emission, population inversion; Principle, construction and working of Ruby laser, engineering applications of lasers.

LIST OF PRACTICALS (To perform minimum 8 experiments)

1. To find the time period of a simple pendulum
2. To determine and verify the time period of cantilever
3. To verify laws of reflection from a plane mirror.
4. To find the focal length of convex lens by parallax method.
5. To determine the magnifying power of an astronomical telescope
6. To verify ohm's laws by drawing a graph between voltage and current.
7. To verify laws of resistances in series and parallel combination.
8. To find resistance of galvanometer by half deflection method
9. To measure very low resistance and very high resistances using Slide Wire bridge
10. Use of CRO in plotting AC and DC waveforms.
11. To find wave length of the laser beam.

INSTRUCTIONAL STATREGY

Teacher may use various instructional media like models, charts and graphs while imparting instructions. The field application should be made clear before teaching the basics to develop proper understanding of the physical phenomenon. Use of demonstration can make the subject interesting and develop scientific temper in the students.

RECOMMENDED BOOKS

1. Text Book of Physics (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. Practical Physics by C. L. Arora, S Chand Publications
4. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic	Time Allotted (hrs)	Marks Allotted (Out of 50)
1	06	10
2	06	10
3	06	10
4	09	15
5	03	05
Total	30	50

2.4 ENVIRONMENTAL STUDIES

L	P
2	-

RATIONALE

Engineering activities require the use of natural resources which results in wide-ranging adverse effects on the environment. Natural replenishment of these resources is practically impossible. This necessitates that all technicians should know about the basics of ecology, environment and its functions, environmental pollution and management and environmental legislation which will enable them to accomplish their professional work with environmental compatibility. Hence this subject.

LEARNING OUTCOMES

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

- Comprehend the importance of ecosystem and environment.
- Demonstrate interdisciplinary nature of environmental issues.
- Identify different types of environmental pollution and control measures.
- Take corrective measures for the abatement of environmental pollutions.
- Compute the impact of human activities on the environment.
- Understand purpose of 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.

DETAILED CONTENTS

1. Introduction: (4 hrs)
Basics of ecology, eco system and environment. Review of carbon, nitrogen, sulphur and water cycle)
2. Conservation of land reforms: (3 hrs)
Desertification, Causes, effects and prevention. rain water harvesting, maintenance of ground water, deforestation – its effects and control measures
3. Environmental Pollution: (10 hrs)
Sources of pollution - natural and man made, causes, effects and control measures of pollution (air, water, noise, soil and radioactive). Concept of BOD, COD and AQI, Prevention of Pollution- Introduction to Cleaner Production Technologies, Waste Minimization Techniques, Concept of Zero Discharge, Impact of Energy

Usage on Environment: Global Warming, Green House Effect, Depletion of Ozone Layer, Acid Rain.

4. Solid Waste management (3 hrs)
Classification of refuse material, sources, effects and control measures.
Introduction to E-waste Management
5. Environmental Legislation (4 hrs)
Introduction to Water (prevention and control of pollution) Act, Air (Prevention and Control of Pollution) Act and Environmental Protection Act, Role and Function of State Pollution Control Board, Introduction to Energy Conservation Act & its importance, Concept of Environmental Impact Assessment (EIA)
6. Energy Conservation and Sustainable Development (6 hrs)
Introduction to Energy Management, Energy Conservation, Energy efficiency and its need. Role of Non-conventional Energy Resources (Solar Energy, Wind Energy, Bio mass energy, hydro energy) in environmental protection. Sustainable development, Concept of Green building and eco friendly materials.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, different activities pertaining to Environmental Studies like expert lectures, seminars, visits etc. may also be organized.

RECOMMENDED BOOKS

1. Sharma, BR, "Environmental and Pollution Awareness", Satya Prakashan, New Delhi.
2. Khitoliya, Dr. RK, "Environmental Pollution", S Chand Publishing, New Delhi.
3. Deswal and Deswal, "Environmental Science", Dhanpat Rai and Co. (P) Ltd. Delhi.
4. Bharucha, Erach, "Environmental Studies", University Press (India) Private Ltd., Hyderabad.
5. Dhamija, Suresh K, "Environmental Engineering and Management", SK Kataria and Sons, New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	06
2	3	05
3	10	16
4	3	05
5	4	06
6	6	12
Total	30	50

2.5 APPLIED MECHANICS

L	P
3	2

RATIONALE

The subject Applied Mechanics deals with basic concepts of mechanics like laws of forces, laws of motion, moment, friction, centre of gravity, 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.
- Solve problems by using principle of moment.
- 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 solid bodies.
- Determine velocity ratio, mechanical advantage and efficiency of simple machines

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Introduction | (2 hrs) |
| | 1.1 Concept of engineering mechanics definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields.
Definition of Applied Mechanics. | |
| | 1.2 Concept of rigid body, scalar and vector quantities | |
| 2. | Laws of forces | (10 hrs) |
| | 2.1 Definition of force, measurement of force in SI units, its representation, types of force: Point force/concentrated force & Uniformly distributed force, contact and non contact forces, effects of force, characteristics of a force | |
| | 2.2 Newton's laws of motion, Newton's laws of gravitation, Difference between mass and weight | |
| | 2.3 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position | |

- 2.4 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
- 2.5 Free body diagram
- 2.6 Equilibrant force and its determination
- 2.7 Lami's theorem (concept only)
[Simple problems on above topics]
- 3. Moment (9 hrs)
 - 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 (9 hrs)
 - 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 (6 hrs)
- 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 (9 hrs)
- 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.

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	2	2
2	10	12
3	9	10
4	9	10
5	6	6
6	9	10
Total	45	50

2.6 CONSTRUCTION MATERIAL

L	P
2	4

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, 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 as per BIS code for effective quality control.

LEARNING OUTCOMES

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

- Classify rocks and identify particular type of stones
- Classify different types of bricks and tiles
- Perform laboratory tests of cement to determine properties of cement
- Identify types of defects of timber
- Identify and use different types of metals/alloys
- Select different materials used for wall paneling and false ceiling such as PVC, POP etc.

DETAILED CONTENTS

- | | | |
|-------|---|----------|
| 1. | Building Stones | (04 hrs) |
| 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 | Identification of common building stones | |

- 1.3 Various uses of stones in construction

2. Bricks and Tiles (06 hrs)
 - 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, clay-flyash bricks, sun dried bricks, only line diagram of kilns
 - 2.4 Classification and specifications of bricks as per BIS: 1077
 - 2.5 Tiles
 - 2.5.1 Building tiles; Types of tiles-wall, ceiling, roofing and flooring tiles
 - 2.5.2 Ceramic, terrazo and PVC tiles: their properties and uses,
 - 2.5.3 Vitrified tiles, Paver blocks, interlocking tiles

3. Cement (04 hrs)
 - **3.1 Introduction, raw materials and their composition, flow diagram of manufacturing of cement.
 - 3.2 Various types of cements such as Ordinary Portland Cement, Portland Pozzolana cement, Rapid Hardening cement, low heat cement, white cement, quick setting cement, light weight cement etc., their properties and uses.

4. Timber and Wood Based Products (04 hrs)
 - 4.1 Identification and uses of different types of timber: Teak, Deodar, Shisham, Sal, Mango, Kail, Chir, Fir, Hollock, Champ
 - 4.2 Seasoning of timber: Purpose, methods of seasoning as per BIS Code
 - 4.3 Defects in timber, decay in timber, methods of preservation of timber

- 4.4 Other wood based products, their brief description of manufacture and uses: Laminated Board, Fibre Board, Hard board, Sunmica, Plywood and Veneers, HPL (High Pressure Laminate)
5. Metals (04 hrs)
 - 5.1 Ferrous metals: Composition, properties and uses of cast iron, mild steel, HYSD steel, high tension steel as per BIS.
 - 5.2 Commercial forms of ferrous, metals.
 - 5.3 Aluminium & Stainless Steel.
6. Miscellaneous Materials (08 hrs)
 - 6.1 Plastics – Introduction and uses of various plastic products in buildings such as doors, water tanks and PVC pipes
 - 6.2 Fibre Sheets and their size and uses
 - 6.3 Types and uses of insulating materials for sound and thermal insulation
 - 6.4 Construction chemicals like water proofing compound, epoxies, polymers
 - 6.5 Glass-types and uses
 - 6.6 Materials used in interior decoration works like POP, PVC panelling

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

PRACTICAL EXERCISES

1. To determine the fineness of cement
2. To determine the setting time of cement
3. To determine the consistency of cement
4. To determine the soundness of cement
5. To determine the compressive strength of cement
6. To perform the field test of cement
7. To identify the stones used in building works by visual examination
8. To determine the crushing strength of bricks
9. To determine the water absorption of bricks and efflorescence of bricks
10. To identify various types of timbers such as: Teak, Sal, Chir, Shisham, Deodar, Kail & Hollock by visual examination only

NOTE: The students should submit a report work on the construction materials, covering water proofing material, cements, steel, 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.

RECOMMENDED BOOKS

1. Sharma, SK and Mathur, GC, “Engineering Materials”, S. Chand and Co., Delhi.
2. TTTI, Chandigarh, “Civil Engineering Materials”, Tata McGraw Hill Publication, New Delhi.
3. Kulkarni, GJ, “Engineering Materials”, Ahmedabad Book Depot, Ahmedabad.
4. Gurcharan Singh, “Engineering materials”, Standard Publishers Distributors, Delhi.
5. SC Rangawala, “Construction Materials”, Charotar Publishers Pvt Co Ltd, Anand.
6. Hemant Sood, “Lab Manual in Testing of Engineering Materials”, New Age International (P) Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (out of 50)
1	4	7
2	6	10
3	4	7
4	4	7
5	4	7
6	8	12
Total	30	50

2.7 INTRODUCTION TO CAD

L	P
-	6

RATIONALE

Computer Aided Drawings plays a very vital role in a in the professional life of a Civil engineer. These days Pen, Pencil and Paper drawings have been replaced by the CAD software. In order to enable the students to use and understand the CAD Software effectively in drawing making this course offers practical applications and understanding of various CAD Software.

LEARNING OUTCOMES

After going through the subject, the students will be able to:

- Explain commands and keyboard shortcuts of any CAD software
- Create new drawings in CAD
- Edit, modify and manipulate CAD drawings
- Make drawing templates
- Create 2D drawing figures.
- Print and plot CAD drawings at given scale

DETAILED CONTENTS CUM PRACTICAL EXERCISES

1. Introduction

Different Type of CAD Software (AutoCAD, ZWCAD, LibreCAD), Graphic user interface of CAD Software, Practical Applications, Workspaces Settings, Menu bar, Ribbons, Command line, Co-ordinate systems, File Types, File Management, Drawing Settings, Options.

Practical Exercise 1:

- To install any CAD Software and Customize the User Interface.

2. Drafting and Drawing Settings

Units Settings, Limits Setting, Ortho Mode, Polar Mode, Grid, Grid Setting, Snap, Object snap, Polar Tracking, Isometric Drafting, Dynamic Inputs, Quick Properties, Selection Cycling, Workspace Switching

Practical Exercise 2:

- To Set drawing units & customize the Grids
- To work with object Snap, Ortho and Polar Mode
- To use the Selection Cycling, Dynamic Inputs, Quick Properties

3. Drawing a line (Using Commands and Menu bar)

Point, Line, Spline, Multiline, 2D Polyline, 3D Polyline, X-line, Ray, Line Type, Line Weight, Line Type Scale, Creating line using Coordinates, Creating line using dimensions and angles, Purpose and uses of different types of lines

Practical Exercise 3:

- To create a point and change point style.
- To draw line, multiline, Spline, X Line and Poly Line.
- To change line type, line type scale and line color.

4. Drawing Shapes (Using Commands and Menu bar)

Rectangle, Polygon, Circle (Using 2 Points, 3 points, Tangents, Radius, Diameter), Arc, Ellipse, Donut, Helix, Creating shapes using Coordinates, Creating shapes using dimensions

Practical Exercise 4:

- To draw a rectangle and polygons using co-ordinates and sides.
- To draw a Circle using 2 Points, 3 points, Tangents, Radius, Diameter
- To draw arcs using various parameters
- To draw other shapes such as Ellipse, Donut and Helix

5. Modify Tools

Erase, Undo, Redo, Explode, Move, Copy, Offset, Rotate, Mirror, Scale, Stretch, Lengthen, Trim, Extend, Break, Join, Chamfer, Fillet, Divide, Measure, Multiline style, Multiline edit, Poly edit, Spline edit, Array, Polar Array, Match Properties, Transparency, List, Properties

Practical Exercise 5:

- To create offsets of various line types.
- To edit a line using trim, extend, join, divide, measure, polyedit
- To use fillet and chamfer tool with two intersecting lines
- To create array and polar array of an object
- To edit the properties, transparency of various objects and use match property tool

6. Text

Single Line Text, Multiline Text, Symbols, Text Style, Bullets and Numbering, tcount, Fonts, Text Scaling, Spell, Table, Table style, Table Editing, Find and Replace

Practical Exercise 6:

- To write a single line &multiline text
- To change text styles, line height, bullets, numbering and fonts
- To create and edit a table
- To use find and replace option to modify text

7. Display Control

Visual Styles, Zoom, Pan, Redraw, Regen, Clean Screen, Steering wheels

Practical Exercise 7:

- To use the above options in a given drawing

8. Working with Layers

Layers and Layer Properties, New Property Filter, New Group Filter, Layer State Manager

Practical Exercise 8:

- To create a drawing using layers
- To modify properties of drawing objects using layers

9. Annotation Tools

Dimension (Linear, Aligned, Radius, Diameter, Center Mark, Angle, Arc length, Continuous, Baseline, Tolerance, Dimension Space, Dimension Break, Jogged radius, Ordinate dimensions, Centre Mark, Centerline), Dimension Style, Dimension Edit, Leader, Align Leader lines.

Practical Exercise 9:

- To use linear, aligned, angular and radial dimensions in a given drawing.
- To customize, change and create dimensions styles in a given drawing.

10. Hatching Objects

Boundary Creation, Hatch, Hatch Edit, Hatch Patterns, Hatch Angle, Hatch Scale, Gradient, Gradient Colors, Wipeout

Practical Exercise 10:

- To create a boundary and hatch in a given drawing.
- To change the hatch pattern, angle and scale in a given drawing
- To create a color gradient in a given drawing
- To use wipeout tool in a given drawing

11. Selection Methods

Select, Quick Select, Draw order, Filter, Creating and inserting Blocks, Group, Understanding difference between block and group

Practical Exercise 11:

- To select particular types of objects in a given drawing using quick select tool.
- To create and insert blocks of repetitive objects in a given drawing.
- To modify a block in the drawing
- To change the order of various objects in a given drawing

12. Plotting and Publishing

Introduction to plotting, Purging, Layout, Data Extract, Viewports, Page setup, Plot Options, Plotting Scales, Plot as Drawing, Save Drawing as PDF, Export in other Formats

Practical Exercise 12:

- To delete unused objects and blocks from drawing using purge method.
- To create drawing layout.
- To set the page for printing of a given drawing.
- To export drawing in PDF, EPS, WMF or in any other format.
- To extract the data of a given drawing in Excel or CSV Format.

13. Miscellaneous

Practical Exercises 13:

- Draw plan of a plot with 4 sides and calculate area using CAD
- Create a given drawing using decimal unit system
- Create a given drawing using engineering Unit System
- Create a traverse with given dimensions and included angles
- Import KML drawing from google earth into CAD
- Print a drawing with and without Line weight

RECOMMENDED BOOKS

1. Kyles, Shannon R, “AutoCAD Workbook for Architects and Engineers”.
2. Mastering ZwcAD, ZwcAD Softwares Co. Ltd.
3. Venugopal, K, “New Age International Engineering Drawing AutoCAD and Building Drawing”.
4. Kulkarni, D.M., “Engineering Graphics with AutoCAD”.

WEBSITES FOR REFERENCES

1. <https://www.cdeep.iitb.ac.in/slides/A18/ME119/ME119-L1.pdf>
2. <https://www.youtube.com/watch?v=Woc4jUXBFtM&list=PLMtZJAOD3B7Z0kAGbqdVPZuT91pNIsF-R>

TRAFFIC AWARENESS & ROAD SAFETY CAMP (II)

A diploma holder must have knowledge of various types of traffic rules and regulations. Road safety education is vital for people of all ages. As a responsible citizen, you should be aware of each and every road safety rules. Observation is the key skill you need in ensuring road safety by obeying safety rules and regulations, you can save yourself and others on the road. This camp covers the basic concepts of traffic rules and safety. Lectures will be delivered on following broad topics with the coordination of Distt. Traffic police. There will be no exam for this camp.

1. Time management
2. Traffic light signals
3. Speed limits of vehicles
4. Schedule of offences
5. Dividing lines
6. Proper road Maintenance and Warnings
7. Test yourself

3.1 FLUID MECHANICS

L	P
2	4

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 applications in solving fluid mechanics problems.

LEARNING OUTCOMES

After undergoing the subject, the student 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: (1 hr)

1.1 Fluids: Real and ideal fluids with examples.

1.2 Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics

2. Properties of Fluids (3 hrs)

Mass density, specific weight, specific gravity, viscosity, surface tension - cohesion, adhesion and, capillarity, vapour pressure and compressibility.(definitions along with mathematical expressions and units)

3. Hydrostatic Pressure (5 hrs)
 - 3.1 Pressure, intensity of pressure, pressure head, Pascal's law and its applications. (Without derivations)
 - 3.2 Total pressure, resultant pressure, and centre of pressure.
 - 3.3 Total pressure and centre of pressure on horizontal, vertical plane surfaces of rectangular, triangular, and circular shapes.
(No derivation - Simple Numerical Problems)

4. Measurement of Pressure (3 hrs)
 - 4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure & their relationship.
 - 4.2 Piezometer, simple manometer and differential manometer, Bourden gauge and dead weight pressure gauge.(Only theoretical concept)

5. Fundamentals of Fluid Flow (4 hrs)
 - 5.1 Types of Flow: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow (Description with examples)
 - 5.2 Discharge and continuity equation (flow equation) {No derivation}
 - 5.3 Types of hydraulic energy: Potential energy, kinetic energy, pressure energy and total energy of fluid.
 - 5.4 Bernoulli's theorem; statement, assumptions and limitations. (without proof of theorem)

6. Flow Measurements (4 hrs)
 - 6.1 Venturimeter and orificemeter.
 - 6.2 Pitot tube
 - 6.3 Orifices and mouthpieces
 - 6.4 Current meters
 - 6.5 Notches and weirs

7. Flow through Pipes (5 hrs)
 - 7.1 Definition of pipe flow; Reynolds number, laminar and turbulent flow

- 7.2 Critical velocity and velocity distributions in a pipe for laminar and turbulent 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)
- 7.4 Hydraulic gradient line and total energy line
- 7.5 Water hammer phenomenon and its effects (only definition and description)

- 8. Flow through Open Channels (4 hrs)
 - 8.1 Definition of an open channel and its types.
 - 8.2 Introduction to Chezy's formula and Manning's formula.
 - 8.3 Most economical channel sections (simple numerical problems)
 - i) Rectangular(conditions only)
 - ii) Trapezoidal (conditions only)
 - 8.4 Head loss in open channel due to friction
 - 8.5 Difference between pipe flow and open channel flow.

- 9. Hydraulic Pumps (1 hr)

Hydraulic pump, brief description about working of reciprocating pump and centrifugal pumps (No numericals and derivations)

PRACTICAL EXERCISES

- 1. Measurement of pressure in a pipeline using simple manometer and differential manometer.
- 2. Measurement of difference of pressure between two pipe lines using differential manometer.
- 3. To verify Bernoulli's Theorem
- 4. To find out venturimeter coefficient
- 5. 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
- 6. To perform Reynold's experiment
- 7. To determine Darcy's Coefficient of friction for flow through pipes.
- 8. To verify loss of head in pipe flow due to
 - a) Sudden enlargement

- b) Sudden contraction
- c) Sudden bend
- 9. To determine velocity of flow of an open channel using current meter and pitot tube
- 10. To determine coefficient of discharge of a rectangular notch/triangular notch.
- 11. To demonstrate working of reciprocating and centrifugal pumps with working model.
- 12. Visit to Hydraulic research station is must to explain the various concepts.

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. Basic hydraulic bench may be used to perform various experiments. Visit to hydraulic research stations must be carried out.

RECOMMENDED BOOKS

1. Jagdish, Lal, "Fluid Mechanics and Hydraulics", Delhi Metropolitan Book Co. Pvt Ltd.
2. Modi, PN, and Seth, SM; "Hydraulics and Fluid Mechanics", Delhi Standard Publishers Distributors.
3. Khurmi, RS, "Hydraulics and Hydraulics Machines", Delhi S Chand and Co.
4. Poonia MP, and Jakhar OP, "Laboratory Manual for Fluid Mechanics", Standard Publishers Distributors, Delhi.
4. Likhi, SK., "Laboratory Manual in Hydraulics", Delhi Wiley Eastern.
5. Birinder Singh, "Fluid Mechanics", Kaption Publishing, New Delhi.
6. Sarao A.S., "Fluid Mechanics", Tech. India Publication, New Delhi.

WEBSITES FOR REFERENCES

1. <https://nptel.ac.in/courses/112104118>
2. <https://nptel.ac.in/courses/105103192>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (out of 50)
1	1	1
2	3	4
3	5	9
4	3	5
5	4	7
6	4	7
7	5	9
8	4	6
9	1	2
Total	30	50

3.2 SURVEYING

L	P
2	6

RATIONALE

The important functions of a diploma civil engineer include 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 on the development of the skills in each type of survey like chain surveying, compass surveying, plane table survey, leveling and theodolite surveying. Field work should be a selected one so that student can check his work and have an idea of the results and 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 skills in plotting.

LEARNING OUTCOMES

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

- Measure a long line with chain or tape
- Measure and setting offsets
- Measure and convert bearings of lines
- Calculate reduce levels
- Prepare map of small area using Plane Table Instruments
- Prepare Topographic maps with Traversing by using survey instruments

DETAILED CONTENTS

- | | | |
|----|--|---------|
| 1. | Introduction | (3 Hrs) |
| | 1.1 Basic principles of surveying, Concept and purpose of surveying, | |
| | 1.2 Measurements: linear and angular, units of measurements, Instruments used for taking these measurements. | |
| | 1.3 Classification based on surveying instruments | |
| 2. | Chain Survey | (3 Hrs) |
| | 2.1 Introduction, Advantages and Disadvantages of chain survey, Types of Chains | |

- 2.2 Ranging (Direct and indirect), offsets (Short, Long, Perpendicular and Oblique)
- 2.3 Triangulation and recording of field notes
- 3. Compass Survey (5 Hrs)
 - 3.1. Purpose of compass surveying. Use of prismatic compass: Study of Parts, Setting and taking observations
 - 3.2. Concept of following with simple numerical problems:
 - a) Meridian: Magnetic and true
 - b) Bearing: Magnetic, True and Arbitrary
 - c) Whole circle bearing and reduced bearing
 - d) Fore Bearing and Back Bearing
 - e) Magnetic Dip and Declination
 - f) Local attraction - Causes, Detection, Errors and Corrections
 - 3.3. Numerical problems on Bearing Conversion, Local Attraction, Magnetic Declination and calculation of included angles in a compass traverse
- 4. Plane Table Survey (5 Hrs)
 - 4.1. Purpose of plane table surveying, Equipment used in plane table survey:
 - 4.2. Setting of a plane table: Centering, Levelling, Orientation
 - 4.3. Methods of plane table surveying: Radiation, Intersection, Traversing, Resection, Concept of Two point and Three-point problems (Concept only).
 - 4.4. Errors in plane table survey and precautions to control them.
 - 4.5. Advantages and disadvantages of Plane table Survey
- 5. Levelling (6 Hrs)
 - 5.1. Purpose of levelling, concept of a level surface, horizontal surface, vertical surface, datum, reduced level and benchmarks.
 - 5.2. Identification of various parts of Dumpy level, Auto level and Digital Level; use of Dumpy level, Auto level and Digital Level. Their Advantages and disadvantages.
 - 5.3. Concepts of line of collimation, axis of the bubble tube, axis of the telescope and vertical axis, Auto compensator mechanism.
 - 5.4. Levelling staff: Single Piece, Folding, Telescopic Staff, Invar precision staff, and Bar-Coded Staff

- 5.5. Concept of back sight, foresight, intermediate sight, change point, to determine reduce levels
 - 5.6. Temporary adjustment and Permanent Adjustments.
 - 5.7. Level book and reduction of levels by
 - Height of instrument method or Line of Collimation Method and
 - Rise and fall method
 - 5.8. Arithmetic checks, problem on reduction of levels, fly levelling and profile levelling (L-section and X-section), errors in levelling, permissible limits,
 - 5.9. Numerical problems on Reduction of Levels
6. Theodolite Survey (8 Hrs)
- 6.1. Working of a Transit Vernier Theodolite and Electronic Digital Theodolite
 - 6.2. Axes of a theodolite and their relation; concept of transiting, swinging, face left, face right and changing face
 - 6.3. Temporary adjustments of a transit theodolite
 - 6.4. Measurement of horizontal angles by repetition method and reiteration method, Measurement of vertical angles.
 - 6.5. Traversing by included angles and deflection angle method; plotting a traverse; concept of coordinate, errors in theodolite survey, Theodolite triangulation,
 - 6.6. Height of objects with accessible and non-accessible bases (Without Derivation)

PRACTICAL EXERCISES

1. Chain Surveying

Preparation of Map with Chain Survey of a small area with triangulation which include:

- Ranging of a line
- Chaining a line and recording in the field book
- Taking offsets - perpendicular and oblique (with a tape only)
- Setting out right angle with a tape

2. Compass Surveying

Study of prismatic compass and Preparation of map a small area using Chain and Compass with Traversing which include:

- Setting the compass and taking observations.
- Calculation of angles between the traverse lines.
- Detailed Survey of Area using chain and tape.

3. Plane Table Survey

Preparation of map of small area with Plane Table Survey of a small area which include:

- Setting the plane table.
- Marking the North direction.
- Traversing with a plane table (at least five lines)
- Plotting a few points by radiation method.
- Plotting few points by intersection method.
- Orientation by Trough compasses and Back sighting.

4. Leveling

- 4.1. Study of dumpy level and levelling staff, Temporary adjustments of various levels, taking staff readings on different stations from the single setting and finding differences of level between them
- 4.2. To find out difference of level between two distant points by shifting the instrument
- 4.3. Longitudinal and cross sectioning of a road.
- 4.4. Setting a gradient by using any leveling Instrument

5. Theodolite Survey

- 5.1. Taking out the Transit Vernier Theodolite Electronic Digital Theodolite, mounting on the tripod, study of a transit vernier theodolite; Measuring horizontal angle. temporary adjustments of theodolite and placing it back in the box
- 5.2. Survey of a closed traverse with a theodolite (at least five sides) and its plotting which includes:

- Measurement of Horizontal angles with Transit vernier theodolite by repetition and reiteration methods
- Measurement of Horizontal angles with Digital theodolite by repetition and reiteration methods
- Measurement of magnetic bearing of a line
- Latitude and Longitude computation and correction
- Calculations using Gale's traverse table

5.3. Determination of Height of objects with and without accessible bases

6. Layout of A Building

Layout of two room residential building by using previously used 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 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.

RECOMMENDED BOOKS

1. Kochar, CL, "A Textbook of Surveying", Ludhiana, Katson Publishing House.
2. Hussain, SK, and Nagraj, MS, "Text Book of Surveying", New Delhi, S Chand and Co Ltd.
3. Deshpande, RS, "A Text Book Surveying and Levelling", Poona, United Book Corporation.
4. Kanetkar, TP, and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan.
5. Mahajan, Sanjay, "Surveying -I", Tech. Publication, Delhi.
6. Punmia, BC, "Surveying and Leveling", Delhi Standard Publishers Distributors.
7. Shahai, PB, "A Text Book of Surveying", Oxford and IBH Publishing Co.

WEBSITES FOR REFERENCES

1. <https://nptel.ac.in/courses/105107122>
2. <https://www.youtube.com/playlist?list=PL20A0651466E8A776>

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	3	5
2	3	5
3	5	8
4	5	8
5	6	10
6	8	14
Total	30	50

3.3 STRUCTURAL MECHANICS

L	P
3	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, types of beams and loads, bending moment and shear force diagrams, second moment of area, bending and shear stresses, slope and deflection of beams 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 in the field of civil engineering.

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

- | | | |
|-----|---|----------|
| 1. | Properties of Materials | (02 hrs) |
| 1.1 | Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials. | |
| 1.2 | Mechanical properties of materials: strength, elasticity, plasticity, ductility, brittleness, malleability, toughness and hardness. | |

2. Simple Stresses and Strains:(simple numerical problems) (8 hrs)
 - 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, elastic limit, Hooke's law and modulus of elasticity.
 - 2.3 Stresses and strains in bars subjected to tension and compression.
 - 2.4 Temperature stresses and strains

3. Shear Force and Bending Moment (12 hrs)
 - 3.1 Concept of a beam and supports (Hinges, Roller and Fixed), types of beams: simply supported, cantilever, propped, over hang, cantilever 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 under combination of both loads.
 - 3.5 Point of maximum bending moment, and point of contraflexure.

4. Moment of Inertia (simple numerical problems) (04 hrs)

Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis(statement only), second moment of area of common geometrical sections: rectangle, triangle, circle (without derivations). Second moment of area for L, T and I sections.

5. Bending Stresses in Beams (06 hrs)
 - 5.1 Concept of pure/simple bending
 - 5.2 Neutral axis, assumptions made in the theory of simple bending, bending equations and its applications, moment of resistance, section modulus.
 - 5.3 Calculations of bending stresses in rectangular, circular, I, T & L cross sectional simply supported beams.

6. Shear Stresses in Beams (04 hrs)

Concept of shear stresses in beams, shear stress distribution in rectangular, circular, I, T, L sections for Steel and timber beams.

7. Slope and Deflection (02 hrs)

Determination of slope and deflection using Moment Area Theorem for simply supported beam for pointed load and U.D.L. (no derivation, numerical problems only)

8. Columns (03 hrs)

Theory of columns; Types, failure, slenderness ratio, end conditions, effective length, Euler's and Rankine's formula and their assumptions. (without derivation)

9. Problem solving using Eulers and Rankine Formula Analysis of Trusses (04 hrs)

9.1 Concept of a perfect, redundant and deficient frames

9.2 Assumptions and analysis of trusses by method of joints

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 searls'apparatus
4. Determination of elastic critical load of metallic columns with different end conditions.
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.

RECOMMENDED BOOKS

1. Ramamrutham, S., "Strength of Materials", Dhanpat Rai and Sons, New Delhi.
2. Ram Chandra, "Applied Mechanics and Strength of Materials", Standard Publishers. Delhi.
3. Punmia, BC., "Strength of Materials", Standard Publishers, Delhi.
4. Prasad, VS, "Structural Mechanics", Galgotia Publications Pvt Ltd, Delhi.
5. Singh, Sadhu, "Strengths of Materials", Standard Publishers, New Delhi.
6. Singh, Birinder, "Structural Mechanics", Kaption Publishers, Ludhiana.

WEBSITE FOR REFERENCES

1. <https://www.youtube.com/watch?v=whB7IX3NQpg&list=PL4C9BB8DDD5D888A6>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (out of 50)
1	02	03
2	08	09
3	12	13
4	04	04
5	06	06
6	04	05
7	02	03
8	03	03
9	04	04
Total	45	50

3.4 BUILDING CONSTRUCTION

L P
3 2

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:

- 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
- Select different types of doors, windows, floors and stairs cases in building
- Recognise 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

DETAILED CONTENTS

1. Introduction (01 hr)
 - 1.1 Definition of a building, classification of buildings based on occupancy
 - 1.2 Different parts of a building
2. Foundations (03 hrs)
 - 2.1 Concept of foundation and its purpose
 - 2.2 Types of foundation-shallow and deep
 - Introduction to shallow foundations and their types
 - Introduction to deep foundation and their types

- 2.3 Earthwork
Layout/setting out for surface excavation, cutting and filling
Excavation of foundation, trenches, shoring, timbering and de- watering
3. Walls (05 hrs)
- 3.1 Purpose of walls
- 3.2 Classification of walls: load bearing, non-load bearing, shear wall, partition walls and cavity wall.
- 3.3 Classification of walls as per materials of construction: Brick, Stone, Reinforced brick, Reinforced concrete, precast, hollow and solid concrete block, AAC blocks and composite masonry walls.
- 3.4 Partition walls: Constructional details, suitability and uses of brick, glass and aluminium partition walls.
- 3.5 Introduction to Scaffolding, Shoring and Underpinning.
4. Masonry (05 hrs)
- 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
Bond – meaning and necessity; English, flemish bond and other types of bonds
Construction of brick walls –methods of laying bricks in walls, precautions observed in the construction of walls.
- 4.2 Stone Masonry
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
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 (04 hrs)
- 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

Types of Arches - Semi circular, segmental, elliptical and parabolic, flat, inverted and relieving

5.4 Lintels

- Purpose of lintel
- Materials used for lintels
- Cast-in-situ and pre-cast lintels
- Lintel along with sun-shade or chhajja

**6. Doors, Windows and Ventilators (03 hrs)

6.1 Glossary of terms with neat sketches

6.2 Purpose and uses of doors, windows and ventilators. Various fixtures and fasteners and materials used for doors, windows and ventilators.

*7. Damp Proofing and Water Proofing (04 hrs)

7.1 Types of Damp proof course (DPC), Sources of dampness and its ill effects on building.

7.2 Damp proofing materials and their specifications: rich concrete and mortar, bitumen, bitumen mastic, polymer coating, use of chemicals

**8. Floors (05 hrs)

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, tile flooring, stone (marble and kota) flooring. Timber flooring, and their brief description

8.3 Special emphasis on level/slope/reverse slope in bathrooms, toilets, kitchen, balcony and staircase

9. Roofs (04 hrs)

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 board, POP, PVC, Wood, Glass

10. Stairs (05 hrs)

- 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

11. Surface Finishes (06 hrs)

- 11.1 Plastering - classification according to use and finishes like plain plaster, grit finish, rough cast, 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
- 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

Note * An expert may be invited from field/industry for extension lecture
 ** A field visit may be planned to explain and show the relevant things

PRACTICAL EXERCISES

- 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 types of doors:
 - a) Panelled door
 - b) Sliding door
 - c) Flush door
 - d) Rolling shutter
 - e) Collapsible door
 - f) Revolving door
 - g) Folding door

- h) Glazed door
- 5. Demonstration of following types of windows:
 - a) Glazed window
 - b) Sliding window
 - c) Aluminium window
 - d) Panelled window
 - e) PVC window
 - f) Wire gauged window
- 6. Demonstration of following types of Stairs:
 - a) Straight Stairs
 - b) Dog- legged Stairs
 - c) Open Well Stairs
 - d) Bifurcated stairs
 - e) Spiral Stairs
 - f) Curved Stairs
 - g) Cantilever Stair
 - h) Ladder
- 6. 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 specialised 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

RECOMMENDED BOOKS

1. Rangwala, SC, "Building Construction"; Anand, Charotar Book Stall.
2. Arora, SP, and Bindra, SP, "A Text Book of Building Construction", New Delhi Dhanpt Rai and Sons.
3. Kumar, Sushil, "Building Construction", Standard Publishers Distributors, Delhi.
4. SP – 62 Hand Book of BIS.
5. B.I.S. – 6313 Part 1, 2, 3.
6. National Building Code.

WEBSITES FOR REFERENCES

1. <https://www.youtube.com/channel/UC7R0m2JO9EsJNJZPDR2U7YQ>
2. <https://theconstructor.org/home-page>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	1	1
2	3	4
3	5	6
4	5	6
5	4	4
6	3	3
7	4	4
8	5	6
9	4	4
10	5	6
11	6	6
Total	45	50

3.5 BUILDING DRAWING

L	P
-	6

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 drawing for execution of work.

LEARNING OUTCOMES

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

- Layout foundation plan of different types of foundations
- Prepare drawings of small buildings
- Draw building drawing sheets using CAD software
- Prepare details of brick courses in joints
- Draw the sketches of various joints of carpentry
- Demonstrate circular arch and segmental arches
- Read and interpret building drawings

DETAILED CONTENTS CUM PRACTICALS

Section-A

Drawing No. 1: (2 sheets)

Details of spread footing foundations, 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 must be shown in the drawing.

Drawing No. 2: (1 Sheet)

Plans of 'T' and Corner junction of walls of 1 Brick, 1½ Brick and 2 brick thick in English bond

Drawing No. 3: (2 Sheets)

Drawing plan, elevation of arches: circular arch, segmental arch

Drawing No. 4: (3 sheets)

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

Drawing No. 5: (2 sheets)

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

Drawing No. 6: (1 sheet)

Drawings of following floors

Cement concrete floors on ground and at first floor

- i) Wooden flooring
- ii) Bonded cement concrete flooring
- iii) Ceramic/vitrified tile flooring

Drawing No. 7: (1 sheet)

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

Drawing No. 8: (1 sheet)

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

Note: Draw at least one sheet of above drawings using CAD software

Section-B

Drawing No. 9: (4 sheets)

Drawing detailed plan, elevation and section of a two-room residential building from a given line plan, showing details of foundations, roof and parapet

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

RECOMMENDED BOOKS

- 1. Shah, MG, and CM Kale, “Principles of Building Drawing”, MacMillan, Delhi.
- 2. Zaidi, SKA, and Suhail Siddiqui, “Drawing and Design of Residential and Commercial Buildings”, Standard Publishers and Distributors, Delhi.
- 3. Layal, JS, “Civil Engineering Drawing”, Satya Parkashan, New Delhi.
- 4. Chandel, RP, “Civil Engineering Drawings”, Katson Publishing House.
- 5. Kumar, NS, “Civil Engineering Drawing”, IPH, New Delhi.
- 6. Malik, RS, and Meo GA, “Civil Engineering Drawing”, Asian Publishing House, New Delhi.

3.6 OPEN ELECTIVE

L	P
2	-

RATIONALE

Open Elective refers to a course that students can opt for in addition to their primary area of study. The open elective is from an unrelated discipline with the intention to provide exposure in that discipline. It provides the students the opportunity to select and learn a subject related to his/her interest, thus allowing them to explore their passion..

LIST OF SUGGESTED OPEN ELECTIVES

The student can opt one course out of the following:

- 1 Foreign Language
- 2 NCC
- 3 Yoga
- 4 First Aid
- 5 Creative Writing
- 6 Sketching, Drawing and Colour Studies
- 7 Gardening
- 8 Photography
- 9 Legal Studies
- 10 Event Management
- 11 Diet and Nutrition

Open elective can be offered online or offline.

3.6.1 FOREIGN LANGUAGE (French, Japanese, German, Spanish)

L P
2 -

RATIONALE

This course is an introduction to the specific language. Learning to understand and articulate oneself in day to day real life situations, and to begin to make sense of the language as a cultural space are the overall objectives of the course. The student should be able to grasp the basic sentence structure and build a good foundational vocabulary through this course.

LEARNING OUTCOMES

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

- Enhance the level of vocabulary in specific language.
- Manage situational communication in specific language.

DETAILED CONTENTS

- | | | |
|----|--|----------|
| 1. | Introduction | (06 hrs) |
| | Self introduction, Numbers, Days, Months, Date, Time, and Counting | |
| 2. | Vocabulary | (06 hrs) |
| | My home, My family, My friend, Daily routine, Hobbies, Food, Greeting and Thanking | |
| 3. | Grammar | (12 hrs) |
| | Verb and Verb forms, Articles, Possessive pronouns, Auxiliary verbs, Questions, Present and Past tense | |
| 4. | Theme | (06 hrs) |
| | Means of transport, Basic directions, Food, Drink, Family, Groceries and Meals | |

RECOMMENDED BOOKS

1. Annie Berthet, Hugot et al, “Alter Ego - Méthode de Français”, Hachette.
2. 3 A Corporation, “Minna no Nihongo”, Goyal Publishers, New Delhi.
3. Stefanie Dengler, “NETZWERK Deutsch als Fremdsprache A1”, Goyal Publishers, New Delhi.
4. Jaime Corpas et.al, “Aula International 1”, Difusión, Madrid.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	06	10
3	12	20
4	06	10
Total	30	50

3.6.2 NATIONAL CADET CORPS (NCC)

L P
2 -

RATIONALE

This course is structured to instil in the students qualities like nationalism, patriotism, discipline, team spirit, esprit-de-corps, leadership, self-confidence, national integration and improve their personality. The objective of the course is to expose the students to a regimental way of life, which is essential to inculcate in them the values of discipline, duty, punctuality, orderliness, smartness, and respect for authority, correct work ethos and self-confidence. In addition, it will inculcate defence services work ethos, which is characterized by hard work, sincerity of purpose, honesty, ideals of selfless service, dignity of labour, secular outlook, comradeship, spirit of adventure and sportsmanship.

LEARNING OUTCOMES

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

- Explain aims and objectives of NCC.
- Understand the importance of national integration.
- Assist Civil Administration in performance of selective duties during disasters.
- Perform drill without arms.
- Contribute towards nation building.
- Provide voluntary social service.

DETAILED CONTENTS

1. Introduction (08 hrs)

Aims and objectives of NCC, Organisation structure and training, NCC Song, National Integration and awareness, Religions, Culture, Traditions and Customs of India, National Integration: Importance and Necessity. Freedom Struggle and Nationalist Movement in India, Problems/ Challenges of national integration, Unity in diversity, Famous leaders of India, Images/ Slogans for national integration, Contribution of youth to nation building

2. Civil Affairs (04 hrs)

Civil Defence Organization and its duties/ NDMA, Types of emergencies/ Natural Hazards, Role of NCC during Natural Hazards/ Calamities

3. Drill Without Arms (08 hrs)

General and Words of Command, Attention, Stand at Ease and Stand Easy, turning and inclining at the halt, Sizing, forming up in three ranks and numbering, open and close order march and Dressing, Saluting at the halt, Getting on parade, dismissing and falling out, Marching, length of pace and time of marching in quick time and halt, slow march and halt, Turning on the march and wheeling, Saluting on the March Individual word of command

4. Personality Development and Leadership (04 hrs)

Personality development, self-awareness, Leadership, life/soft skills, time management and character building.

5. Social Service (06 hrs)

Basics of Social service, and its needs, Social/ Rural Development Projects: MNREGA, SGSY, NSAP; Literacy enhancement and poverty alleviation, Social evils, Contribution of youth towards social welfare.

RECOMMENDED BOOKS

- 1 “Cadet Hand Book (Common Subjects)”, published by DG, NCC.
- 2 “Grooming Tomorrow’s Leaders”, published by DG, NCC.
- 3 “Youth in Action”, published by DG, NCC.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	14
2	04	06
3	08	14
4	04	06
5	06	10
Total	30	50

3.6.3 YOGA

L	P
2	-

RATIONALE

Yoga is a practice that connects the body, breath, and mind. It uses physical postures, breathing exercises, and meditation to improve overall health. It not only improves physical health but also mental and spiritual well-being, which are the foundations of life. The course is aimed at developing skills in yoga for strength, flexibility and relaxation.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Explain the importance of yoga and its effect on health
- Perform yoga in various forms and combinations
- Understand the philosophy of heartfulness meditation.
- Promote positive health and holistic wellness through yoga and meditation.

DETAILED CONTENTS

1. Yoga (4 hrs)

Concept, need and importance, Yogic principles, Rules and precautions to be followed by yoga practitioners, Introduction to Ashtanga yoga and Yoga sutra

2. Asanas and Mudras (14 hrs)

Basic asanas, Asanas in different postures - Sukshma Vayayam, Pawan Mukhtasan, Surya Namaskar, Hasta Utthanasana, Padahasthasana, Tadasana, Vrikshhasana, Tirayak Tadasana, Natarajasana, Vajrasana, Padmasana, Bhujangasana.

Mudras - Concept, Important mudras - Prana Mudra, Varuna Mudra, Prithvi Mudra, Aakash Mudra, Gyana Mudra.

3. Pranayama (6 hrs)

Kapalbhati Pranayama, Nadi Shodhan Pranayama (Anulom Vilom), Bhastrika Pranayama, Ujjayi Pranayama.

4. Meditation (3 hrs)

Heartfulness meditation, Practice on meditation

5. Health Benefits of Yoga and Meditation (3 hrs)

Benefits and effect of Asanas, Mudras and Pranayama on various systems and organs of human body. Relaxation and wellness through meditation

RECOMMENDED BOOKS

1. Saraswati, Swami Satyananda, "Asana, Pranayama, Mudra and Bandha", Yoga Publication Trust, Bihar.
2. BKS Iyengar, "Light on Yoga", George Allen and Unwin.
3. Mudras by Heartfulness; Heartfulness Education Trust.
4. Kamlesh D Patel, "The Way of the Heart", Spiritual Hierarchy Publication Trust
5. Goel, Aruna, "Yoga Education: Philosophy and Practice", Deep & Deep Publications, New Delhi.
6. Nagendra, H R, and R Nagarathna, "Yoga for Promotion of Positive Health". Swami Vivekananda Yoga Prakashan.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	14	24
3	06	10
4	03	05
5	03	05
Total	30	50

3.6.4 FIRST AID

L P
2 -

RATIONALE

First aid is a valuable and life-saving course. The objective of this course is to impart knowledge and skills to the students necessary in an emergency to help sustain life, reduce pain, and minimize the consequences of injury or sudden illness until professional medical help arrives.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Administer basic life support skills including cardiopulmonary resuscitation
- Provide first aid of simple and multiple system trauma.

DETAILED CONTENTS

1. Basics of First Aid (4 hrs)

First aid, importance of first aid, first aider, laws of first aid, contents of an ideal first aid kit, dealing with an emergency.
2. Emergency Response (10 hrs)

CPR, steps for performing CPR, CPR for newborns and infants, recovery position, first aid in drowning, fractures of bones, causes and types of fractures, dislocation.
3. First Aid in Burns (4 hrs)

Types of burns, danger of burns, first aid in dry burns and scalds, electrical burns, chemical burns, sunburn, heatstroke.
4. First Aid in Wounds and Injuries (6 hrs)

Types of wounds- small cuts and abrasions, Head injury- nose bleed, bleeding gums, bleeding from varicose veins, Shocks- causes of shock and its first aid.

5. First Aid in Poisoning (3 hrs)

Poisoning by swallowing, gases, injections, skin absorption, Animal bites, snake bites and insect stings.

6. First Aid in Foreign Objects Entering the Sense Organs: (3 hrs)

Foreign body in the eye, ear, nose, skin, swallowing of foreign objects.

Note : Persons from Civil Defence/ National Disaster Response Force (NDRF) etc. can be invited for conduct of first aid classes and demonstration of first aid practices.

RECOMMENDED BOOKS

1. Gauri Goyal, Dr. Kumkum Rajput, Dr. Manjul Mungali,, “First Aid and Health”, SBPD Publishing House
2. Williamson, Swapna Naskar and Goswami Mala, “First Aid and Emergency Care”, Kumar Publishing House, New Delhi.
3. Mahopatra, R., “First Aid for You and Me”, Academic Publishers, New Delhi.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	10	18
3	04	06
4	06	10
5	03	05
6	03	05
Total	30	50

3.6.5 CREATIVE WRITING

L P
2 -

RATIONALE

Creative writing is a written art form that uses the imagination to tell stories and compose essays, poetry, screenplays, novels, lyrics, and more. The objective of this course is to acquaint the students with ideas related to creative writing including art, craft and basic skills required for a creative writer.

LEARNING OUTCOMES

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

- Distinguish between literary genres.
- Practice various forms of creative writing.
- Write for various media.

DETAILED CONTENTS

1. Fundamentals of Creative Writing (06 hrs)

Meaning and significance of creative writing, Genres of creative writing: poetry, fiction, Non-fiction, Drama and other forms, Research for creative writing

2. Elements of Creative Writing (10 hrs)

Plot, Setting, Character, Dialogue, Point of view, Literary devices and figurative language, Elements of style, Grammar and the structure of language, Proof reading and editing

3. Traditional Forms of Creative Writing (10 hrs)

Fiction: short story, novella and novel, Poetry, Drama, Essay, Fable, Biography, Memoire and autobiography, Travelogues, Diaries, Self-narrative writing

4. Writing for Media (04 hrs)

Print media, Broadcast media, Internet - Web content writing and blog writing, Advertising

RECOMMENDED BOOKS

1. Anjana Neira Dev. Anuradha Marwah, Swati Pal, “Creative Writing: A Beginner’s Manual”, Pearson Longman, Delhi.
2. Robert Scholes, Nancy R. Comley, Carl H. Klaus, Michael Silverman, “Elements of Literature: Essay, Fiction, Poetry, Drama, Film”, Delhi.
3. Bell, Julia and Magrs, Paul, “The Creative Writing Course-Book”, Macmillan, London.
4. Gardner, John, “The Art of Fiction”, Vintage, New York.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	6	10
2	10	16
3	10	16
4	4	08
Total	30	50

3.6.6 SKETCHING, DRAWING AND COLOUR STUDIES

L	P
2	-

RATIONALE

This course is aimed to develop aesthetic sense of students. It also encompasses training in sketching, drawing and colouring to develop their mental faculties of observation, imagination and creation.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Sketch common objects and various geometrical and non-geometrical forms found in life and nature.
- Use different medium and materials.
- Use colour judiciously in creation of visual work.
- Prepare collage using various paper and materials.

DETAILED CONTENTS

1. Sketching of Objects and Nature (8 hrs)

Sketching of objects at home like cup, plate, glass, book, pencil box etc.
Sketching of tree, mountain, hills, vegetables flower etc. for Nature study using Pencil, colour Pencil
2. Drawing of Human and Animal Figures (10 hrs)

Drawing of Human and animal form with the help of Basic Geometrical shapes
3. Collage Making (4 hrs)

Creating Collage with the help of coloured cut out papers, picture from a magazine or any easily available materials

4. Colours (8 hrs)

Water colour, Poster colour, Colour theory – Colour system, Colour wheel, Colour dimensions, Drawing with oil pastel colour and dry pastel.

RECOMMENDED BOOKS

1. Betty Edwards, “Color: A Course in Mastering the Art of Mixing Colors”, Penguin Group Inc., New York.
2. Feisner, E., “Colour Studies”, Fairchild Publications, USA.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	08	14
2	10	16
3	04	06
4	08	14
Total	30	50

3.6.7 GARDENING

L	P
2	-

RATIONALE

Gardening activities are fantastic for helping students engage in a way that is more difficult in the classroom. Watching plants grow is a fun and educational experience for them. Their enormous curiosity and excitement over anything new makes them natural for gardening. Growing plant seeds teaches them how nature works and adds to their interest in environmental sustainability.

LEARNING OUTCOMES

At the end of the course, the students will be able to :

- Explain various techniques of gardening, cultivation, multiplication, raising of seedlings of garden
- Discuss new and modern techniques of plant propagation.
- Develop interest in nature and plant life.

DETAILED CONTENTS

- | | | |
|----|-----------|---------|
| 1. | Gardening | (6 hrs) |
|----|-----------|---------|

Definition, objectives and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design.

- | | | |
|----|----------------------|----------|
| 2. | Gardening Operations | (14 hrs) |
|----|----------------------|----------|

Soil laying, manuring, watering, management of pests and diseases and harvesting.

- | | | |
|----|---------------------------------------|----------|
| 3. | Sowing/Raising of Seeds and Seedlings | (10 hrs) |
|----|---------------------------------------|----------|

Structure and types - Seed dormancy; causes and methods of breaking dormancy. Seed storage: Seed banks, factors affecting seed viability, genetic erosion Seed production technology. Seed testing and certification. Transplanting of seedlings.

RECOMMENDED BOOKS

1. Bose T.K., Mukherjee, D., “Gardening in India”, Oxford & IBH Publishing Co. New Delhi.
2. Kumar, N., “Introduction to Horticulture”, Rajalakshmi Publications. Nagercoil, Tamil Nadu.
3. Sandhu, M.K., “Plant Propagation”, New Age International Publishers.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	14	24
3	10	16
Total	30	50

3.6.8 PHOTOGRAPHY

L	P
2	-

RATIONALE

Photography is a unique and creative medium of self-expression that requires aesthetic sense as well as technical expertise. Students who are highly passionate about learning the workings of cameras and different technologies based on them can pursue this course. The objective of this course is to enable the candidates to understand the utility of different camera parts and the art of taking candid shots.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Explain the principles of photography.
- Handle various cameras for taking photographs.
- Apply aesthetics of photography.

DETAILED CONTENTS

- | | | |
|----|-------------------|----------|
| 1. | Basic Photography | (04 hrs) |
|----|-------------------|----------|

Meaning and definition of photography, Basic principle in the film and digital photography, History of photography.

- | | | |
|----|---------------------------------|----------|
| 2. | Camera Function and Accessories | (04 hrs) |
|----|---------------------------------|----------|

Basic camera, Different parts of camera and their basic functions, Camera Accessories

- | | | |
|----|-------------------------|----------|
| 3. | Main Controls of Camera | (10 hrs) |
|----|-------------------------|----------|

Parts of Camera, Types of lenses, Shutter, Diaphragm, Exposure, Film and digital image sensor, Depth of field, Lighting, Photography with flash, Filters in photography.

4. Digital Camera (05 hrs)

Process of digital imaging, Types of digital cameras, Menu operationsof digital cameras, Introduction to colors.

5. Aesthetics of Photography (07 hrs)

Definition of lighting, Principles of lighting, Reflection, Light characteristics, Color, Direct light and indirect light, Light and subject, Light as subject, Shadow as subject, Light sources, Natural light and artificial light, Principles of visualization, Composition guidelines

RECOMMENDED BOOKS

1. Dilwali, Ashok, "All about Photography", National Book Trust, New Delhi.
2. Sharma, O.P., "Practical Photography", Hind Pocket Books.
3. Freeman, "The Photographer's Guide to Light", John Collins & Brown

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

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SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	04	08
3	10	16
4	05	08
5	07	12
Total	30	50

3.6.9 LEGAL STUDIES

L	P
2	-

RATIONALE

The course introduces the students to Indian legal system, contracts management, and legal documentation. Further, the course familiarizes students with basic knowledge of labour laws that would be useful.

LEARNING OUTCOMES

At the end of the course, the students will be able to:

- Understand the Indian Legal System.
- Discuss Indian Contract Act.
- Explore labour laws and laws related to women.

DETAIL CONTENTS

- | | | |
|----|---|----------|
| 1. | Introduction to Indian Legal System | (4 hrs) |
| | Constitution of India, Sources of Law and Judicial system. | |
| 2. | The Indian Contract Act | (6 hrs) |
| | Contract – meaning and kinds. Essentials of a valid contract, Discharge of a contract, Contract of Agency | |
| 3. | Legal Documentation | (10 hrs) |
| | Drafting of legal documents including Non-Disclosure Agreements (NDA), Request for Proposal (RFP), collaboration agreements, joint venture agreements, tendering and subcontracting | |
| 4. | Labour Laws | (6 hrs) |
| | Provident Fund, ESIC, Gratuity and Bonus | |

5. Legislation Related to Women

(4 hrs)

Sexual harassment at Work place (Prevention, Prohibition and Redressal), Protection of Women from Domestic Violence Act, Criminal Law (Amendment) Act, The Indecent Representation of Women (Prohibition) Act.

RECOMMENDED BOOKS

1. Joseph Minattur, "Indian Legal System", Indian Law Institute, New Delhi.
2. Srivastava, S.C., "Industrial Relations and Labour Laws", Vikas Publishing House Pvt. Ltd.
3. Aggarwal, S K, "Business Law", Galgotia Publishers, Delhi.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	07
2	06	10
3	10	16
4	06	10
5	04	07
Total	30	50

3.6.10 EVENT MANAGEMENT

L	P
2	-

RATIONALE

Event Management is a course which deals with the planning, coordinating, and organising of events for people and communities. It is a part of the mass communication course which is offered by many prestigious colleges in India. Event management course aims to imbibe knowledge on analysing, marketing, planning and strategies in business administration to its students.

LEARNING OUTCOMES

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

- Explain the purpose of special events in an organization.
- Use techniques and strategies required to plan successful special events.
- Promote and conduct special events.
- Assess the quality and success of special events.

DETAILED CONTENTS

1. Principles of Event Management (04 hrs)

Introduction to event management, size & type of event, event team, code of ethics, principles of event management, role of event manager – planning, organising, leading and controlling an event

2. Event Planning (08 hrs)

Objective of event, use of planning tools, protocols, dress codes, staging, staffing.

3. Event Marketing (04 hrs)

Advertising, publicity, event marketing process, even hospitality

4. Event Leadership (06 hrs)

Teambuilding & work distribution, managing team, managing meetings, written & verbal communication.

5. Event Safety and Security (04 hrs)

Role of Security, Safety, Crowd management, Risk management.

6. Event Accounting (04 hrs)

Budget, Cash flow analysis, Profit & loss statement, Balance sheet.

RECOMMENDED BOOKS

1. Singla, Sita Ram, "Event Management", ATH Publishers, New Delhi.
2. Sharma, Divakar, "Event Planning and Management", Deep & Deep Publication.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	4	06
2	8	12
3	4	08
4	6	10
5	4	08
6	4	06
Total	30	50

3.6.11 DIET AND NUTRITION

L	P
2	-

RATIONALE

The objective of this course is to help the students to understand the concept of diet and nutrients and provide knowledge about causes and symptoms of Nutrition-related disorders.

LEARNING OUTCOMES

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

- Comprehend the nutritional value of different food items.
- Explain the need of nutrition during the normal stages of life.
- Calculate normal dietary requirements and balanced diet.

DETAILED CONTENTS

1. Introduction (04 hrs)

Basic concepts of health, Nutrition, Nutrients, Nutrition requirement, Balanced diet. Relationship between health & nutrition, Assessment of nutritional status.

2. Nutrients (16 hrs)

Nutrients & their classification. Macro Nutrients –Sources, Functions and Effects on the Body; Micro nutrients - sources, Functions and effects on the Body; Fat soluble nutrients - sources, Functions and effects on the body, Water soluble nutrients - Sources, Functions and effects on the body, Digestion, Absorption of carbohydrates, Lipids, Proteins and energy.

3. Energy and Nutrition-related Disorders (06 hrs)

Basic concepts, Definition and components of energy requirement, Protein malnutrition, Iodine deficiency disorders, Disease and disorder caused by imbalance of nutrients, Food allergies.

4. Nutritional Needs (04 hrs)

Nutritional need during normal stages of life - Infancy, Childhood, Adolescence, Pregnancy, Lactation and Old age, Disease management with diet.

RECOMMENDED BOOKS

1. Antia, F.P., "Clinical Dietetics and Nutrition", Oxford University Press.
2. Swaminathan, "Essentials of Food and Nutrition", Ganesh and Co., Madras.
3. Subhangini Joshi, "Nutrition and Dietetics", McGraw Hill Publishers.
4. B.S. Narsinga Rao et al, "Nutritive Value of Indian Foods", National Institute of Nutrition, Hyderabad.

INSTRUCTIONAL STRATEGY

Teachers are expected to develop necessary knowledge in the students for comprehending basic concepts and principles of the subject so that they may pursue their passion. As far as possible, the teaching of subject shall be supplemented by demonstration and practices to enhance the relevant skills.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	04	06
2	16	28
3	06	10
4	04	06
Total	30	50

ENERGY CONSERVATION AWARENESS CAMP

A diploma holder must have knowledge of various tips of energy conservation. Energy conservation has attained priority as it is regarded as additional energy resource. Energy saved is energy produced. This camp covers the basic concepts of energy management and its conservation. It gives the insight to energy conservation opportunities in household appliances and star rating. Lectures will be delivered on following broad topics. There will be no exam for this camp.

1. Classification of energy- primary and secondary energy, commercial and non-commercial energy, non-renewable and renewable energy with special reference to solar energy
2. Introduction to energy management, energy conservation, energy efficiency and its need
3. Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance
4. Standards and Labeling
 - Concept of star rating and its importance
 - Types of product available for star rating
5. Salient Features of Punjab Energy Conservation Building Code (ECBC)
6. General Energy Saving Tips in:
 - Lighting System
 - Room Air Conditioners
 - Refrigerators
 - Water Heater
 - Computers
 - Fans, Heaters, Blowers and Washing Machines
 - Colour Television
 - Water Pumps
 - Kitchens
 - Transport

DRUGS USE AND ABUSE AWARENESS CAMP

This is to be organized at a stretch for two to three days during third semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

1. Drugs Use and Abuse in Society
 - b. Concept and overview
 - c. Extent of the problem
 - d. Drug use as a social problem
 - e. Causes of Drug Use: Biological, Socio-cultural, psychological
2. Types of Dugs and identification of Abuse
 - a. Familiar drugs: Tabacco, Caffeine, over the counter drugs
 - b. Restricted Drugs: Opiates, Hallucinogens, Marijuana
 - c. Reformance enhancing drugs
 - d. Uppers and Downers: Stimulants and Depressants
3. Impact of Drug Abuse
 - a. Individual level biological and psychological
 - b. Family social, National
4. Management and Prevention of Drug Abuse
 - a. Medical and psychological
 - b. Role of family School , Media and Legislation

4.1 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

L P
3 -

RATIONALE

Generic Skills and Entrepreneurship Development is one of the courses from “Human Science” subject area. Generic skills have emerged as an important component of employability skills, which enable an individual to become and remain employable over lifetime and to lead happy and prosperous life. Entrepreneurship development aims at developing conceptual understanding for setting-up one’s own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager. Both the subject areas are supplementary to each other and soft skills are required to be developed in diploma pass-outs for enhancing their employability and self confidence.

LEARNING OUTCOMES

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

- Explain the importance of generic skills
- Manage himself/herself physically, intellectually and psychologically
- Work effectively as a team member
- Manage tasks effectively
- Develop an entrepreneurial mindset.
- Identify entrepreneurial support system for new ventures and small businesses.
- Recognize a business opportunity.
- Conduct market survey and prepare project report.

DETAILED CONTENTS

- | | | |
|-----|---|----------|
| 1. | Introduction to Generic Skills | (04 hrs) |
| 1.1 | Importance of Generic Skill Development | |
| 1.2 | Life Long Learning and associated importance of Generic Skill Development | |

2. Managing Self (07 hrs)
 - 2.1 Knowing Self for Self Development
 - Self-concept, personality, traits, multiple intelligence such as language intelligence, numerical intelligence, psychological intelligence etc.
 - 2.2 Managing Self - Physical

Personal grooming, Health, Hygiene, Time Management
 - 2.3 Managing Self – Intellectual development
 - INFORMATION SEARCH: SOURCES OF INFORMATION
 - COMMUNICATION: OFFICIAL & BUSINESS CORRESPONDENCE, JOB APPLICATION COVERING LETTER AND RESUME
 - 2.4 Managing Self – Psychological
 - Stress, Emotions, Anxiety-concepts and significance
 - Techniques to manage stress
3. Managing in Team (06 hrs)
 - 3.1 Team - definition, team dynamics
 - 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
4. Task Management (03 hrs)
 - 4.1 Task Initiation, planning, execution, close out
 - 4.2 Exercises/case studies on task planning towards development of skills for task management
5. Problem Solving (05 hrs)
 - 5.1 Prerequisites of problem solving- meaningful learning, ability to apply knowledge in problem solving
 - 5.2 Different approaches for problem solving.
 - 5.3 Steps followed in problem solving.
 - 5.4 Exercises/case studies on problem solving.

6. Entrepreneurship (20 hrs)

6.1 Introduction

- Concept/Meaning and its need
- Qualities of an entrepreneur
- Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, Small Industries Service Institute (SISIs), Small Industries Development Bank of India (SIDBI), National Bank of Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State/National level.

6.2 Obtaining financial assistance through various government schemes like Prime Minister Employment Generation Program (PMEGP) Pradhan Mantri Mudra Yojana (PMMY), Make in India, Start up India, Stand up India, National Urban Livelihood Mission (NULM); Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP).

6.3 Market Survey and Opportunity Identification (Business Planning)

- How to start a small scale unit/ industry
- Procedures for registration of small-scale unit /industry
- Assessment of demand and supply in potential areas of growth.
- Understanding business opportunity
- Considerations in product selection

6.4 Project Report Preparation

- Preliminary Project Report
- Techno-Economic Feasibility Report
- Exercises on preparation of Detailed Project Report

INSTRUCTIONAL STRATEGY

This subject will require a blend of different teaching and learning methods beginning with lecture method. Some of the topics may be taught using question answer, assignment, case studies or seminar. In addition, expert lectures may be arranged from within the institution or from management organizations. Conceptual understanding of Entrepreneurship, inputs by teachers and outside experts will expose the students so as to facilitate in starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial

qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also. The students may also be provided relevant text material and handouts.

RECOMMENDED BOOKS

1. Balasubramanian, S., “Soft Skills for Interpersonal Communication”, Orient Black Swan, New Delhi.
2. “Lifelong learning”, Policy Brief (www.oecd.org).
3. Rathore, BS, and Dr JS Saini, “A Handbook of Entrepreneurship”, Aapga Publications, Panchkula (Haryana).
4. Gupta, CB, and P Srinivasan, “Entrepreneurship Development”, Sultan Chand and Sons, New Delhi.
5. “Entrepreneurship Development”, Tata McGraw Hill Publishing Company Ltd., New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1.	04	06
2.	07	08
3.	06	06
4.	03	04
5.	05	06
6.	20	20
Total	45	50

4.2 CONCRETE TECHNOLOGY

L	P
2	4

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 going through 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
- Recognise bleeding, segregation, harshness defects in fresh concrete
- Conduct various destructive and non-destructive (NDT) test
- Design mix of concrete as per IS code
- Demonstrate how to carry out various concreting operation

DETAILED CONTENTS

1. Introduction: Definition of concrete, uses of concrete in comparison to other building materials. (01 hrs)
2. Ingredients of Concrete (04 hrs)
 - 2.1 Cement: physical properties of cement; different types of cement as per BIS Codes
 - 2.2 Aggregates:

- Classification of aggregates according to size and shape
- 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
- Grading of aggregates: coarse aggregate, fine aggregate; All-in-aggregate; fineness modulus; interpretation of grading charts

2.3 Water: Quality requirements as per IS:456-2000

3. Water Cement Ratio (01 hrs)

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 (6 hrs)

4.1 Properties in plastic state: Workability, Segregation, Bleeding and Harshness, Factors affecting workability

4.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes.

5. Concrete Mix Design (04 hrs)

5.1 Objectives 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.

6. Introduction to Admixtures (chemicals and minerals) for improving performance of concrete. (01 hrs)

7. Special Concretes (only features) (04 hrs)

- 7.1 Concreting under special conditions, difficulties and precautions before, during and after concreting
 - Cold weather concreting
 - Under water concreting
 - 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

8. Concreting Operations (8 hrs)

**8.1 Storing of Cement:

- Storing of cement in a warehouse
- Storing of cement at site
- Effect of storage on strength of cement
- 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)

- Batching of Cement
- Batching of aggregate by:
 - Volume, using gauge box (farma) selection of proper gauge box
 - Weight spring balances and batching machines
- Measurement of water

**8.4 Mixing:

- Hand mixing
- Machine mixing - types of mixers, capacities of mixers, choosing appropriate size of mixers, operation of mixers
- Maintenance and care of mixers

**8.5 Transportation of concrete: Transportation of concrete using: wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower crane and hoists etc.

8.6 Placement of concrete:

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

**8.7 Compaction:

- Hand compaction
 - Machine compaction - types of vibrators, internal screed vibrators and form vibrators
 - Selection of suitable vibrators for different situations
- 8.8 Finishing concrete slabs - screeding, floating and trowelling
- 8.9 Curing:
- Objective of curing, methods of curing like ponding, membrane curing, steam curing, chemical curing
 - 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) (1 hr)

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

PRACTICAL EXERCISES

1. To determine silt content in fine aggregate
2. Determination of specific gravity and water absorption of aggregates
3. Determination of bulk density and voids of aggregates
4. Determination of particle size distribution of fine, coarse and all-in-aggregate by sieve analysis (grading of aggregate)
5. To determine workability by slump test and to verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump
6. Compaction factor test for workability
7. Non destructive test on concrete by:
 - a) Rebound Hammer Test
 - b) Ultrasonic Pulse Velocity Test
8. To determine compressive strength of concrete cubes for different grades of concrete
9. To determine flexural strength of concrete beam
10. Concrete Mix Design

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. The experiments may also be demonstrated to students through video programmes developed in the field of ‘concrete technology’ by NITTTR, Chandigarh.

RECOMMENDED BOOKS

1. Kulkarni, PD, RK Ghosh, and YR Phull, "Text Book of Concrete Technology", Oxford and IBH Publishing Co. New Delhi.
2. Gupta, BL, and Gupta Amit, "Text Book of Concrete Technology", Standard Publishers Distributors, Delhi.
3. Handoo, BL, LD Puri, and Sanjay Mahajan, "Concrete Technology", Satya Prakashan, New Delhi.
4. Sood, Hemant, LN Mittal, and PD Kulkarni, "Laboratory Manual on Concrete Technology", CBS Publishers, New Delhi, 2002.
5. Gambhir, ML, "Concrete Technology", MacMillan India Ltd., New Delhi.
6. Singh, Birinder, "Concrete Technology", Kaption Publications, Ludhiana.
7. "Video programme on different experiments in ‘Concrete Technology’ developed by NITTTR", Chandigarh.

WEBSITES FOR REFERENCES

- 1 <https://www.youtube.com/channel/UC7R0m2JO9EsJNJZPDR2U7YQ>
- 2 <https://theconstructor.org/home-page>

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	1	2
2	4	8
3	1	3
4	6	8
5	4	5
6	1	3
7	4	6
8	8	13
9	1	2
Total	30	50

4.3 WATER SUPPLY AND WASTE WATER ENGINEERING

L	P
3	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 | (02 hrs) |
| 1.1 | Necessity and brief description of water supply system. | |
| 1.2 | Sources of water – surface/sub-surface sources | |
| 2 | Quantity of Water | (03 hrs) |
| 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)

3. Quality of Water (04 hrs)

- 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) (06 hrs)

- **4.1 Sedimentation - purpose, types of sedimentation tanks
- **4.2 Coagulation/floculation - 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 (05 hrs)

- **5.1 Different types of pipes - cast iron, PVC, steel, asbestos cement, concrete PPR pipes and lead pipes. Their suitability and uses, types of joints in different types of pipes.
- 5.2 Distribution system: Requirement of distribution, minimum head and rate, methods of layout of distribution pipes
 - Systems of water supply - Intermittent and continuous service reservoirs - types, necessity and accessories.
 - Wastage of water - preventive measures
 - Maintenance of distribution system
 - Leakage detection

6. Laying of Pipe (02 hrs)

- 6.1 Setting out alignment of pipes

6.2 Handling, lowering and jointing of pipes

6.3 Testing of pipe lines

7. Building Water Supply (02 hrs)

Connections to water main (practical aspect only)

B. WASTE WATER ENGINEERING

8. Introduction (03 hrs)

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

9. Sewerage System (03 hrs)

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: (03 hrs)

Excavations, checking the gradient with boning rods preparation of bedding, handling and jointing testing and back filling of sewers/pipes.

11. Sewage Characteristics: (03 hrs)

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 (02 hrs)

- 12.1 Disposal by dilution
- 12.2 Self purification of stream
- 12.3 Disposal by land treatment

13. Sewage Treatment (06 hrs)

- 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)

14. Building Drainage (01 hrs)

Aims of building drainage and its requirements

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

PRACTICAL EXCERCISES

- 1) To determine turbidity of water sample
- 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/threading 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.

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.

RECOMMENDED BOOKS

1. Duggal, KN, “Elements of Public Health Engineering”, S. Chand and Co. New Delhi.
2. Rangwala, SC, “Water Supply and Sanitary Engineering”, Anand Charotar Book Stall.
3. Kshirsagar, SR, “Water Supply Engineering”, Roorkee Publishing House, Roorkee.
4. Kshirsagar, SR, “Sewage and Sewage Treatment”, Roorkee Publishing House, Roorkee.
5. Gurjar, BR, “Sludge Treatment and Disposal”, CRC Press.
6. Garg, Santosh Kumar, “Water Supply Engineering”, Khanna Publishers, Delhi.
7. Duggal, Ajay K and Sanjay Sharma, “A Laboratory Manual in Public Health Engineering”, Galgotra Publications, New Delhi.
8. Mahajan, Sanjay, “Water Supply and Waste Water Engineering”, Satya Prakashan Ltd., Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	2	2
2	3	3
3	4	5
4	6	7
5	5	6
6	2	2
7	2	2
8	3	3
9	3	3
10	3	3
11	3	3
12	2	3
13	6	7
14	1	1
Total	45	50

4.4 WATER RESOURCES ENGINEERING

L P
3 -

RATIONALE

Diploma holders in civil engineering have to supervise the construction, repair and maintenance of canals, head works, cross drainage works, regulatory and other works. Some of diploma holders are also engaged for preventing water logging and irrigation by tubewells. This subject imparts knowledge regarding hydrology, flow irrigation – storage and distribution system, constructional features of head works, 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:

- Recognize different crops and their water requirements
- Measure rainfall and read rain gauges and hydrographs
- Supervise construction and maintenance work of canal and canal linings
- Use various water harvesting techniques
- Supervise maintenance and construction work of canal head works and cross regulators
- Carry out de-silting operation of canals

DETAILED CONTENTS

- | | | |
|----|---|---------|
| 1. | Introduction | (2 hrs) |
| | 1.1 Definition of irrigation | |
| | 1.2 Necessity of irrigation | |
| | 1.3 Brief history of development of irrigation in India | |
| | 1.4 Organisational structure of water resources department. | |
| 2. | Water Requirement of Crops | (4 hrs) |

- 2.1 Principal crops in India and their water requirements
- 2.2 Crop seasons – Kharif and Rabi
- 2.3 Duty, Delta and Base Period, their relationship
- 2.4 Gross commanded area (GCA), culturable commanded area (CCA), Intensity of Irrigation, Irrigable area (Basic introduction without numericals)

3. Catchment Area and Run-off (4 hrs)

Rain-gauges and their types (automatic and non-automatic), methods of estimating average rainfall (Arithmetic system); catchment area runoff, factors affecting runoff, basic concept of hydrograph and unit hydrograph.

4. Methods of Irrigation (6 hrs)
 - 4.1 Flow irrigation and its advantages and limitations
 - 4.2 Lift Irrigation and its advantages and limitations.
 - 4.3 Sprinkler irrigation conditions favourable and essential requirements for sprinkler irrigation, sprinkler system – classification and component parts
 - 4.4 Drip irrigation, suitability of drip irrigation, layout, component parts, advantages.

5. Canals (6 hrs)
 - 5.1 Classification, different canal cross-sections, working head and discharge measurement units for canals.
 - 5.2 Canal lining - its advantages and disadvantages, Brief description about various types of canal lining.
 - 5.3 Breaches and their control
 - 5.4 Maintenance of lined and unlined canals

6. Tube Well Irrigation (6 hrs)
 - 6.1 Introduction, location and command, 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 formulae for determining yield of well
 - 6.3 Types of tube wells and their choice-cavity, strainer and slotted type;

- 6.4 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 (5 hrs)
- 7.1 Classification of dams; earthen dams - types, causes of failure; cross-section of zoned earth dam, description about various methods of construction, gravity dams – types, cross-sections of a dam.
- 7.2 Concept of small and micro dams
- 7.3 Basic concept of spillways and energy dissipaters
8. Canal Head Works and Regulatory Works (6 hrs)
- 8.1 Definition, object, general layout and different parts of head works. Difference between weir and barrage
- 8.2 Definition and function of cross and head regulators.
- 8.3 Outlets-Types and sketches.(Important terms: minimum modular head, width horizontally ,depth vertically of outlet, crest level, difference between FSL and crest level of outlet etc.)
- 8.4 Falls
- 8.5 Canal escapes.
9. Cross Drainage Works (2 hrs)
- 9.1 Functions and types: aqueduct, super passage, level crossing, inlet and outlet
- 9.2 Sketches of the above cross drainage works
10. River Training Works (1 hr)
- Importance of river training works and its components
11. Water Logging and Drainage (3 hrs)
- 11.1 Definition of water logging – its causes, effects and remedies
- 11.2 Surface and sub-surface drains and their layout

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.

RECOMMENDED BOOKS

1. Singh, Bharat, “Fundamentals of Irrigation Engineering”, Nem Chand and Bros, Roorkee.
2. Garg, Santosh Kumar, “Irrigation Engineering and Hydraulics Structures”, Khanna Publishers, Delhi.
3. Punmia, BC, and Pande Brij Bansi Lal, “Irrigation and Water Power Engineering”, Delhi, Standard Publishers Distributors, Delhi.
4. Sharma, RK, “Text Book of Irrigation Engineering and Hydraulics Structures”, Oxford and IBH Publishing Company, New Delhi.
5. Sharma, SK, “Principles and Practice of Irrigation Engineering”, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Varshney RS, Gupta SC, Gupta RL, “Theory and Design of Irrigation Structures”, Vol. I and II.
7. Saharsabudhe, SR, “Irrigation Engineering and Hydraulic Structures”.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	2	03
2	4	05
3	4	05
4	6	07
5	6	07
6	6	07
7	5	06
8	6	07
9	2	03
10	1	02
11	3	03
Total	45	50

4.5 MODERN SURVEYING

L	P
2	4

RATIONALE

The important function 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 this subject of Modern Surveying, stress has been given to the development of knowledge and skill in modern surveying instruments used for surveying nowadays

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 on sheets, as this will also reveal errors in the work and develop skill in plotting.

LEARNING OUTCOMES

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

- Measure inaccessible distances.
- Conduct survey of an area using Total Station.
- Make layout of an area using Total Station
- Draw a contour plan of an area manually and using computer software
- Conduct GPS survey of an area.
- Set out simple circular curve.

DETAILED CONTENTS

- | | | |
|-----|--|---------|
| 1. | Tachometry and electronic distance measurement | (4 hrs) |
| 1.1 | Tachometry, Instruments to be used in tachometry, methods of tachometry, general principles of stadia tachometry | |
| 1.2 | Tachometric Constant, Examples of stadia tachometry and Numerical problems. | |
| 1.3 | Electronic distance measuring Instruments, Working Principle, Types, Uses, | |

- 1.4 Advantages and Disadvantages of tachometry and Electronic Distance Measurement
- 2. Total station survey (6 hrs)
 - 2.1 Introduction, Working Principle, Parts of Total Station, Sources of Error
 - 2.2 Infrared And Laser Total Station Instruments, Microwave System, Measuring Principle of Total Station Instruments.
 - 2.3 Comparison between Electro-optical (Infrared and Laser) and Microwave system.
 - 2.4 Care and maintenance of Total Station instruments,
 - 2.5 Traversing and Trilateration, Resection, Coordinate and Geometry functions, offsets and stake out-land survey applications.
- 3. Contouring (4 hrs)
 - 3.1 Concept of Contours, Purpose of Contouring,
 - 3.2 Contour Interval and Horizontal Equivalent, Factors Effecting Contour Interval
 - 3.3 Characteristics of Contours
 - 3.4 Methods of Contouring: Direct and Indirect, Interpolation of Contours.
 - 3.5 Uses of contour map,
 - 3.6 Volume calculation using contours.
- 4. Global positioning system (6 hrs)
 - 4.1 Basic concepts of GPS, Historical perspective and development, Geoid and Ellipsoid
 - 4.2 Applications of GPS in Land Surveying,
 - 4.3 Positioning concept, Different segments of GPS - Space, Control and User Segment
 - 4.4 Global navigation satellite system (GNSS), independent regional navigation satellite system (IRNSS) and GPS Aided GEO Augmented Navigation (GAGAN)
 - 4.5 GPS satellite signals, Static, Kinematic and Differential GPS
 - 4.6 Advantages and disadvantages of GPS Surveying

5. Introduction to geographic information system (6 hrs)
 - 5.1 Definition of Geographic Information Systems, Advantages and Disadvantages of Geographic Information Systems,
 - 5.2 Different types of map projections,
 - 5.3 Concept of vector data and Raster data models, Advantages and disadvantages associated with vector and raster data, Different raster data file formats,
 - 5.4 Spatial database systems and their types, Spatial data interpolation.
 - 5.5 Applications of Geographic Information Systems

6. Curves (4 hrs)
 - 6.1 Horizontal Curves, Types of Horizontal Curves (Simple Circular, Compound, Reverse, Deviation & Transition).
 - 6.2 Simple Circular Curve: Need and definition of a simple circular curve.
 - 6.3 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.
 - 6.4 Vertical Curves, Types of Vertical Curves (Summit and Valley).

NOTE: No sketch of the instruments should be asked in the examination

PRACTICAL EXERCISES

1. Tachometry and electronic distance measurement
 - a) Measure distances by using tachometer
 - b) Measure distances by using EDM
2. Total station survey

Unboxing total station instrument and understanding its components

 - a) Plotting a traverse using total station
 - b) Conducting survey of an area using total station
 - c) Determination of remote height using total station
 - d) Layout of a 2-room set using total station
3. Contouring
 - a) Preparing a contour plan by radial line method

- b) Preparing a contour plan by method of squares
- 4. GPS Surveying
 - a) Unboxing and setting of DGPS instrument
 - b) Survey of a small area using GPS measurements.
- 5. Geographic information system
 - a) Preparation of map of a previously total station surveyed area using GIS.
 - b) Plotting contours using GIS software.
- 6. Curves
 - a) Setting out of a simple circular curve by using chain or tape.
 - b) Setting out of a simple circular curve by using theodolite.
 - c) Setting out of a simple circular curve by using total station.

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments and software use in surveying, stress should be laid on correct use of various instruments 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 Punjab Remote Sensing Center (Ludhiana) is recommended.

RECOMMENDED BOOKS

1. Hussain, SK and Nagraj, MS, "Text Book of Surveying", S Chand and Co Ltd., New Delhi.
2. Kocher, CL, "A Textbook of Surveying", Katson Publishing House, Ludhiana.
3. Kanetkar, TP, and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan, Pune.
4. Duggal, S K, "Surveying Vol-I", McGraw Hill.
5. Gopi, Satheesh, R. Sathikumar, N. Madhu, "Advanced Surveying: Total Station", GIS and Remote Sensing, Pearson.

WEBSITES FOR REFERENCES

1. <https://nptel.ac.in/courses/105107157>
2. <https://nptel.ac.in/courses/105102015>
3. <https://nptel.ac.in/courses/105107155>
4. <https://nptel.ac.in/courses/105104100>

RECOMMENDED GIS SOFTWARES

1. QGIS, <https://www.qgis.org/>, Open Source, Free Download
2. GVSIG, <http://www.gvsig.com/>, Open Source, Free Download
3. OrbisGIS, <http://orbisgis.org/>, Open Source, Free Download
4. ArcGIS, <https://www.arcgis.com/>, Paid
5. Google Earth, <https://earth.google.com/>, Freeware

SUGGESTED DISTRIBUTION OF MARKS

Topic Number	Time Allotted (hrs)	Marks Allotted (Out of 50)
1	4	9
2	6	7
3	4	9
4	6	9
5	6	9
6	4	7
TOTAL	30	50

4.6 PUBLIC HEALTH AND WATER RESOURCES ENGINEERING DRAWING

L P
- 4

RATIONALE

Diploma holders in Civil Engineering are expected to supervise construction of water supply and waste water treatment works and irrigation structures. This subject aims at imparting skills for preparing water supply and wastewater 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 engineering drawings

DETAILED CONTENTS CUM PRACTICALS

PART A: WATER SUPPLY AND WASTE WATER ENGINEERING DRAWING

1. Cross section of earthen ware and RCC sewer pipes. (1 Sheet)
2. Traps, manholes and inspection chamber
 - 2.1 Detailed section of floor trap and gully trap. (1 Sheet)
 - 2.2 Detailed plan and section of an inspection chamber. (1 Sheet)
 - 2.2 Detailed plan and section of a manhole. (1 Sheet)
3. Detailed plan and cross sections of a domestic septic tank with soak pit for 5-10 users (1 Sheet)

4. Bathroom and W.C Connections
 - 4.1 Draw sectional elevation through the external wall of two-storey building including lavatories at ground and first floor showing the one pipe system and the connections of the lavatory to inspection chamber. (1 Sheet)
 - 4.2 Draw detailed plan of a bathroom showing positions of lavatory, bathtub, wash-basin, taps and showers and show the connection of floor trap, gully trap and inspection chamber. (1 Sheet)
5. 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: WATER RESOURCES ENGINEERING DRAWING:

1. Typical cross section of an unlined and lined channel in cutting, partly cutting and partly filling and fully in filling with given design data. (3 Sheets)
2. Draw Layout plan of detailed components of canal head works. (1 Sheet)
3. Draw Layout plan of Cross Drainage Works including Aqueduct, Super passage, Level Crossing, Inlet & Outlet. (1 Sheet)
4. Draw the X-section of Zoned type Earthen Dam. (1 Sheet)
5. Cross section of a tube well. (1 Sheet)
6. Layout and cross section of rainwater harvesting system (1 Sheet)

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.

RECOMMENDED BOOKS

1. Layal, JS, “Civil Engineering Drawing”, Satya Parkashan, New Delhi.
2. Chandel, RP, “Civil Engineering Drawings”, Katson Publishing House.
3. Kumar, NS, “Civil Engineering Drawing”, IPH, New Delhi.
4. Malik, RS, and Meo GA, “Civil Engineering Drawing”, Asian Publishing House, New Delhi.

4.7 MINOR PROJECT WORK (CONSTRUCTION SITE ORIENTED)

L	P
-	6

RATIONALE

Minor project work aims at exposing the students to field practices, size and scale of operations and work culture at works sites. For this purpose, students during middle of course, are required to be sent at different work sites where some construction activities are in progress or some operations are going on.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Apply concepts, principles and practices taught in the classroom in solving field problems.

GENERAL GUIDELINES

Depending on the interests of the students, they may be sent to following (or any other field project related to Civil Engineering):

- i) Building construction sites
- ii) Water treatment plant, Sewage treatment plant
- iii) Crusher plant, Cement Manufacturing Plant, Brick kiln
- iv) Highway construction site
- v) Material and Soil testing laboratory, Soil investigation projects
- vi) Hydel Power Project
- vii) Land surveying projects
- viii) Community development works
- ix) Constructional site like building, bridge, tunnel, canal lining, highway, railway track, irrigation works etc.

As a minor project activity, each student is supposed to study the operations at site and prepare a detailed project report of the observations/processes seen by him/her and give

seminar using computer aided presentation slides using photographs. These students should be guided by respective subject teachers. Each teacher may guide a group of 10 – 15 students.

The teachers along with field supervisors will conduct performance assessment of students. Some of the projects are suggested below:

1. Survey of a village approach road, drawings of L-section and x-sections
2. Estimation of white washing and distempering in hostel building
3. Preparation of detailed estimate with drawings of septic tank for 30-40 users
4. Plumbing work and installation of PVC over-head water tank on a toilet block and then prepare report
5. Construction of different components of a building
6. Identification of water-supply fittings and replacement of defective fittings and then prepare report.
7. Construction of a pipe/slab culvert
8. Ferro-cement construction techniques
 - a) Low cost housing
 - b) New construction materials
9. Study and preparation of models of hydraulic pumps.

This Industry oriented minor project work will carry 50 marks for internal assessment.

A group of students not exceeding 5 may work on any one project. Each student will prepare the project report of the activities observed by him. They will study the whole process of the plant, and explain the same in their project report. Further they are required to present the Project Report of work done by them through seminar in the class for internal assessment. External examiner will ask the questions on the construction, working, processes observed by the students during their project work: Shortcomings in the works (site) and their remedial measures may be suggested by the students.

NOTE:

This is only a suggestive list. The students may take any other problem as per their interest. The students of the class may be divided into five groups and work may be assigned to each group as per their interest.

EVALUATION OF STUDENTS FOR MINOR PROJECT

The criteria for evaluation of minor project work is as follows :

Criteria	Weightage
Punctuality and Regularity	10 %
Planning and Execution	30%
Initiative in learning new things	10%
Report Writing	20%
Presentation and Viva	30%

Note :

A viva voce examination will be conducted at the end of minor project for assessing the work of student. The examination Committee for this purpose will consist of a professional and the teacher who has guided the project.

ENTREPRENEURIAL AWARENESS CAMP

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject.

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks. State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business
11. Preparation of Project Report

INDUSTRIAL TRAINING OF STUDENTS

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 a minimum of 6 weeks duration to be organised during the semester break starting after second year i.e. after 4th semester examinations. The concerned HODs along with other teachers will guide and help students in arranging appropriate training places relevant to their specific branch. It is suggested that a training schedule may be drawn for each student before starting of the training in consultation with the training providers. Students should also be briefed in advance about the organizational setup, product range, manufacturing process, important machines and materials used in the training organization.

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

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

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

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

- | | | |
|----|-----------------------------------|-----|
| a) | Punctuality and regularity | 15% |
| b) | Initiative in learning new things | 15% |
| c) | Relationship with workers | 15% |
| d) | Industrial training report | 55% |

5.1 REINFORCED CONCRETE DESIGN

L	P
3	-

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 this subject, students will be able to:

- Explain basic concepts of RCC
- Discuss limit state design method of RCC Design
- Design reinforced beams as per IS Code
- Design slabs as per IS Code
- Design axially loaded columns

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Introduction | (02 hrs) |
| | 1.1 Concept of Reinforced Cement Concrete (RCC) | |
| | 1.2 Loading on structures as per IS:875 | |
| | 1.3 Introduction to various methods of RCC Design | |
| 2. | Concept of Limit State Method | (06 hrs) |
| | 2.1 Definitions and assumptions made in limit state of collapse (flexure) | |
| | 2.2 Partial factor of safety for materials and loads | |
| | 2.3 Design loads, Stress block parameters | |
| | 2.4 Shear and Development length | |

3. Design of Reinforced beams (12 hrs)
 - 3.1 Theory and design of singly reinforced beam by Limit State Method
 - 3.2 Theory and design steps of doubly reinforced rectangular beam by Limit State Method (No Numericals)
 - 3.3 Behaviour of T beam (No Numericals)
4. Design of Slabs (15 hrs)
 - 4.1 Theory and design of simply supported one-way slab including sketches showing reinforcement details (plan and section) by Limit State Method.
 - 4.2 Theory and design steps of two-way simply supported slab by Limit State Method (No Numericals)
5. Axially Loaded Column (07 hrs)
 - 5.1 Definition and classification of columns
 - 5.2 Effective length of column
 - 5.3 Specifications for longitudinal and lateral reinforcement
 - 5.4 Design of axially loaded square, rectangular and circular short columns by Limit State Method including sketching of reinforcement (sectional elevation and plan)
6. Pre-stressed Concrete (03 hrs)
 - 6.1 Concept of pre-stressed concrete
 - 6.2 Methods of pre-stressing : pre-tensioning and post-tensioning
 - 6.3 Advantages and disadvantages of pre-stressing
 - 6.4 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.

RECOMMENDED BOOKS

1. Punmia, BC, "Reinforced Concrete Structure Vol. I", Standard Publishers, Delhi.
2. Ramamurtham, S, "Design and Testing of Reinforced Structures", Dhanpat Rai and Sons, Delhi.
3. Gambhir, M.L., "Reinforced Concrete Design", Macmillan India Limited.
4. Singh, Birinder, "RCC Design and Drawing", Kaption Publishing House, New Delhi.
5. Singh, Harbhajan, "Design of Reinforced Concrete Structures", Abhishek Publishers Ltd., Chandigarh.
6. Mallick, SK, and Gupta, AP, "Reinforced Concrete", Oxford and IBH Publishing Co, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	02	02
2	06	06
3	12	14
4	15	17
5	07	08
6	03	03
Total	45	50

5.2 HIGHWAY ENGINEERING

L	P
2	4

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
- Carry out repair and maintenance of roads
- Supervise preparation of bituminous mix in the hot mix plants
- Use various road construction equipment
- Describe the basic terminology of various components of an airport.

DETAILED CONTENTS

- | | | |
|-----|--------------------------------------|----------|
| 1. | Introduction | (02 hrs) |
| 1.1 | Importance of Highway engineering | |
| 1.2 | Functions of IRC, CRRI, MORT&H, NHAI | |
| 1.3 | Classification of roads | |

2. Road Geometrics (05 hrs)
 - 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 Super elevation and methods of providing super elevation
 - 2.4 Sketch of typical cross-sections in cutting and filling on straight alignment and at a curve
(Note: No design/numerical problem to be given)
3. Highway Alignment (02 hrs)
 - 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 (04 hrs)
 - 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)
5. Road Pavements (07 hrs)
 - 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 (Elementary part)
- 5.5 Surfacing:
* Types of surfacing
a) Prime coat and tack coat
b) Surface dressing with seal coat
c) Open graded premix carpet
d) Mix seal surfacing
e) Semi dense bituminous concrete
f) Bituminous Concrete
* Methods of constructions as per MORT&H specifications and quality control; equipments used for above.
- 5.6 Rigid Pavements:
Construction of concrete roads as per IRC specifications: Form work laying, mixing and placing the concrete, compacting and finishing, curing, joints in concrete pavement, equipment used. Roller compacted concrete.

6. Hill Roads (02 hrs)

- 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 geo-grids, geo-flexible, 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 (03 hrs)
- 7.1 Necessity of road drainage work, cross drainage works
- 7.2 Surface and subsurface drains and storm water drains. Location, spacing and typical details of side drains, side ditches for surface drainage. Intercepting drains, pipe drains in hill roads, details of drains in cutting embankment, typical cross sections
8. Road Maintenance (03 hrs)
- 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 (berms)
- 9 Airport Engineering (02 hrs)
- 9.1 Necessity of study of airport engineering, aviation transport scenario in India.
- 9.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.
- 9.3 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 flakiness and elongation index of aggregate

8. Determination of the California bearing ratio (CBR) for the sub-grade soil
9. Demonstration of working of hot mix plant through a field visit
10. 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
11. 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.

RECOMMENDED BOOKS

1. Khanna, SK and Justo, CEG, "Highway Engineering", Nem Chand and Bros., Roorkee.
2. Bindra, SP, "A Course on Highway Engineering", Dhanpat Rai and Sons, New Delhi.
3. Duggal AK, Puri VP., "Laboratory Manual in Highway Engineering", New Age Publishers (P) Ltd, Delhi.
4. NITTTR, Chandigarh "Laboratory Manual in Highway Engineering".
5. Singh, Jagroop, "Highway Engineering", Eagle Publications, Jalandhar.
6. NPTEL :: Civil Engineering - Transportation Engineering I

IRC Publications

- i) MORTH Specifications for Road and Bridge Works (Fifth Revision)
- ii) MORTH Pocket book for Highway Engineers.
- iii) MORTH Manual for Maintenance of Roads.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	02	04
2	05	07
3	02	04
4	04	07
5	07	12
6	02	04
7	03	04
8	03	04
9	02	04
Total	30	50

5.3 R.C.C. DRAWINGS

L	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 this 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 CUM PRACTICAL EXERCISES

RCC Drawing

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

Drawing No. 1

(3 Sheets)

RC Slabs - One way slab, Two way slab

Drawing No. 2

(5 Sheets)

Beams - Singly and doubly reinforced rectangular beams and Cantilever beam (All beams with vertical stirrups)

Drawing No. 3

(3 Sheets)

Columns and Footings – Square, Rectangular and Circular Columns with lateral ties and their isolated sloped column footings.

Drawing No. 4**(1 Sheets)**

Portal Frame – Three bay two storey RC portal frame with blow up of column beam junctions.

Drawing No. 5**(2 Sheets)**

Draw at least two sheet using AutoCAD software

RECOMMENDED BOOKS

1. Loyal JS, “Civil Engineering Drawing”, Satya Parkashan, New Delhi.
2. Chandel, RP, “Civil Engineering Drawings”.
3. Kumar; NS, “Civil Engineering Drawing”, IPH, New Delhi.
4. Malik, RS, and Meo GA, “Civil Engineering Drawing” Asian Publishing House, New Delhi.
5. Singh, Birinder, “RCC Design and Drawing” Kaption Publishing House, New Delhi.

5.4 SURVEY CAMP

L P
- 2

(10 Days Duration)

PURPOSE

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

LEARNING OUTCOMES

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

- Interpret the contours
- Work as a team
- Calculate the earth work
- Prepare a topographical plan of an area.

Task:

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

The students may be assigned an undulated area of about up to 3.00 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 intervals.

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

Instruments to be used in Survey Camp

Preference should be given to Modern instruments like Total Station, Global Positioning System (GPS), Auto level or Digital level as far as possible, Vernier or Digital Theodolite can be used for survey if Total Station is not available.

5.5 RAILWAYS, BRIDGES AND TUNNELS

L	P
3	-

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

(25 hrs)

1. Brief introduction to Indian Railways, Rail gauge and different rail gauges used in India.
2. Permanent way and its components
 - 2.1 Rails, it's function and types (Double headed, Bull headed and Flat footed)
 - 2.2 Sleepers, it's function and types along with advantages and drawbacks (Wooden sleepers, Concrete sleepers, Steel sleepers, Cast iron and Composite)

- 2.3 Ballast, it's function and requirement of ideal material for ballast.
- 2.4 Sub-ballast, it's function.
- 3. Important Terminology in Railways
 - 3.1 Tilting of rails
 - 3.2 Coning of wheels
 - 3.3 Cant : Cant excess, cant equilibrium, cant deficiency and negative cant.
- 4. Rail Fastenings: Rail joints, types of rail joints, fastenings for rails, fish plates, bearing plate
- 5. Crossings and signaling: Brief description regarding different types of crossings/ signaling
- 6. Maintenance of track: Necessity and general maintenance works.
- 7. Station and yards: purpose and types of stations and yards

PART-II: BRIDGES

(12 hrs)

- 8. Introduction : Bridge – its function and component parts, difference between a bridge and a culvert
- 9. Classification of Bridges: According to life, deck level, Material and briefly according to different structural forms (grade separators, beam type, arch type, suspension type and position of highest flood level. Concept of ROB and RUB.
- 10. Bridge Foundations: Introduction to open foundation, pile foundation, well foundation
- 11. Piers, Abutments and Wing walls and bridge bearings : Introduction and function.
- 12. Inspection and Routine Maintenance of Bridges

PART - III: TUNNELS**(8 hrs)**

13. Definition and necessity of tunnels
14. Typical section of tunnels for a national highway and single and double broad gauge railway track
15. Ventilation –necessity and methods of ventilation, by blowing, exhaust and combination of blowing and exhaust
16. Drainage and 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.

RECOMMENDED BOOKS

1. Vaswani, NK, “Railway Engineering”, Publishing House, Roorkee.
2. Rangwala, SC, “Railway Engineering”, Anand, Charotar Book Stall.
3. Deshpande, R, “A Text Book of Railway Engineering”, Poonam United Book Corporation.
4. Algia, JS, “Bridge Engineering”, Anand, Charotar Book Stall.
5. Johnson, Victor, “Essentials of Bridge Engineering” Oxford and IBH, Delhi.
6. Rangwala, S.C., “Bridge Engineering”, Anand, Charotar Book Stall.
7. “IRC Bridge Codes”.
8. “MORTH drawings for various types of bridges”.
9. “MORTH pocket books for bridge Engineers”.
10. Saxena, Subhash C, “Tunnel Engineering”, Dhanpat Rai and Sons, Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	25	27
2	12	14
3	8	09
Total	45	50

5.6 SOIL AND FOUNDATION ENGINEERING

L	P
3	4

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.

LEARNING OUTCOMES

After undergoing this subject, students will be able to:

- Identify and classify various types of soils
- 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
- Select particular type of foundation according to loading of structure

DETAILED CONTENTS

- | | | |
|-----|--|---------|
| 1. | Introduction | (2 Hrs) |
| 1.1 | Importance of Soil Studies in Civil Engineering | |
| 1.2 | Geological origin of soils, residual and transported soil, black cotton soils and their engineering characteristics. | |

2. Physical Properties of Soils (3 Hrs)
 - 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 (No Derivation)
3. Classification and Identification of Soils (6 Hrs)
 - 3.1 Particle size, shape and their effect on engineering properties of soil
 - 3.2 Particle size classification of soils
 - 3.3 Classifications of Soil as per BIS 1498
 - 3.4 Relative density and its use
 - 3.5 Behavior of cohesive soils with change in water content.
 - 3.6 Atterberg's limit - definitions, use and practical significance
4. Flow of Water Through Soils (3 Hrs)
 - 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 BIS
5. Effective Stress (Concept Only) (3 Hrs)
 - 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 (4 Hrs)
 - 6.1 Meaning, conditions/situations of occurrence with emphasis on practical significance of:
 - Consolidation and settlement
 - Creep
 - Plastic flow

- Heaving
- Lateral movement
- 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 Allowable Settlement limit as per BIS

7. Shear Strength of Soil (5 Hrs)

- 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 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

8. Compaction (4 Hrs)

- 8.1 Definition and necessity of compaction
- 8.2 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, moisture control, thickness control, jobs of an embankment supervisor in relation to compaction

9. Soil Exploration (4 Hrs)

- 9.1 Purpose and necessity of soil exploration
- 9.2 Reconnaissance, methods of soil exploration, Trial pits, brief description of various methods of 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.

10. Bearing Capacity of Soil (6 Hrs)
- 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 concept of vertical stress distribution in soils due to foundation loads, pressure bulb, Applications of SPT, unconfined compression test and direct shear test in estimation of bearing capacity.
 - 10.5 Plate load test (no procedure details) and its limitation.
 - 10.6 Improvement of bearing capacity by sand drain method, Grouting, compaction, use of geo-synthetics, Soil Replacement Method.
11. Foundation Engineering (5 hrs)
- 11.1 Concept of shallow and deep foundation
 - 11.2 Shallow foundations: Types - combined, isolated, strip, mat, and their suitability. Factors affecting the depth of shallow foundations
 - 11.3 Deep foundations: Piles and Well.
 - 11.4 Pile Foundation, types of piles and their suitability; pile classification on the basis of material, pile group and pile cap.
 - 11.5 Well foundation, suitability of well foundation, components of well, scouring depth.

PRACTICAL EXERCISES

1. Sieve analysis of given soil sample and plot grain size analysis chart. (Wet and Dry analysis)
2. To study given sample of soil and classify it according to BIS 1498
3. To determine moisture content of a soil sample by oven drying method
4. To determine moisture content of a soil sample by Rapid Moisture Meter / Calcium Carbide Method
5. To determine liquid limit of a given soil sample
6. To determine plastic limit of a given soil sample
7. To determine shrinkage limit of a given soil sample
8. To determine field density of soil by Core Cutter method
9. To determine field density of soil by Sand Replacement Method

10. To determine Optimum Moisture Content and Maximum Dry density of a soil sample by Standard Proctor test
11. To determination of permeability of fine-grained soils by falling head permeability test
12. To determination of permeability of granular soils by constant head permeability test
13. To determine shear strength of soil using direct shear test.
14. To determine unconfined compressive strength of a given soil sample.
15. To collect disturbed samples from filed using Augur Boring.
16. To determine bearing capacity of given soil sample using Standard Penetration 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.

RECOMMENDED BOOKS

1. Punmia, BC, "Soil Mechanics and Foundations", Standard Publishers, Delhi.
2. Bowles, Joseph E, "Engineering Properties of soils and their Measurement", Tata McGraw Hill., Delhi.
3. Gulati, SK, and Manoj Dutta, "Geotechnical Engineering", Tata McGraw Hill, Delhi.
4. S Mittal and JP Shukla, "Soil Testing for Engineers", Khanna Publishers Ltd., Delhi.
5. Duggal, AK., Ramana, TR., Krishnamurthy, S., "Soil Sampling and Testing - A Laboratory Manual", Galgitra Publications, Delhi.
6. "BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)".
7. Jagroop Singh, "Soil and Foundation Engineering", Eagle Parkashan, Jalandhar.
8. Rabinder Singh, "Soil and foundation Engineering", SK Kataria and Sons, Ludhiana.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	2	2
2	3	3
3	6	7
4	3	3
5	3	3
6	4	4
7	5	6
8	4	5
9	4	4
10	6	6
11	5	7
Total	45	50

5.7 QUANTITY SURVEYING AND VALUATION

L	P
3	4

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 this 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 | (02 hrs) |
| 1.1 | Introduction to quantity surveying and its importance. | |
| 1.2 | Duties of quantity surveyor | |
| 2. | Types of Estimates | (02 hrs) |
| 2.1 | Preliminary estimates, Plinth area estimate, Cubic content estimate | |
| 2.2 | Detailed estimates: Definition, Stages of preparation, details of measurement and calculation of quantities and abstract | |

3. Measurement (03 hrs)
 - 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. Calculation of Quantities (06 hrs)
 - 4.1 Cement mortars of different proportion
 - 4.2 Cement concrete of different proportion
 - 4.3 Brick/stone masonry in cement mortar of different proportion
 - 4.4 Plastering, pointing and painting
 - 4.5 D.P.C. and flooring (PCC, Tiles, Marble)
5. Analysis of Rates (06 hrs)
 - 5.1 Steps involved in the analysis of rates. Requirement of material, labour, sundries, contractor's profit and overheads
 - 5.2 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
 - RCC in roof slab/beam/lintels/columns
 - Brick masonry in cement mortar
 - Cement Plaster
 - White washing, painting
 - 5.3 Running and maintenance cost of construction equipment
6. Contracting (06 hrs)
 - 6.1 Meaning of contract
 - 6.2 Qualities of a good contractor and their qualifications
 - 6.3 Essentials of a contract
 - 6.4 Types of contracts, their advantages, dis-advantages and suitability, system of payment

- 6.5 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.
- 6.6 Classification and types of contracting firms/construction companies
- 7. Valuation (05 hrs)
 - 7.1 Purpose of valuation
 - 7.2 Principles of valuation
 - 7.3 Definition of various terms related to valuation like depreciation, sinking fund, salvage and scrap value, market value, fair rent, year's purchase etc.
 - 7.4 Methods of valuation (i) replacement cost method (ii) rental return method

INSTRUCTIONAL STRATEGY

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.

PRACTICAL EXERCISES

1. Prepare 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) Woodwork including polishing
 - g) Sanitary and water supply installations
 - h) False ceiling, aluminum (glazed) partitioning
 - i) Tile flooring including base course
2. Calculate quantities of single room using Center line and Long Wall and Short wall method.
3. Prepare detailed estimate including quantities calculation of Two room Set with verandah.

4. Prepare detailed estimate including quantities calculation of Septic Tank
5. Prepare detailed estimate including quantities calculation of Road Work in cutting and filling
6. Prepare analysis of rates for above (3, 4, 5) exercises.
7. Determination of coefficient of sinking fund

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.

RECOMMENDED BOOKS

1. Pasrija, HD, Arora, CL and S. Inderjit Singh, “Estimating, Costing and Valuation (Civil)”, New Asian Publishers, Delhi.
2. Rangwala, S.C, “Estimating and Costing”, Anand, Charotar Book Stall.
3. Chakraborti, M, “Estimating, Costing and Specification in Civil Engineering”, Calcutta.
4. BN Dutta, “Estimating and Costing in Civil Engineering”, UBS Publishers Distributors Ltd.
5. S.P. Mahajan & Sanjay Mahajan, “Estimating and Costing”, Satya Parkashan, Delhi.

PWD PUBLICATION

1. Latest Punjab Common Schedule of Rates.

SUGGESTED DISTRIBUTION OF MARKS

Topic No	Time Allotted (hrs)	Marks Allotted (Out of 50)
1	2	6
2	2	6
3	3	6
4	6	8
5	6	8
6	6	8
7	5	8
Total	30	50

PERSONALITY DEVELOPMENT CAMP

This is to be organized at a stretch for two to three days. Extension lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this camp.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person interviews; telephonic interviews, panel interviews; group interviews and video conferencing etc.
5. Presentation Techniques
6. Group Discussion Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene

6.1 STEEL STRUCTURES DESIGN

L	P
3	-

RATIONALE

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 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
- Analyse and design single angle section tension and compression members.
- Analyse and design of simply supported steel beams
- Explain different types of trusses, their different components and usability
- Select various types of plate girders

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Introduction | (04 Hrs) |
| | 1.1 Introduction to structural steel. | |
| | 1.2 Advantages and disadvantages of steel structures | |
| | 1.3 Designation of structural steel sections as per IS handbook and SP-06(1), | |
| | 1.4 Rolled and Welded steel sections. | |
| | 1.5 Methods of Steel Structures Design | |
| | 1.6 Introduction to Limit State Method, Assumptions of Limit State Design Methods | |
| 2. | Bolted Connections | (06 hrs) |
| | 2.1 Important terms: Pitch, Gauge and Edge Distance | |
| | 2.2 Types of bolts, Parts of Bolt, Permissible stresses in bolt, Types of bolted joints | |
| | 2.3 Assumptions in the theory of bolted joints. | |
| | 2.4 Failure of a bolted joint. | |

- 2.5 Strength and efficiency of a bolted joint.
- 2.6 Design of bolted joints for axially loaded members as per IS 800-2007 (No Staggered bolts).

- 3. Welded Connections (05 Hrs)
 - 3.1 Types of welds and welded joints,
 - 3.2 Throat Thickness, Advantages and disadvantages of welded joints.
 - 3.3 Design of welded connections for axially loaded members as per IS 800-2007.

- 4. Tension Members (07 hrs)
 - 4.1 Analysis and design of single angle section tension members and their bolted and welded connections with gusset plate as per IS:800-2007 using Limit State Method. (Without Lug Angles)

- 5. Compression Members (08 hrs)
 - 5.1 Column, Strut, Effective Length, Radius of gyration, Classifications of Columns.
 - 5.2 Analysis and design of single angle section compression members subjected to axial load as per IS:800-2007 using Limit State Method.

- 6. Beams (08 hrs)
 - 6.1 Elastic section modulus, Plastic Section Modulus, Moment of Inertia
 - 6.2 Analysis and design of single section simply supported laterally restrained steel beams as per IS:800-2007 using Limit State method.
 - 6.3 Introduction to plate girder and various elements of a plate girder (No numerical).

- 7. Roof Trusses (04 hrs)
 - 7.1 Types of roof trusses
 - 7.2 Components of a trussed roof
 - 7.3 Pitch of roof truss, spacing of trusses, spacing of purlins,
 - 7.4 Connection between purlin and roof covering. (no design, only concept)
 - 7.5 Connection between purlin and principal rafter (no design, only concept)

8. Column Bases (03 hrs)

- 8.1 Types of column bases i.e. slab base, gusseted base
- 8.2 Grillage foundation (Concept only)

Important Note:

Use of IS:800-2007 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

RECOMMENDED BOOKS

1. Duggal, SK, "Limit State Design of Steel Structures", Standard Publishers, Delhi.
2. Bhavikatti, S. S., "Design of Steel Structures: By Limit State Method as Per IS: 800 – 2007", I K International Publishing House Pvt. Ltd.
3. Rajeev Bhatia, "Steel Structures Design", by Eagle Prakashan.
4. Punmia, B.C., "Comprehensive Design of Steel Structures", Laxmi Publications.
5. Subramanian, N., "Design of Steel Structures: Limit State Method as per IS 800-2007", Oxford University Press.
6. "IS 800-2007 General Construction in Steel - Code of Practice", Bureau of Indian Standards, New Delhi.
7. "SP 6(1) Handbook for Structural Engineers No-1", Bureau of Indian Standards, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Total Marks (Out of 50)
1	4	04
2	6	07
3	5	06
4	7	08
5	8	09
6	8	09
7	4	04
8	3	03
Total	45	50

6.2 EARTHQUAKE RESISTANT BUILDING CONSTRUCTION

L	P
2	-

RATIONALE

Diploma holders in civil engineering have to supervise construction of various earthquake resistant buildings. Therefore, the students should have requisite knowledge regarding terminology of earthquake and the precautions to be taken while constructing earthquake resistant buildings

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- Classify the earthquakes
- Explain seismic behavior of traditionally built constructions
- Supervise construction of earthquake resistant buildings
- Monitor reinforcement detailing in earthquake resistant structures
- Manage all rescue operation caused due to earthquake

DETAILED CONTENTS

1. Elements of Engineering Seismology (06 hrs)

General features of tectonic of seismic regions. Causes of earthquakes, Seismic waves, earthquake size (magnitude and intensity), Epicentre, Seismograph, Classification of earthquakes, Seismic zoning map of India, Static and Dynamic Loading, Fundamental period.
2. Seismic Behaviour of Traditionally-Built Constructions of India (04 hrs)

Performance of building during earthquakes and Mode of failure (Out-of-plane failure, in-plane failure, Diaphragm failure, Connection failure, Non-structural components failure)
3. Special construction method, tips and precautions to be observed while planning, designing and construction of earthquake resistant building. (04 hrs)

4. Introduction to IS:1893 (Part 1), IS 4326, IS 13828 and IS: 13920 (latest edition) (03 hrs)
5. Seismic provision of strengthening and retrofitting measures for traditionally-built constructions and RCC structures (05 hrs)
6. Provision of reinforcement detailing in masonry and RC constructions (04 hrs)
7. Disaster Management: Disaster rescue, psychology of rescue, rescue workers, rescue plan, rescue by steps, rescue equipment, safety in rescue operations, debris clearance and casualty management. (04 hrs)

INSTRUCTIONAL STRATEGY

The student may be taken for visit to various building construction sites where precautions related to earthquake resistant construction are being taken so that the students may appreciate the importance of the subject.

RECOMMENDED BOOKS

1. Krishana, Jai, and AR Chandrasekaran, “Elements of Earthquake Engineering”, Sarita Parkashan, Meerut.
2. Gupta, BL, and NL Arora, “Building Construction”, Satya Prakashan, New Delhi.
3. “Manual”, Earthquake Engineering Department, IIT Roorkee / IIT Kanpur.
4. “IS 13920, IS: 13827, IS: 13828, IS 1893-2002, IS 4326 (latest edition)”.
5. Singh, Jagroop, and Rajeev Bhatia, “Earthquake Resistant Building Construction”, Eagle Publication, Jalandhar.
6. “NPTEL : Civil Engineering - Introduction to Earthquake Engineering”.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	06	10
2	04	06
3	04	07
4	03	04
5	05	09
6	04	07
7	04	07
Total	30	50

6.3 STEEL STRUCTURES DRAWINGS

L	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 CUM PRACTICAL EXERCISES

Steel Structures Drawings

Structural drawing from given data for following steel structural elements.

1. Drawing No.1: Column Splices (2 Sheets)

Drawing of splicing of steel columns.

2. Drawing No.2 - Column Bases (3 Sheets)

Drawings of slab base, gusseted base and grillage base for single section steel columns.

3. Drawing No.3: Column Beam Connections (4 Sheets)

(a) Seated and Framed Beam to Beam Connections

(b) Seated and Framed Beam to Column Connections

4. Drawing No. 4: Roof Truss (3 Sheets)

Drawing of Fink Roof Truss with details of joints, fixing details of purlins and roof sheets.

5. Drawing No. 5: Plate Girder (Bolted) (1 Sheet)

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.

6. Draw at least Three sheets using CAD software

RECOMMENDED BOOKS

1. Loyal JS, "Civil Engineering Drawing", Satya Parkashan, New Delhi.
2. Chandel RP, "Civil Engineering Drawings".
3. Kumar; NS, "Civil Engineering Drawing", IPH, New Delhi.
4. Rajeev Bhatiya, "Steel Structures Design & Drawings", Eagle Publisher.
5. Malik RS, and Meo GA, "Civil Engineering Drawing" Asian Publishing House, New Delhi.
6. Singh, Birinder, "Steel Structures Design and Drawing", Kaption Publishing House, New Delhi.

6.4 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

L	P
-	4

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 softwares in civil engineering.

LEARNING OUTCOME

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 CUM PRACTICAL EXERCISES

1. Use of AutoCAD for making 2D Drawings and develop plan, section and elevation of a residential building
2. Introduction and demonstration of following software:
 - STAAD-Pro or etabs
 - AutoCAD Civil 3D
 - MX Road
 - Revit
 - Building Information Modeling (BIM)
 - Primavera Project Planner
 - Microsoft Project
 - ArcGIS
 - Any other equivalent software for above mentioned software
3. Use of any one software available in the institute (mentioned in topic 2)

Note: If the above software are not available in the institution, the demonstration of the above said software should be arranged outside the institute.

6.5 CONSTRUCTION MANAGEMENT AND ACCOUNTS

L	P
3	-

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 OUTCOMES

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 labour 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

DETAILED CONTENTS

CONSTRUCTION MANAGEMENT

- | | | |
|------|---|----------|
| 1. | Introduction | (03 Hrs) |
| 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, organising, staffing, directing, controlling and coordinating, meaning of each of these with respect to construction job. | |
| 1.4. | Stages in construction from conception to completion | |
| 1.5. | The construction team: owner, engineer, architect and contractors, their functions and inter-relationship | |

2. Construction Planning (6 Hrs)
 - 2.1. Importance of construction planning
 - 2.2. Stages of construction planning
 - Pre-tender stage
 - Contract stage
 - 2.3. Scheduling construction works by bar charts
 - Definition of activity, identification of activities though
 - Preparation of bar charts for simple construction work
 - Limitations of bar charts
 - 2.4. Scheduling by network techniques
 - 2.5. Introduction to network techniques; PERT and CPM, differences between PERT and CPM terminology
3. Organization (03 Hrs)
 - 3.1. Types of organizations: Line, line and staff, functional and their characteristics
4. Site Organization (03 Hrs)
 - 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 (04 Hrs)
 - 5.1. Conditions of construction workers in India, wages paid to workers
 - 5.2. Important provisions of the following Acts:
 - Payment of Wages Act 1936 (as amended)
 - Minimum Wages Act 1948 (as amended)
6. Control of Progress (02 Hrs)
 - 6.1. Methods of recording progress
 - 6.2. Analysis of progress
 - 6.3. Taking corrective actions keeping head office informed

7. Inspection And Quality Control (04 Hrs)

- 7.1. Need for inspection and quality control
- 7.2. Principles of inspection
- 7.3. Stages of inspection and quality control for
 - Masonry
 - RCC

8. Accidents and Safety in Construction (04 Hrs)

- 8.1. Accidents – causes and remedies
- 8.2. Safety measures for
 - Excavation work
 - Hot bituminous works
 - Scaffolding, ladders, form work
- 8.3. Safety campaign and safety devices, safety training

ACCOUNTS

9. Public Work Accounts (16 Hrs)

- 9.1. Introduction, technical sanction, allotment of funds, measurement book running and final account bills complete, preparation of bill of quantities (BOQ), completion certificate & report, hand receipt. 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, 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

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

RECOMMENDED BOOKS

1. Shrinath, LS, "PERT and CPM - Principles and Applications", East West Press, New Delhi.
2. Singh, Jagroop, "Construction Management and Accounts", Eagle's Publication.
3. Singh, Harpal, "Construction Management and Accounts", Tata McGraw Hill Publishing Company, New Delhi.
4. Wakhlo, ON, "Civil Engineering Management", Light and Life Publishers, New Delhi.
5. Verma, Mahesh; "Construction Equipment and its Planning and Application".
6. Dharwadker, PP; "Management in Construction Industry", Oxford and IBH Publishing Company, New Delhi.
7. Gahlot PS; Dhir, BM; "Construction Planning and Management", Wiley Eastern Limited, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	3	03
2	6	08
3	3	03
4	3	03
5	4	04
6	2	02
7	4	04
8	4	05
9	16	18
Total	45	50

6.6.1 REPAIR AND MAINTENANCE OF BUILDINGS

L P
3 -

RATIONALE

One of the major concerns of a civil engineer is to take care of the building works, already constructed, in order to keep these buildings in utmost workable conditions. Usually it is being felt that the buildings deteriorate faster for want of care and proper maintenance. The buildings usually have a shabby appearance due to cracks, leakage from the roofs and sanitary/water supply fittings. Thus the need for teaching the subject in proper perspective has arisen making students aware of importance of maintenance of buildings.

LEARNING OUTCOMES

After undergoing the subject, students will be able to:

- State various factors causing deterioration to buildings
- Investigate/diagnose various defects in buildings
- Explain main causes of defects in buildings
- Select the materials for repair and maintenance of buildings
- Carry out repairs for various types of building defects

DETAILED CONTENTS

- | | | |
|----|--|----------|
| 1. | Need for Maintenance | (03 hrs) |
| | 1.1 Importance and significance of repair and maintenance of buildings | |
| | 1.2 Meaning of maintenance | |
| | 1.3 Objectives of maintenance | |
| | 1.4 Factors influencing the repair and maintenance | |
| 2. | Agencies Causing Deterioration (Sources, Causes, Effects) | (04 hrs) |
| | 2.1 Definition of deterioration/decay | |
| | 2.2 Factors causing deterioration, their classification | |
| | 2.2.1 Human factors causing deterioration | |
| | 2.2.2 Chemical factors causing deterioration | |
| | 2.2.3 Environmental conditions causing deterioration | |
| | 2.2.4 Miscellaneous factors | |

- 2.3 Effects of various agencies of deterioration on various building materials i.e. bricks, timber, concrete, paints, metals, plastics, stones
- 3. Investigation and Diagnosis of Defects (07 hrs)
 - 3.1 Systematic approach/procedure of investigation
 - 3.2 Sequence of detailed steps for diagnosis of building defects/problems
 - 3.3 List non-destructive and others tests on structural elements and materials to evaluate the condition of the building and study of three most commonly used tests
- 4. Defects and their root causes (07 hrs)
 - 4.1 Define defects in buildings
 - 4.2 Classification of defects
 - 4.3 Main causes of building defects in various building elements
 - 4.3.1 Foundations, basements and DPC
 - 4.3.2 Walls
 - 4.3.3 Column and Beams
 - 4.3.4 Roof and Terraces
 - 4.3.5 Joinery
 - 4.3.6 Decorative and protective finishes
 - 4.3.7 Services
 - 4.3.8 Defects caused by dampness
- 5. Materials for Repair, maintenance and protection (07 hrs)
 - 5.1 Compatibility aspects of repair materials
 - 5.2 State application of following materials in repairs:
 - 5.2.1 Anti corrosion coatings
 - 5.2.2 Adhesives/bonding aids
 - 5.2.3 Repair mortars
 - 5.2.4 Curing compounds
 - 5.2.5 Joints sealants
 - 5.2.6 Waterproofing systems for roofs
 - 5.2.7 Protective coatings

6. Remedial Measures for Building Defects (17 hrs)

- 6.1 Preventive maintenance considerations
- 6.2 Surface preparation techniques for repair
- 6.3 Crack repair methods
 - 6.3.1 Epoxy injection
 - 6.3.2 Grooving and sealing
 - 6.3.3 Stitching
 - 6.3.4 Adding reinforcement and grouting
 - 6.3.5 Flexible sealing by sealant
- 6.4 Repair of surface defects of concrete
 - 6.4.1 Bug holes
 - 6.4.2 Form tie holes
 - 6.4.3 Honey comb and larger voids
- 6.5 Repair of corrosion in RCC elements
 - 6.5.1 Steps in repairing
 - 6.5.2 Prevention of corrosion in reinforcement
- 6.6 Material placement techniques with sketches
 - 6.6.1 Pneumatically applied (The gunite techniques)
 - 6.6.2 Open top placement
 - 6.6.3 Pouring from the top to repair bottom face
 - 6.6.4 Birds mouth
 - 6.6.5 Dry packing
 - 6.6.6 Form and pump
 - 6.6.7 Preplaced – aggregate concrete
 - 6.6.8 Trowel applied method
- 6.7 Repair of DPC against Rising Dampness
 - 6.7.1 Physical methods
 - 6.7.2 Electrical methods
 - 6.7.3 Chemical methods
- 6.8 Repair of walls
 - 6.8.1 Repair of mortar joints against leakage
 - 6.8.2 Efflorescence removal
- 6.9 Waterproofing of wet areas and roofs
 - 6.9.1 Water proofing of wet areas
 - 6.9.2 Water proofing of flat RCC roofs
 - 6.9.3 Various water proofing systems and their characteristics
- 6.10 Repair of joints in buildings
 - 6.10.1 Types of sealing joints with different types of sealants
 - 6.10.2 Techniques for repair of joints

6.10.3 Repair of overhead and underground water tanks

INSTRUCTIONAL STRATEGY

This is very important course and efforts should be made to find damaged/defective work spots and students should be asked to think about rectifying/finding solution to the problem. Visits to work site, where repair and maintenance activities are in progress can be very useful to students. The students will also prepare a project report based upon the available water proofing materials, sealant, special concrete for repair and adhesives and other repair material available in the market.

RECOMMENDED BOOKS

1. Gahlot, P.S., and Sanjay Sharma, "Building Defects and Maintenance Management", CBS Publishers, New Delhi.
2. Nayak, BS, "Maintenance Engineering for Civil Engineers", Khanna Publishers, Delhi.
3. Ransom, WH, "Building Failures - Diagnosis and Avoidance", E and F.N. Span.
4. Hutchinson, BD; et al, "Maintenance and Repair of Buildings", Newness – Butterworth,

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	3	03
2	4	04
3	7	08
4	7	08
5	7	08
6	17	19
Total	45	50

6.6.2 BASICS OF GREEN BUILDINGS

L	P
3	-

RATIONALE

Buildings have major impact on the environment and human health during its construction and also lifelong its use. It accounts large amount of land use, water and energy consumption causes air and atmospheric pollution. Green Buildings bring environment friendly construction and utilization, ultimately reduce green house gas emissions and impact on climate change. Hence, Green Building subject is introduced in the curriculum of Diploma in Civil Engineering Course at Polytechnic Level.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Describe various features of green building and benefits of green buildings
- Explain site selection and site planning
- List out various concepts of design of components of Green Building
- Use eco-friendly green building materials
- Integrate renewable energy systems in the green building construction
- Use energy conservation measures in the buildings by following ECBC
- Evaluate different type of Green Building Ratings for certification of building

DETAILED CONTENTS

- | | | |
|----|---|----------|
| 1. | Introduction | (03 hrs) |
| | Introduction and objectives of Green Buildings, benefits of Green Buildings, features of Green Buildings | |
| 2. | Green Building Planning and Design Concepts | (05 hrs) |
| | Site selection and planning, Passive Solar design concepts; orientation, building envelope, roof, walls, fenestration, shading and colour | |

3. Eco-friendly Green Building Materials (07 hrs)

Different types of eco-friendly materials, recycled materials; fly ash bricks, autoclave aerated blocks hollow concrete blocks, aggregates, sun controlled glass, UPVC windows, wood, steel and sun reflective paints

4. Integration of Renewable Energy Systems (05 hrs)

Solar Thermal Systems; Solar Water Heating System, Solar chimney, Wind mills. Solar Photovoltaic Systems; Rooftop Solar Power Plant, Solar Lights, Net-metering system

5. Energy Efficiency (11 hrs)

Use of Energy Conservation Building Code (ECBC), Energy Efficient Star labeled Appliances, Energy monitoring and evaluation, Energy Auditing and implementation of energy conservation measures

6. Water Efficiency (05 hrs)

Use of Water Efficient fixtures, rainwater harvesting, waste water management, solid waste management

7. Indoor Environment Quality (04 hrs)

Natural air ventilation, day lighting, various types of low Volatile Organic Compounds materials

8. Green Building Rating and Certification (05 hrs)

Various types of Green Building Ratings; LEED India, GRIHA, BEE; Features and criteria of each rating system and its compliance

Field Visits : Field visits for study of green building construction in the region

INSTRUCTIONAL STRATEGY

Green Building subject involves introduction through lectures-cum-discussions, field work and site visits. The students should be taught this subject through case studies.

RECOMMENDED BOOKS

1. “Energy Conservation Building Code (ECBC)”, Publication of Bureau of Energy Efficiency, Ministry of Power, Government of India.
2. “Rating Manuals of Indian Green Building Council”, Hyderabad.
3. “Rating Manuals of GRIHA”, TERI, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	03	03
2	05	05
3	07	08
4	05	05
5	11	13
6	05	06
7	04	04
8	05	06
Total	45	50

6.6.3 PRE-STRESSED CONCRETE

L P
3 -

RATIONALE

Now a days, diploma holders in Civil Engineering has to supervise pre-stressed concrete construction. So, it is necessary that they should have basic knowledge of pre-stressed concrete.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Explain basic concept of pre-stressed concrete.
- Discuss various methods of pre-stressing.
- Calculate bending and shear capacity of pre-stress members.
- Discuss various types of losses in pre-stressing.

DETAILED CONTENTS

1. Introduction (10 hrs)

Basic concept of pre-stressed concrete, advantages of pre-stressed concrete in comparison with RCC application of pre-stressed to various building elements, bridges, water tanks and precast elements
2. Materials (08 hrs)

Materials requirement for prestressing concrete – High strength concrete, prestressing steel wires, strands and high strength bars. Stresses in high strength steel and stress-strain relationship, tendon profile
3. Prestressing Methods (08 hrs)

Introduction to prestressing methods – pre-tensioning and post-tensioning, their suitability and comparison, circular prestressing and its application

4. Bending and Shear Capacity (09 hrs)

Concept of bending and shear capacity of prestressed members. Calculation of bending stresses in rectangular simply supported beams with straight profile of tendons

5. Losses in Prestressing (10 hrs)

Types of losses in prestress – Elastic shortening, creep and shrinkage of concrete, friction loss and stress relaxation in prestress steel. Computation of losses for simple beam problems.

INSTRUCTIONAL STRATEGY

Teachers are expected to lay considerable emphasis on the basic concepts of prestressed concrete. The students must understand various methods of prestressing and should be able to compute losses for simple beam problems. If possible, some field visits may be arranged to demonstrate the prestressed concrete construction.

RECOMMENDED BOOKS

1. Raju, N Krishna, “Prestressed Concrete”, Tata McGraw Hill, Delhi.
2. Dayaratnam, P, “Prestressed Concrete”, Oxford and I B H Publishing Co., Calcutta.
3. Ramamurthum, S, “Prestressed Concrete”, Dhanpat Rai Publishing Co Pvt Ltd.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (Out of 50)
1	10	11
2	08	09
3	08	09
4	09	10
5	10	11
Total	45	50

6.4 MAJOR PROJECT

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RATIONALE

Major Project 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 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.
- 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 abilities like interpersonal skills, communication skills, positive attitude and values etc.

General Guidelines

The individual students have different aptitudes and strengths. Project work, therefore, should match the strength 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 them as major project. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. There should not be more than 6 students in a group. The project work identified in collaboration with industry should be preferred.

This project work should not be considered as merely conventional industrial/field training in which students are sent to work places with either minimal or no supervision. The project work 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 industry/field organizations for providing such an experience to students. It is necessary that each organization is visited well in advance to identify the project. The chosen project needs to match with the curricular interest of students and should be of professional value to industrial/ field organizations.

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. Analysis of green 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
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 flyash
19. 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:4326
22. Design of car parking in your polytechnic
23. Design of acoustics for an auditorium
24. To prepare analysis of rates for non -schedule items e.g. aluminium door, windows, work stations etc.
25. Study of retrofitting of a given Civil Engineering works.
26. Survey of your polytechnic by using total station.
27. Traffic volume study and analysis on different roads in a city
28. Case study of a flyover with regard to its various construction components
29. Study and preparation of detailed project report of ready mix concrete (RMC) unit

30. 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 and construction of septic tank with soak pit for 100 users
35. 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

NOTE:

The list is only the guideline for selecting a project; however a student is at liberty to select any other related project of his choice independently under guidance of his teacher.

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 an external and an internal (teacher) examiner is given in the table below:

Sr. No.	Performance Criteria	Max. Marks	Rating Scale						
			Outstanding	Excellent	Very Good	Good	Above Average	Average	Pass
1.	Planning	10	10	9	8	7	6	5	4
2.	Execution	30	30	27	24	21	18	15	12
3.	Quality of Project	20	20	18	16	14	12	10	8
4.	Report Writing	20	20	18	16	14	12	10	8
5.	Presentation/ Viva voce	20	20	18	16	14	12	10	8
Total marks		100	100	90	80	70	60	50	40

Important Note

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 100 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 may be a person from industry/organization, who has been associated with the project-oriented professional training of the students or a senior faculty from technical institute.
4. It is proposed that the institute may organize an annual exhibition of the project work.

9. RESOURCE REQUIREMENT

9.1 Physical Resources

9.1.1 Space Requirement:

Norms and standards laid down by All India Council for Technical Education (AICTE) may 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.

9.1.2 Equipment Requirement:

1. Name of Laboratory: Construction Materials Testing
 - A) Concrete
 - B) Roads and Soils

Sr. No.	Item	Quantity
CONCRETE LABORATORY		
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.	Platform weighing machine	1
11.	Concrete cube moulds	18 each
12.	Concrete mixers	1
13.	Sieve shaker	1
14.	Set of sieves	2 sets
15.	Needle vibrator	1 each
16.	Flakiness index apparatus	2
17.	Elongation index apparatus	2
18.	Bulk density apparatus	2
19.	Wire basket	4
20.	Table vibrator	2
21.	Rebound test hammer	1
22.	Ultrasonic pulse velocity apparatus	1
23.	Digital weighing Scale 30 Kg capacity/1g accuracy	1
24.	Digital weighing Scale 6 Kg capacity/0.1g accuracy	1

ROADS AND SOILS LABORATORY

1.	Ring and Ball apparatus (with heating mantle)	1
2.	CBR apparatus with loading machine	1
3.	Los angles Abrasion testing machine apparatus	1
4.	Water bath (Thermostatically controlled)	1
5.	Aggregate impact value testing apparatus with automatic blow counter	2
6.	Ductility machine	1
7.	Direct shear test apparatus	1
8.	Drying oven (Thermostatically controlled)	1
9.	Electronic balance 10 kg capacity/ 1 gm precision	1
10.	Standard penetrometer	1
11.	Soil exploration equipment (Augers etc)	1
12.	Sand replacement method apparatus	2
13.	Liquid limit and plastic limit apparatus	2 each
14.	Compaction apparatus using light compaction (Proctor Test)	2
15.	Grain size distribution test apparatus (sieve set)	2 set
16.	Sieve shaker	2
17.	Permeability apparatus	1
18.	Core cutter apparatus	2
19.	Rapid moisture meter	2
20.	Pycnometer with burette	6
21.	Liquid limit apparatus (Cone penetrometer method)	2

SURVEY EQUIPMENT AND STORES

1.	Plane Table with stand and accessories	16
2.	Dumpy level	8
3.	Transit theodolite (Vernier type)	12
4.	Prismatic compass	15
5.	Planimeter	5
6.	Leveling staves (All aluminum)	5
7.	Total Station	4
8.	Ranging rods	60
9.	Pantagraph	2
10.	Abney level	5
11.	Tangent clinometer (Indian Pattern)	5
12.	Telescopic Alidade	2
13.	Prismatic binoculars	1
14.	Metric chain/non-metrics	10
15.	Metallic tapes/Invar tape	20
16.	Tent age, camp equipment and other misc. items and instruments	LS
17.	Modern survey equipment	LS
18.	Digital Theodolite	4
19.	Electronics Distance Measurement (EDM)	2
20.	GPS Instrument	1

FLUID MECHANICS LABORATORY

1.	Hydraulic Bench	2
2.	*Flow measurement apparatus by Venturimeter and Orificemeter	1
3.	*Pipe Friction apparatus	1
4.	*Orifice and Mouthpiece apparatus	1
5.	*Bernoulli's Theorem apparatus	1
6.	*Flow over a notch apparatus	1
7.	*Losses in pipe bends apparatus	1
8.	Reynold's apparatus	1
9.	Working models of:	
	- Reciprocating pump	1
	- Centrifugal pump	1
10.	Manometers of different types and pressure gauges like:	
	- Piezometer	6
	- Differential Manometers (Double column type manometer)	10
	- Universal manometers (Single column type manometer)	2
	- Inclined tube manometer	2
	- Bourdon pressure gauges	2
	- Compound Gauges (Vacuum and pressure gauge combined)	2
	* These apparatus should be purchased along with hydraulic bench as the design of these apparatus depend upon the design of Hydraulic bench	
11.	Current meter, Pitot tube	2
12.	Rectangular Notch, Triangular Notch	1
13.	Misc. tools etc.	LS

CIVIL ENGINEERING FABRICATION AND ERECTION SHOP

1.	Masonry erection tools, such as iron pans, trowels, plumb bobs, shovels, 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 models (for an ordinary residential building)	1 set
5.	Plumber of Centering	5
6.	Pipes and pipe fittings, valves, gulley traps, GI grating, manhole, Taps, WC pan with foot rest, flushing cistern, urinal pan with cistern, taps, wash basin, water meter etc.	LS
7.	Hoisting and conveying equipment tripod, hoist, pulleys, ladders, ballis etc.	LS
8.	Compressed air equipment with accessories	1
9.	Steel fabrication equipment with fabricating small trusses, reinforcement cages, small girder, column beam connections, column truss connection	1Set
10.	Floor grinding/polishing machine, spray guns etc	LS

WATER SUPPLY & WASTE WATER ENGINEERING		
1.	Total dissolved Solid (TDS) meter	2
2.	Centrifuge	1
3.	Turbidity meter	2
4.	pH meter	2
5.	Jar test apparatus (Flocculator)	2
6.	Dissolved oxygen meter	2
7.	B.O.D incubator	1
8.	Water bath with digital controller	1
9.	Hot air oven	1
10.	Hot plate	2
11.	Bacteriological incubator	1
12.	Colony counter	1
13.	Water sampler	1
14.	Water analysis kit	1
15.	Water distillation apparatus	1
16.	Conductivity meter	1
17.	Electronic balance 5kg Capacity/ 0.1g precision	1
COMPUTER LAB		
1.	Auto CAD	{ Any other equivalent software may be purchased depending upon the availability
2.	STAAD Pro	
3.	Primavera/MS Project	
4.	Revit	
5.	BIM	

NOTE:

In addition to above laboratories in respect of physics, chemistry, applied mechanics, workshops, computer centre etc will be required for effective implementation of the course.

Provision for overhead projector with PC, photocopier, duplicating machines, drafting machines etc. are required.

9.1.3 Furniture Requirement

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

9.2 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. The website www.aicte.ernet.in may be referred for downloading current norms and standards pertaining to technician courses.

10. LIST OF CONTRIBUTORS/EXPERTS

- a) Online Curriculum Workshops for Designing the Contents of First Year Subjects for Diploma Programmes for Punjab State on 22nd April, 2022, 26th April, 2022, 28th April, 2022, 12th May, 2022 13th May, 2022, 16th May, 2022, 17th May, 2022, 24th May, 2022 and 6th June, 2022 at NITTTR, Chandigarh

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26.	Dr G H Hugar, Cecturer Chandigarh College of Engineering and Technology Diploma Wing, Deptt of Applied Science Chandigarh
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29.	Ms. Shelly Singla, Lect, Govt Polytechnic College Khuni Majra
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34.	Mr. Jasvir Singh, Foreman Instructor, S R S Govt Polytechnic College For Girls Ludhiana
35.	Mr. Gurjit Singh, Foreman Instructor, Govt Polytechnic College Bathinda
36.	Mr. H S Kalra, Ex-Principal, ITI, Sector 28, Chandigarh
37.	Mr. Balwan Singh, Officer Incharge- Mechanical Workshop, ABIT
38.	Mr. SS Ubhi, Ex Workshop Supdt., Guru Nanak Dev Polytechnic College, Ludhiana
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42.	Mr. Gagandeep Singh, Lecturer, Govt Polytechnic College Bathinda
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44.	Mr. Rajesh Kumar, Lecturer Env. Studies, Mehr Chand Poly Jalandhar
45.	Ms. Shavinder Kaur, Lecturer (Chemistry), Thapar Polytechnic Patiala
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61.	Ms. Tarandeep Kaur, Lecturer, CSE, Thapar Polytechnic, Patiala
62.	Ms. Divya Jyoti, Lecturer, Pt. J R Govt. Polytechnic, Hoshiarpur
63.	Mr. Manoj Jambla, HOD, CSE, Govt Polytechnic College For Girls, Ludhiana
64.	Dr. Anshu Sharma, Sr Lecturer, Govt Polytechnic College, Khunimajra
65.	Mr. Kulwinder Singh Pannu, HOD, Electronics & Communication Engineering, SGHS GPC, Ranwan
66.	Dr. A B Gupta, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh

- b) Online Curriculum Workshops for Designing the Contents of Open Electives for Diploma Programmes for Punjab State on 27th March, 2023, and 8th May, 2023, at NITTTR, Chandigarh

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5.	Ms. Jagminder Kaur Mann, HOD, Medical Lab. Technology, Govt Polytechnic College For Girls, Patiala
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11.	Ms. Monica Jaggi, Lecturer, Govt Polytechnic College For Girls, Patiala
12.	Mr. Suresh Gandhi, PITT, Amritsar
13.	Mr. Naresh Kumar, PITT Amritsar
14.	Ms. Ramanpreet Kaur, Lecturer Spinning, Textile Technology, Amritsar
15.	Ms. Ravneet Kaur, HOD, Architecture Assistantship, Govt Polytechnic College For Girls, Patiala
16.	Dr. A B Gupta, Professor and Head, Curriculum Development Centre, NITTTR, Chandigarh

- c) Online Workshops to Develop the Curriculum of Diploma Programme in 'Civil Engineering' for the State of Punjab on 10th May, 2022, 23rd May, 2022, 9th June, 2022, 22nd July, 2022, 31st October, 2022, and 22nd December, 2022 at NITTTR, Chandigarh

S. No.	Name, Designation and Official Address
1.	Er. R P Gupta, Chief Engineer (Retd.), PWD (PH) Punjab
2.	Er. Anil Garg, Chief Engineer, PWD (B&R) Punjab
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