

REVISED CURRICULUM FOR DIPLOMA PROGRAMME IN CIVIL ENGINEERING

FOR THE STATE OF HIMACHAL PRADESH



Prepared by:-

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FOREWORD

Globalization, liberalization and privatization have been sweeping the developing world over the last few decades. They have removed barriers of distances, state boundaries, culture, language etc. for trade and commerce, so that a person or a firm with superior quality product and services can reach any where in the world, trade and prosper. Emergence of Indian multinationals viz. Infosys, Tata etc. is evidence to this phenomenon. This has resulted into an era where the motto of “survival of the fittest” works. We as a country have been exposed to the competition of ever lasting nature, affecting our society, industry as well as individuals. Moreover it has broken monopolistic trade practices that industries use to enjoy before.

Coupled with globalization are advancements in science and technology affecting economical and socio-political systems at various levels viz. international, continental, national and regional. The emergence of new bodies of knowledge has been posing a great threat to existing manufacturing and related trade practices. There is a visible growth drift from manufacturing sector to service sector giving rise to knowledge economy.

The knowledge economy, a recently known term uses knowledge as a major resource for national growth in production and services, and in increasing its Gross Domestic Product. The economy where emphasis is laid on new ideas instead of exploiting labour, where life-long learning is preferred over traditional learning, where inter-disciplinary research is promoted resulting into short product development cycle.

Under such circumstances the importance and requirement of technical manpower that is well-qualified and equipped with higher order competencies has increased manifold. Such a manpower is being considered as “Human Capital” globally and the countries based on knowledge economy are treating it (Human Capital) as a prime resource to compete at international level and for keeping an edge over the others.

Under prevailing situation where India is emerging as a global economy, technical education of our country has a great role to play. The polytechnics in the country are supposed to cater to national need of human capital at middle level managers by way of developing diploma graduates having requisite technical as well as generic skill sets. This is the only way through which we can realize our dream of becoming knowledge society by 2020.

Composite Curriculum Development Centre (CCDC) of our State has been extending expert services to polytechnic education system of the states in northern region. It has track record of precisely sensing contemporary techno-socio-politico-economical context, and deriving aims and objectives of a given programme and finally design its curriculum for its implementation for satisfying societal need.

This curriculum document is the result of the judicious/exhaustive exercise undertaken by CCDC considering the prevailing context as stated above. In order to meet the present day need of our national human capital, a course on Generic Skill Development is appropriately introduced in this curriculum of diploma programme along with other requisite changes in various technical courses.

It is now upto the managers of the technical education system to transform this scheme into reality by planning, developing and implementing learning experiences at various levels.

The attention of all concerned educational managers is solicited to strive hard and convert this plan into reality. I wish them good luck.

**S. S. Guleria HAS
Director(TE)
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PREFACE

Curriculum Document is a comprehensive plan or a blue print for developing various curriculum materials and implementing given educational programme to achieve desired and formally pre-stated educational objectives. Moreover it (the document) is the output of exhaustive process of curriculum planning and design, undertaken by the implementers under the expert guidance of curriculum designer.

Technical Education Department of Himachal Pradesh has undertaken restructuring of the diploma programmes offered by the polytechnics in the State. Consequently H.P. State Board of Technical Education assigned the project for revision of six existing diploma programmes to this institute in the month of April 2007 with a view to update the courses and their contents as per employment needs of the world of work. A series of workshops were held in the months of April-May, 2007 and 1st Year curriculum of diploma programmes was handed over to the H.P. State Board of Technical Education for its implementation from July, 2007. Subsequently another series of workshops were held for the revision of 2nd and 3rd Year curriculum of all these courses during September – December 2007.

While working out the detailed contents and study and evaluation scheme, the following important elements have been kept in mind:

- i) Major employment opportunities of the diploma holders*
- ii) Modified competency profile of the diploma holders with a view to meet the changing needs due to technological advancement and requirements of various employment sectors.*
- iii) Vertical and horizontal mobility of diploma passouts for their professional growth*
- iv) Pragmatic approach in implementing all the curricula of diploma programmes in engineering and technology in the state of H.P.*

The document is an outcome of the feedback received from industry/field organizations of different categories viz. small, medium and large scale which offer wage employment for the diploma passouts. In every stage of planning and designing of this curriculum, suggestions and advice of experts representing industry, institutions of higher learning, research organizations etc. were sought. Moreover, the representative sample of polytechnic faculty from H.P. state, who are the actual implementors of these programmes were drawn for the revision to ensure seamless curriculum implementation. The document contains the study and evaluation scheme and detailed subject/course contents for all the three years to enable the H.P. Polytechnics to implement revised curriculum to achieve the desired objectives.

We have taken cognizance of recommendation of experts both from industry and academic institutions and have adequately incorporated segments of Entrepreneurship Development, Environment and Safety Awareness, Industry Oriented Practice Based Minor and Major Projects, Industrial Training etc. Time has specifically been allocated for undertaking extra-curricular activities. Emphasis has been laid on developing and improving communication skills in the students for which Communication Lab has been introduced during the first year itself.

We hope that this revision will prove useful in producing competent diploma holders in the state of Himachal Pradesh. The success of this curriculum depends upon its effective implementation and it is expected that the managers of polytechnic education system in Himachal Pradesh will make efforts to create better facilities, develop linkages with the world of work and foster conducive and requisite learning environment as prescribed in the curriculum document.

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DIPLOMA PROGRAMME IN CIVIL ENGINEERING
(For the State of Himachal Pradesh)

1. SALIENT FEATURES

- 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 as prescribed by State Board of Technical Education, Himachal Pradesh
- 4) Intake : 40/60 (or as prescribed by the Board)
- 5) Pattern of the Programme : Semester Pattern

6) Industrial Training:

Four weeks of industrial training is included after IV semester during summer vacation. Internal assessment out of 50 marks and external assessment out of another 50 marks are added in 5th semester. Total 100 marks are allotted to industrial training.

Distribution of Marks:

- Daily diary and reports of training - 50 Marks
- Viva Voce (External) - 50 Marks

7) Ecology and Environment :

As per Govt. of India directives, an awareness camp on Ecology and Environment has been incorporated during second semester.

8) Entrepreneurship Development:

An Entrepreneurial Awareness Camp and a full subject on Generic Skill and Entrepreneurship Development has been incorporated in the scheme.

9) Student Centred Activities:

A provision of 3-4 hrs per week has been made for organizing Student Centred Activities for overall personality development of students. These 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 cultural activities etc.

2. GUIDELINES

2.1 GUIDELINES FOR ASSESSMENT OF STUDENT CENTRED ACTIVITIES (SCA)

Distribution of 25 marks for SCA will be as follows:

- i. 5 Marks shall be given for general behaviour
- ii. 5 Marks for attendance shall be based on the following distribution:
 1. Less than 75% Nil
 2. 75-79.9% 3 Marks
 3. 80-84.9% 4 Marks
 4. Above 85% 5 Marks
- iii. 15 Marks shall be given for the Sports/NCC/Cultural and Co-curricular activities/other activities after due consideration to the following points:
 1. For participation in sports/NCC/Cultural/Co-curricular activities at National or above level, shall be rewarded with minimum of 10 marks
 2. For participation in sports/NCC/Cultural/Co-curricular activities at Inter-polytechnic level, shall be rewarded with minimum of 08 marks
 3. For participation in two or more of the listed activities, 5 extra marks should be rewarded

2.2 GUIDELINES FOR INTERNAL ASSESSMENT

- The distribution of marks for Internal Assessment in theory subjects and drawing shall be made as per the following guidelines:
 - i. 60% of internal assessment shall be based on the performance in the house tests. At least three such tests shall be conducted during the semester out of which at least one house test should be conducted. 30% weight age will be given to house test and 30% to class test(One best out of two).
 - ii. 20% marks shall be given to home assignments, class assignments, seminars etc.
 - iii. 20% marks shall be given for attendance/punctuality in the subject concerned.
- The distribution of marks for Internal Assessment in practical subjects shall be made as per the following guidelines:
 - i. 60% marks shall be awarded for performance in practical
 - ii. 20% marks shall be given for Report/Practical book and punctuality in equal proportion.
 - iii. 20% marks shall be for Viva-voce conducted during the practical.

3. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN CIVIL ENGINEERING

It was envisaged that the employment in government/public sector undertakings is dwindling day by day. 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:

- i) Wage employment in public sector /private construction companies/Boards/ Corporation/Departments
- ii) Wage employment in service sector specially for repair and maintenance of buildings and their upkeep like:
 - Estate Offices of Universities/Colleges/ Business organizations etc
 - Hotels and Hospitals
- iii) Wage employment in Military Engineering Services/BRO/Defence/Railways/ Power Projects/Banks/Municipal Corporations and Committees/Panchayati Raj etc.
- iv) Testing Laboratories
- v) Self employment opportunities:
 - Small building contractors
 - Public Health, plumbing and water supply installation contracts
 - White washing, distempering, repair and maintenance of buildings/ renovations, specialized flooring etc.
 - Anti - termite treatment
 - Fabrication Job
 - Construction material suppliers/Marketing
 - Preparation of computer aided design and drafting
 - Estimating and costing jobs
 - Surveyor/loss assessment/valuation of buildings etc
 - Water proofing of existing and new building
 - A small enterprise like precast elements/hume pipes/water proofing chemicals etc.
 - Rain water harvesting system

4. **COMPETENCY PROFILE OF DIPLOMA HOLDERS IN CIVIL ENGINEERING**

Keeping in view, the employment scenario and suggestions received during brainstorming session for revamping curriculum of diploma course in civil engineering, following are the competency profile of diploma holders in civil engineering:

1. Ability to prepare read and interpret civil engineering drawings like that of: buildings; RCC, steel and timber structures; water supply and sanitary installations; roads, bridges and culverts, hydraulic structures etc and their layout.
2. Knowledge of various types of construction materials, their properties, suitability and uses, availability and cost.
3. Ability to test various construction materials (Laboratory test & field testing) for their quality and suitability as per BIS code of practice.
4. Knowledge and skills are pertaining to principles and methods of surveying like levelling, plane tabling, theodolite surveying, and tachometry and contouring; modern surveying techniques like total station, remote sensing and GIS.
5. Understanding basic concepts and principles of hydraulics as applied to civil engineering practices.
6. Knowledge of various construction techniques and equipments from substructure to superstructure and finishing operations in respect of;
 - Earth work and foundation
 - Brick masonry
 - Stone masonry
 - RCC structure
 - Pre-fabrication construction elements
 - Hollow blocks
 - Steel and timber structures
 - Joinery and finishing
 - Anti termite treatment
 - Prestressing techniques
 - Installation of public health fittings
7. Knowledge of various BIS Codes and Standards related to civil engineering in the related subjects/areas.
8. Knowledge of concrete technology i.e. importance of mix design, admixtures, types of concretes, concrete operations and associated skills.
9. Knowledge and associated skills pertaining to temporary structures including shuttering and centering
10. Basic knowledge of various types of soils, their behaviour and suitability as construction and foundation material; type of foundations and their construction

11. Knowledge and skills related to water supply, sewerage and sanitary systems
12. Basic Knowledge of various components and constructional aspects pertaining to:
 - Railways, bridges/culverts and tunnels
 - Highways and airports
 - Irrigation and drainage structures, etc.
13. Ability to design simple structural elements of RCC, steel and masonry with a view to develop appreciation of structural behaviour and safety during earthquakes including other natural disasters
14. Ability to prepare material estimates as per CSR, costing, valuation and tender documents as per given drawings.
15. Knowledge of various types of common defects in buildings and their rectification.
16. Knowledge of basic principles of management, construction management techniques and accounts
17. Awareness regarding ecology and environmental considerations for executing construction activities/projects
18. Knowledge of:
 - Safety measures and regulations
 - Building bye laws
 - Labour management
 - Importance of interpersonal relations and communication skills
 - Report writing skills
 - Value system
 - Generic skills of problem solving
19. Understanding the characteristics of an entrepreneur and entrepreneurial support system.
20. Ability to make use of computer softwares for different applications in the field of civil engineering
21. Knowledge of applied and engineering sciences to facilitate understanding of technical subjects, to develop analytical skills, and to facilitate continuing education of diploma engineers

Note: *This competency profile will form the basis for identification of subjects and limit the boundaries of knowledge and skills for working out curriculum details*

5. DERIVING CURRICULUM AREAS FROM COMPETENCY PROFILE

Sr. No	Competency Profile	Curriculum Areas
1.	Ability to prepare, read and interpret civil engineering drawings like that of buildings; RCC, steel and timber structures; water supply and sanitary installations; roads, bridges and culverts etc. and their layout	<ul style="list-style-type: none"> - Engineering Drawing - Civil Engineering Drawings - Surveying - Building Construction
2.	Knowledge of various types of construction materials, their properties, suitability and uses, availability and cost	Construction Materials
3.	Ability to test various construction materials for their quality and suitability as per BIS code of practice	Testing of Materials (part of relevant subjects)
4.	Knowledge and skills pertaining to principles and methods of surveying like levelling, plane tabling, theodolite surveying, tachometry and contouring; modern surveying techniques including remote sensing and GIS	- Surveying
5.	Understanding basic concepts and principles of hydraulics as applied to civil engineering practices	Fluid Mechanics
6.	Knowledge of various construction techniques from structure to superstructure and finishing operations in respect of; <ul style="list-style-type: none"> - Earth work and foundation - Brick masonry - Stone masonry - RCC structure - Steel and timber structures - Joinery and finishing - Anti-termite treatment - Prestressing technique - Installation of public health fittings 	Building Construction
7.	Knowledge of various BIS Codes and Standards related to civil engineering	BIS Codes and Standards (Part of relevant subjects)
8.	Knowledge of concrete technology i.e. mix design, admixtures, types of concretes, concrete operations and associated skills	Concrete Technology
9.	Knowledge and associated skills pertaining to temporary structures including shuttering and centering	Temporary Structures (Part of building construction)

10.	Basic knowledge of various types of soils, their behaviour and suitability as construction and foundation material types of foundation and their construction	Soil and Foundation Engineering
11.	Knowledge and skill related to water supply, sewerage and sanitary systems	Water Supply and Waste Water Engineering
12.	Knowledge of constructional aspects pertaining to highways, railways, irrigation structures, bridges/culverts and tunnels	- Highway and Airport Engineering - Railways, Bridges and Tunnels - Irrigation Engineering
13.	Ability to design simple structural elements of RCC, steel, masonry and timber with a view to develop appreciation of structural behaviour and safety during earthquakes including other natural disasters	- Applied Mechanics - Structural Mechanics - Elementary Structural Design (RCC and Steel) - Aspects of Earthquake Resistant Building Construction
14.	Ability to prepare material estimates as per CSR, costing and tender documents as per given drawings	Quantity Surveying and Valuation
15.	Knowledge of various types of common defects in buildings and their rectification	Repair and Maintenance of Buildings
16.	Knowledge of basic principles of management, construction management techniques and accounts	- Construction Management and Accounts - Basics of Management
17.	Awareness regarding ecology and environmental considerations for executing construction activities/projects	Environmental Awareness (Through Camps)
18.	Knowledge of: - Safety measures and regulations - Building bye laws - Labour management - Importance of interpersonal relations and communication skills - Report writing skills - Generic skills of problem solving	- Construction Management - Communication Skills - Professional Ethics - Generic Skills
19.	Understanding the characteristics of an entrepreneur and entrepreneurial support system	- Entrepreneurship Awareness (Through Camps) - Entrepreneurship Development & Management
20.	Ability to make use of computers for different applications in the field of civil engineering	- Basics of I.T. - Computer Applications in Civil Engineering
21.	Knowledge of applied and engineering sciences to facilitate understanding of technical subjects to develop analytical skills, and to facilitate continuing education of diploma engineers	- Applied Mathematics - Applied Physics - Applied Chemistry - Applied Mechanics

6. ABSTRACT OF CURRICULUM AREAS

(a) General Studies

1. English and Communication Skills
2. Practice in Communication Skills
3. Basics of Information Technology
4. Entrepreneurial Awareness
5. Ecology and Environmental Awareness
6. Generic Skills and Entrepreneurship Development
7. Basics of Management

(b) Applied Sciences

8. Applied Mathematics
9. Applied Physics
10. Applied Chemistry

(c) Basic Courses in Engineering/Technology

11. Engineering Drawing
12. General Workshop Practice
13. Applied Mechanics
14. Fluid Mechanics

(d) Applied Courses in Engineering/Technology

15. Construction Materials
16. Building Construction
17. Building Drawing
18. Concrete Technology
19. Water Supply and Waste Water Engineering
20. Soil and Foundation Engineering
21. Surveying & Survey Camp
22. Structural Mechanics
23. RCC Design & Drawing
24. Public Health Engineering Drawing
25. Steel Structure Design and Drawing
26. Highway Engineering
27. Computer Applications in Civil Engineering
28. Railways, Bridges and Tunnels
29. Irrigation Engineering and Drawing
30. Quantity Surveying and Valuation
31. Earthquake Resistant Building Construction
32. Construction Management and Accounts
33. Major Project Work
34. Minor Project Work

(e) Specialized Courses in Engineering/Technology (Electives)

(Any one of the following)

35. Environmental Engineering
36. Repair and Maintenance of Buildings
37. Pre-stressed Concrete

7. HORIZONTAL AND VERTICAL ORGANISATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution in Hours in Various Semesters					
		I	II	III	IV	V	VI
1.	English and Communication Skills	5	5	-	-	-	-
2.	Applied Mathematics	5	5	-	-	-	-
3.	Applied Physics	6	5	-	-	-	-
4.	Applied Chemistry	6	5	-	-	-	-
5.	Engineering Drawing	7	6	-	-	-	-
6.	General Workshop Practice -	7	6	-	-	-	-
7.	Basics of Information Technology	-	4	-	-	-	-
8.	Applied Mechanics	-	-	5	-	-	-
9.	Fluid Mechanics	-	-	6	-	-	-
10.	Surveying and Survey Camp	-	-	8	8	-	-
11.	Construction Material	-	-	5	-	-	-
12.	Building Construction	-	-	6	-	-	-
13.	Building Drawing	-	-	6	-	-	-
14.	Concrete Technology	-	-	-	5	-	-
15.	Water Supply and Waste Water Engineering	-	-	-	7	-	-
16.	Soil and Foundation Engineering	-	-	-	6	-	-
17.	Structural Mechanics	-	-	-	6	-	-
18.	Public Health Engineering Drawing	-	-	-	4	-	-
19.	RCC Design & Drawing	-	-	-	-	7	-
20.	Transportation Engineering	-	-	-	-	6	-
21.	Computer Applications in Civil Engineering	-	-	-	-	6	-
22.	Railways, Bridges and Tunnels	-	-	-	-	-	-
23.	Irrigation Engineering and Drawing	-	-	-	-	6	-
24.	Generic skills & Entrepreneurship Development and Management	-	-	-	-	3	-
25.	Minor Project Work	-	-	-	-	-	-
26.	Quantity Surveying	-	-	-	-	-	5
27.	Steel Structure Design and Drawing	-	-	-	-	-	7
28.	Earthquake Resistant Building Construction	-	-	-	-	3	-
29.	Construction Management & Accounts	-	-	-	-	-	5
30.	Major Project Work	-	-	-	-	4	10
31.	Basics of Management	-	-	-	-	-	3
32.	Practice in Communication Skills	-	-	-	-	-	2
33.	Electives	-	-	-	-	-	3
34.	Student Centred Activities	4	4	4	4	5	5
Total		40	40	40	40	40	40

1. **STUDY AND EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN CIVIL ENGINEERING, HIMACHAL PRADESH**

FIRST SEMESTER (CIVIL ENGINEERING)

SR. NO	SUBJECTS	STUDY SCHEME <i>Hrs/Week</i>		MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	*English and Communication Skills – I	3	2	30	20	50	100	3	50	3	150	200
1.2	*Applied Mathematics - I	5	-	50	-	50	100	3	-	-	100	150
1.3	*Applied Physics – I	4	2	30	20	50	100	3	50	3	150	200
1.4	*Applied Chemistry – I	4	2	30	20	50	100	3	50	3	150	200
1.5	*Engineering Drawing – I	-	7	-	50	50	100	4	-	-	100	150
1.6	*General Workshop Practice – I	-	7	-	100	100	-	-	50	4	50	150
#Student Centred Activities		-	4	-	-	-	-	-	-	-	-	-
Total		16	24	140	210	350	500	16	200	-	700	1050

* Common with other diploma programmes

Will comprise of co-curricular activities like games, hobby clubs, including photography, seminars, declamation contests, extension lectures, educational field visits, N.C.C., NSS, cultural activities etc.

SECOND SEMESTER (CIVIL ENGINEERING)

SR. NO.	SUBJECTS	STUDY SCHEME <i>Hrs/Week</i>		MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*English and Communication Skills - II	3	2	30	20	50	100	3	50	3	150	200
2.2	*Applied Mathematics – II	5	-	50	-	50	100	3	-	-	100	150
2.3	* Applied Physics-II	3	2	30	20	50	100	3	50	3	150	200
2.4	* Applied Chemistry-II	3	2	30	20	50	100	3	50	3	150	200
2.5	*Basic of Information Technology	-	4	-	50	50	-	-	50	3	50	100
2.6	* Engineering Drawing-II	-	6	-	50	50	100	4	-	-	100	150
2.7	*General Workshop Practice – II	-	6	-	100	100	-	-	50	4	50	150
#Student Centred Activities		-	4	-	-	-	-	-	-	-	-	-
Total		14	26	140	260	400	500	16	250	16	750	1150

* Common with other diploma programmes

Will comprise of co-curricular activities like games, hobby clubs, including photography, seminars, declamation contests, extension lectures, educational field visits, N.C.C., NSS, cultural activities etc.

THIRD SEMESTER (CIVIL ENGINEERING)

SR. NO	SUBJECTS	STUDY SCHEME <i>Hrs/Week</i>		MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	Fluid Mechanics	4	2	30	20	50	100	3	50	3	150	200
3.2	**Applied Mechanics	3	2	30	20	50	100	3	50	3	150	200
3.3	Surveying - I	2	6	30	20	50	100	3	50	3	150	200
3.4	Construction Materials	3	2	30	20	50	100	3	50	3	150	200
3.5	Building Construction	4	2	30	20	50	100	3	50	3	150	200
3.6	Building Drawing	-	6	-	50	50	100	4	-	-	100	150
# Student Centred Activities including Ecology and Environmental Awareness Camp		-	4	-	25	25	-	-	-	-	-	25
Total		16	24	150	175	325	600	-	250	-	850	1175

** Applied Mechanics will be taught by Mechanical Engineering Department.

Will comprise of co-curricular activities like games, hobby clubs, including photography, seminars, declamation contests, Blood donation, student chapter, SWA, extension lectures, educational field report, N.C.C., NSS, cultural activities etc.

FOURTH SEMESTER (CIVIL ENGINEERING)

SR. NO	SUBJECTS	STUDY SCHEME <i>Hrs/Week</i>		MARKS IN EVALUATION SCHEME									Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT						
		Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot		
4.1	Concrete Technology	3	2	30	20	50	100	3	50	3	150	200	
4.2	Water Supply and Waste Water Engineering	5	2	30	20	50	100	3	50	3	150	200	
4.3	Soil and Foundation Engineering	4	2	30	20	50	100	3	50	3	150	200	
4.4	Surveying-II	2	6	30	20	50	100	3	50	3	150	200	
4.5	Structural Mechanics	4	2	30	20	50	100	3	50	3	150	200	
4.6	Public Health Engineering Drawing	-	4	-	50	50	100	4	-	-	100	150	
# Student Centred Activities including Entrepreneurial Awareness camp		-	4	-	25	25	-	-	-	-	-	25	
Total		18	22	150	175	325	600	-	250	-	850	1175	

Will comprise of co-curricular activities like games, hobby clubs, including photography, seminars, declamation contests, extension lectures, educational field visits, N.C.C., NSS, cultural activities etc.

Industrial Training - After examination of 4th Semester, the students shall go for training in a relevant industry/field organisation for a minimum period of 4 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 incharge – training at the start of 5th Semester.

FIFTH SEMESTER (CIVIL ENGINEERING)

SR. NO.	SUBJECTS	STUDY SCHEME		MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		<i>Hrs/Week</i>	Th	Pr	Th	Pr	Tot	Th	Hrs	Pr	Hrs	
5.1	RCC Design and Drawing	4	4	30	20	50	150** (100+50)	4	-	-	150	200
5.2	Transportation Engineering	4	2	30	20	50	100	3	50	3	150	200
5.3	Survey Camp	-	-	-	50	50	-	-	50	3	50	100
5.4	Computer Applications in Civil Engineering	-	6	-	50	50	-	-	100	3	100	150
5.5	Earth Quake Resistant Building Construction	3	-	50	-	50	100	3	-	-	100	150
5.6	Irrigation Engineering and Drawings	4	2	30	20	50	150** (100+50)	4	-	-	150	200
5.7	*Generic Skills and Entrepreneurship Development	3	-	50	-	50	100	3	-	-	100	150
5.8	Minor Project Work	-	4	-	50	50	-	-	100	3	100	150
	Industrial Training	-	-	-	50	50	-	-	50	3	50	100
	# Student Centred Activities	-	4	-	25	25	-	-	-	-	-	25
	Total	18	22	190	285	475	600	-	350	-	950	1425

Note: Survey Camp will be held during 5th Semester for minimum one week in a mountainous area.

* The subject general skill & entrepreneurship development and basic of management(6th semester) have to be taught by lecturer, trained in the field of management.

** 100 marks for theory examination and 50 marks for drawing.

Will comprise of co-curricular activities like extension lectures, games, hobby clubs, including photography, seminars, declamation contests, educational field visits, N.C.C., NSS, Cultural Activities etc.

SIXTH SEMESTER (CIVIL ENGINEERING)

SR. NO.	SUBJECTS	STUDY SCHEME		MARKS IN EVALUATION SCHEME								Total Marks of Int. & Ext.
				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		<i>Hrs/Week</i>		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	*Basics of Management	3	-	50	-	50	100	3	-	-	100	150
6.2	Steel Structure Design and Drawing	4	4	30	20	50	150** (100+50)	4	-	-	150	200
6.3	Quantity Surveying	5	-	50	-	50	100	3	-	-	100	150
6.4	Construction Management and Accounts	5	-	50	-	50	100	3	-	-	100	150
6.5	Elective	3	-	50	-	50	100	3	-	-	100	150
6.6	Major Project Work	-	10	-	100	100	-	-	100	3	100	200
6.7	*Practice in Communication Skills	-	2	-	50	50	-	-	50	3	50	100
# Student Centred Activities		-	4	-	25	25	-	-	-	-	-	25
TOTAL		20	20	230	195	425	550	-	150	-	700	1125

* Common with other diploma programmes

** 100 marks for theory examination and 50 marks for drawing.

Will comprise of co-curricular activities like games, hobby clubs, including photography, seminars, declamation contests, extension lectures, educational field visits, N.C.C., NSS, cultural activities etc.

9. 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 4 weeks duration to be organised during the semester break starting after second year i.e. after IV 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 V 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. The formative and summative evaluation may comprise of weightage to performance in testing, general behaviour, quality of report and presentation during viva-voce examination. It is recommended that such evaluations may be carried out by a team comprising of concerned HOD, teachers and representative from industry.

Teachers and students are requested to see the footnote below the study and evaluation scheme of IV Semester for further details.

2. DETAILED CONTENTS OF CIVIL ENGINEERING SUBJECTS

1.1 ENGLISH AND COMMUNICATION SKILLS – I

L T P
3 - 2

RATIONALE

*Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this course is to enable the diploma holders to acquire proficiency, both in spoken (oral) and written language. At the end of the course, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English. It is expected that each polytechnic will establish a **communication skill laboratory** for conducting practical's mentioned in the curriculum.*

DETAILED CONTENTS

1. **Facets of Literature** (14 hrs)
 - 1.1 Short Stories
 - 1.1.1 Homecoming – R.N. Tagore
 - 1.1.2 The Selfish Giant - Oscar Wilde
 - 1.1.3 The Diamond Necklace- Guy- De Maupassant
 - 1.2 Prose
 - 1.2.1 I Have A Dream – Martin Luther King
 - 1.2.2 On Habits – A. G. Gardiner
 - 1.2.3 My struggle for An Education- Booker T Washington
 - 1.3 Poems
 - 1.3.1 Ozymandias – P.B. Shelley
 - 1.3.2 Daffodils – William Wordsworth
 - 1.3.3 Stopping by Woods on a Snowy Evening – Robert Frost
2. **Grammar and Usage** (10 hrs)
 - 2.1 Parts of speech
 - 2.1.1 Nouns
 - 2.1.2 Pronouns
 - 2.1.3 Adjectives
 - 2.1.4 Articles
 - 2.1.5 Verbs
 - 2.1.6 Adverbs
 - 2.1.7 Prepositions
 - 2.1.8 Conjunction
 - 2.1.9 Interjection
 - 2.1.10 Identifying parts of speech
 - 2.2 Pair of words (Words commonly confused and misused)
 - 2.1 Tenses
 - 2.2 Correction of incorrect sentences
 - 2.3 One word Substitution
3. **Translation** (04 hrs)
 - 3.1 Glossary of Administrative Terms (English and Hindi)
 - 3.2 Translation from Hindi into English and English to Hindi.

4. Paragraph of 100-150 words from outlines (08 hrs)
5. **Comprehension** (04 hrs)
Unseen passages of literacy, scientific, data/graph based for comprehension exercises
6. **Communication** (08 hrs)
 - 6.1 Definition, Introduction and Process of Communication
 - 6.2 Objectives of Communication

LIST OF PRACTICALS

1. Locating a Book in Library
2. How to look up words in a Dictionary: meaning and pronunciation of words as given in the standard dictionary using symbols of phonetics,
3. How to Seek Information from an Encyclopedia
4. Listening pre-recorded English language learning programme
5. Paper Reading before an audience (reading unseen passages)
6. Study of spelling Rules
7. Study of essentials of a Good Speech to respond and comprehend visual, oral themes, situations or stimulus and practice before select gathering
8. Exercises on use of different abbreviations
9. Greetings for different occasions
10. Introducing oneself, others and leave taking
11. Exercises on writing sentences on a topic

Note:

1. *The Text Book on “English and Communication Skills, Book-I By Kuldip Jaidka et. al. developed by NITTTR, Chandigarh is recommended to be used for teaching and setting-up the question papers.*
2. *A communication laboratory may be set up consisting of appropriate audio-video system with facility of playing CDs/DVDs and a video camera for recording the performance of each student with play back facility. A set of CDs from any language training organization e.g. British Council etc. may be procured for use of students.*
3. *Elements of body language will be incorporated in all practicals*
4. *The practical exercises involving writing may also be included in Theory Examination.*

RECOMMENDED BOOKS

1. *English and Communication Skills, Book-I By Kuldip Jaidka, Alwainder Dhillon and Parmod Kumar Singla, Prescribed by NITTTR, Chandigarh Published By Abhishek Publication, 57-59, Sector-17, Chandigarh*
2. *Essentials of Business Communication by Pal and Rorualling; Sultan Chand and Sons*
3. *The Essence of Effective Communication, Ludlow and Panthon; Prentice Hall of India*

4. *New Design English Grammar, Reading and Writing Skills by AL Kohli (Course A and course B), Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,*
5. *New Design English Reading and Advanced Writing Skills for Class XI and XII by MK Kohli and AL Kohli; Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,*
6. *A Practical English Grammar by Thomson and Marlinet*
7. *Spoken English by V Sasikumar and PV Dhamija; Tata McGraw Hill*
8. *English Conversation Practice by Grount Taylor; Tata McGraw Hill*
9. *Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi*
10. *Business Correspondence and Report Writing by RC Sharma and Krishna Mohan; Tata McGraw Hill Publishing Company Ltd. New Delhi*
11. *Communication Skills by Ms R Datta Roy and KK Dhir; Vishal Publication, Jalandhar*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	14	40
2	10	15
3	4	10
4	8	10
5	4	10
6	8	15
Total	48	100

Glossary of Administrative Terms

1.	Senior	वरिष्ठ
2.	Cashier	खजान्ची
3.	Consent	सहमती
4.	Earned Leave	जमा छुट्टी
5.	Under Consideration	विचार अधीन
6.	Criterion	कसौटी
7.	Staff	कर्मचारी
8.	Tenure	कार्यकाल
9.	Working Committee	कार्य समिति
10.	Estate	सम्पदा
11.	Self-Sufficient	आत्मनिर्भर
12.	Emergency	आपात्तकाल
13.	General Body	आम सभा
14.	Exemption	छूट
15.	Daily wages	दिहाड़ीदार
16.	Death-Cum Retirement	मृत्यु और निवृत्ती
17.	Despatch Register	रवानगी रजिस्टर
18.	Despatch	रवानगी
19.	Stenography	आशुलिपिक
20.	Assurance	दिलासा
21.	Justify	सही साबित करना
22.	Superior	बढ़िया
23.	High Commission	उच्चायुक्त
24.	Simultaneous	साथ - साथ
25.	Precautionary	एहतियाती
26.	Commanding Office	कमांडिंग अफसर
27.	Negligence	लापरवाही
28.	Performance	पुरा करना
29.	Proof Reader	पुफ रीडर
30.	Take Over	काम सभालना
31.	Timely Compliance	समय दौरान पुरा करना
32.	Responsibility	जिमेदारी
33.	Chief Justice	मुख्य न्यायधिेश
34.	Disciplinary Action	अनुशासनिक कारवाई
35.	Efficiency Bar	दक्षता रोक
36.	Flying Squad	उड़न दस्ता
37.	Regret	खेद
38.	Inconvenience	असुविधा
39.	Ambiguous	अस्पष्ट
40.	Part Time	अंशकालीन
41.	Academy	अकादमी
42.	Disparity	असमानता
43.	Extraordinary	असाधारण
44.	Provisional	अस्थायी
45.	Income Tax	आयकर
46.	Bonafide	असली
47.	Acting in Official Capacity	बतौर अधिकारिक हैसियत
48.	Contractor	ठेकेदार
49.	On probation	परिवीक्षाधीन
50.	State	राज्य

51.	Administrator	प्रशासक
52.	Admission	प्रवेश
53.	Aforesaid	पूर्वोक्त, उपरोक्त
54.	Affidavit	शपथपत्र
55.	Agenda	कार्यसूची
56.	Alma Mater	विद्यालय जहां किसी व्यक्ति ने शिक्षा प्राप्त
57.	Appointing Authority	मनोनित अधिकारी
58.	Apprentice	शिल्पकार
59.	Additional	अतिरिक्त
60.	Advertisement	विज्ञापन
61.	Assistant	सहायक
62.	Assumption of Charge	अधिकार ग्रहण करना
63.	Attested Copy	सत्यापित प्रति
64.	Chief Minister	मुख्यमन्त्री
65.	Clerical Error	लेखन सम्बन्धी भ्रम
66.	Code	कानून की किताब, गुप्त भाषा
67.	Corruption	नैतिक भ्रष्टाचार, खोटापन
68.	Craftsman	कारीगर
69.	Compensation	हरजाना
70.	Compensatory Allowance	क्षतिपूरक भत्ता
71.	Compile	संकलन करना, संग्रह करना
72.	Confidential Letter	गुप्त पत्र
73.	Chief Engineer	मुख्य अभिन्यता
74.	Data	स्वीकृत तत्त्व (आंकड़े)
75.	Dearness Allowance	संहर्गाई भत्ता
76.	Department	विभाग
77.	Dictionary	शब्द कोष
78.	Director	निदेशक, संचालन
79.	Director of Tech. Edu.	तकनीकी शिक्षा निदेशक
80.	Executive Engineer	अधिशासी अभिन्यता
81.	Employment Exchange	व्यवसाय केन्द्र
82.	Head Office	मुख्य कार्यालय
83.	Head Clerk	प्रधान लिपिक
84.	Indian Admn. Service	भारतीय प्रशासनिक सेवा
85.	Legislative Assembly	विधान सभा
86.	Officiating	स्थानापन्न
87.	Office Record	कार्यालय रिकार्ड
88.	Office Discipline	कार्यालय अनुशासन
89.	Polytechnic	बहुतकनीकी
90.	Temporary	अस्थायी
91.	Qualified	योग्यता प्राप्ति
92.	Under Investigation	जांच अधीन
93.	Sub-treasury	उप-खजाना
94.	Target Date	लक्ष्य तिथि
95.	Technical Approval	तकनीकी मान्यता
96.	Verification	जांच पड़ताल
97.	Viva-voce	मौखिक परीक्षा
98.	Write off	बटटेखाते डालना
99.	Warning	चेतावनी
100.	Yours faithfully	भवदीय

1.2 APPLIED MATHEMATICS - I

L T P

5 - -

RATIONALE

Applied Mathematics forms the backbone of engineering students. Basic elements of algebra, trigonometry, coordinate geometry have been included in the curriculum as foundation course. This course will develop analytical abilities to make exact calculations and will provide continuing educational base to the students.

DETAILED CONTENTS

1. **Algebra** (30 hrs)
 - 1.1 Complex Numbers: Complex number, representation, modulus and amplitude. De-Moivre's theorem, its application in solving algebraic equation.
 - 1.2 Geometrical progression, its nth term and sum of n terms and to infinity. Application of Arithmetic progression and Geometrical progression to Engineering problem.
 - 1.3 Partial fractions (linear factors, repeated linear factors)
 - 1.4 Permutations and Combinations: Value of ${}^n P_r$ ${}^n C_r$. Simple problems
 - 1.5 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

2. **Trigonometry** (20 hrs)
 - 2.1 Concept of angles, measurement of angles in degrees, grades and radians and their conversions.
 - 2.2 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).
 - 2.3 Graphs of Sin x, Cos x, Tan x and e^x

3. **Differential Calculus** 30 hrs)

3.1 Definition of function; Concept of limits.

$$\text{Lt } x \rightarrow a \frac{x^n - a^n}{x - a}$$

Four standard limits

$$\text{Lt } x \rightarrow 0 \frac{\sin x}{x}, \quad \text{Lt } x \rightarrow 0 \frac{a^x - 1}{x}, \quad \text{Lt } x \rightarrow 0 \frac{x - a}{x}$$

$$\text{Lt } x \rightarrow 0 \frac{(1+x)^{1/x} - 1}{x}$$

3.2 Differentiation by definition of x^n , $\sin x$, $\cos x$, $\tan x$, e^x , $\log_a x$

3.3 Differentiation of sum, product and quotient of functions. Differentiation of function of a function.

3.4 Differentiation of trigonometric inverse functions. Logarithmic differentiation. Exponential differentiation Successive differentiation (excluding nth order).

3.5 Applications:

(a) Errors and increments

(b) Maxima and minima

(c) Equation of tangent and normal to a curve (for explicit functions only)

RECOMMENDED BOOKS

1. *Elementary Engineering Mathematics* by BS Grewal, Khanna Publishers, New Delhi
2. *Engineering Mathematics* by Vol. I & II by S Kohli, IPH, Jalandhar
3. *Applied Mathematics* by Dr. RD Sharma
4. *Applied Mathematics, Vol. I & II* by SS Sabharwal & Sunita Jain, Eagle Parkashan, Jalandhar
5. *Comprehensive Mathematics, Vol. I & II* by Laxmi Publications
6. *Engineering Mathematics* by Dass Gupta
7. *Engineering Mathematics* by C Dass Chawla, Asian Publishers, New Delhi
8. *Comprehensive Mathematics, Vol. I & II* by Laxmi Publications
9. *Engineering Mathematics, Vol I, II & III* by V Sundaram et al, Vikas Publishing House (P) Ltd., New Delhi
10. *Engineering Mathematics* by N.Ch.S.N Iyengar et.al, Vikas Publishing House (P) Ltd., New Delhi
11. *Engineering Mathematics, Vol I & II* by SS Sastry, Prentice Hall of India Pvt. Ltd.,
12. *Engineering Mathematics, Vol I & II* by AK Gupta, MacMillan India Ltd., New Delhi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	30	30
2	20	30
3	30	40
Total	80	100

1.3 APPLIED PHYSICS– I

L T P
4 - 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.

DETAILED CONTENTS

1. **Units and Dimensions** (08 hrs)
 - 1.1 Physical quantities
 - 1.2 Units - fundamental and derived units, systems of units (FPS, CGS, MKS and SI units)
 - 1.3 Dimensions and dimensional formulae of physical quantities
 - 1.4 Dimensional equations and principle of homogeneity, applications to conversion from one system of units to another, checking the correctness of physical relations and derivation of simple physical relations, limitations of dimensional analysis
 - 1.5 Significant figures and error analysis

2. **Force and Motion** (12 hrs)
 - 2.1 Scalar and vector quantities – examples, addition and multiplication (scalar product and vector product) of vectors
 - 2.2 Force, resolution and composition of forces – resultant, parallelogram law of forces, equilibrium of forces, Lami's theorem
Force, type of forces, gravitational electromagnetic weak and strong force, conservative and non-conservative forces with simple examples.
 - 2.3 Newton's Laws of motion – concept of momentum, Newton's laws of motion and their applications, determination of force equation from Newton's second law of motion; Newton's third law of motion, conservation of momentum, impulse, simple numerical problems
 - 2.4 Circular motion – angular displacement, angular velocity and angular acceleration
 - 2.5 Relation between linear and angular variables (velocity and acceleration)
 - 2.6 Centripetal force (derivation) and centrifugal force
 - 2.7 Banking of roads

3. **Work, Power and Energy** (12 hrs)
 - 3.1 Work: definition and its SI units
 - 3.2 Work done in moving an object on horizontal and inclined plane (incorporating frictional forces)
 - 3.3 Power: definition and its SI units, calculation of power in simple cases

- 3.4 Energy: Definition and its SI units: Types: Kinetic energy and Potential energy with examples and their derivation
 - 3.5 Principle of conservation of mechanical energy (for freely falling bodies), transformation of energy from one form to another
 - 3.6 Relation between work, heat and energy
 - 3.7 Concept of friction, cause and types, applications of friction in daily life
4. **Rotational Motion** (06 hrs)
- 4.1 Definitions of torque, angular momentum, their relationship
 - 4.2 Conservation of angular momentum (qualitative) and its examples
 - 4.3 Moment of inertia and its physical significance, radius of gyration
 - 4.4 Theorems of parallel and perpendicular axes (statements)
 - 4.5 Moment of inertia of rod, disc, ring and sphere
5. **Properties of Matter** (10 hrs)
- 5.1 Elasticity, definition of stress and strain, different types of modulus of elasticity, stress – strain diagram, Hooke's law
 - 5.2 Pressure – its units, gauge pressure, absolute pressure, atmospheric pressure, Pascal law and its applications.
 - 5.3 Surface tension – its units, measurement of surface tension by capillary tube method, applications of surface tension, effect of temperature and impurity on surface tension
6. **Thermometry** (10 hrs)
- 6.1 Principles of measurement of temperature and different scales of temperature
 - 6.2 Difference between heat and temperature on the basis of K.E. of molecules
 - 6.3 Types of thermometers, Physical properties on which they are based
(No description of individual thermometer)
 - 6.4 Co-efficient of linear, surface and cubical expansions and relation amongst them
 - 6.5 Modes of transfer of heat (Conduction, convection and radiation with examples)
 - 6.6 Co-efficient of thermal conductivity, determination of thermal conductivity of good conductor (Searle's method) and bad conductor (Lee's disc method)

7. **Space Exploration and Radio-activity** (06 Hrs)
 Concept of Natural, artificial satellite, equatorial orbit, Geo-Stationary orbit, Polar orbit, Apogee, Perigee, inclination, purpose of space research, space science in India, Indian satellite, Application of space science, Useful life of satellite, Natural radioactivity, units, concept of nuclear fission, fusion and nuclear reactor. Applications of Radioisotopes in Agriculture industry and medicine.

LIST OF PRACTICALS (to perform minimum eight experiments)

1. To find the diameter of wire using a screw gauge
2. To find volume of solid cylinder and hollow cylinder using a vernier caliper
3. To determine the thickness of glass strip and radius of curvature of a concave surface using a spherometer
4. To verify the parallelogram law of forces
5. To verify conservation of energy of a rolling solid sphere/cylinder
6. To find the diameter of a capillary tube using Travelling Microscop
7. To find the time period of a simple pendulum
8. To find the time period of cantilever
9. To determine the atmospheric pressure at a place using Fortin's Barometer
10. To find the coefficient of thermal conductivity of copper using Searle's conductivity apparatus

RECOMMENDED BOOKS

1. *Test Book of Physics for Class XI (Part-I, Part-II) N.C.E.R.T /C.B.S.E.*
2. *Test Book of Physics for Class XII (Part-I, Part-II) N.C.E.R.T /C.B.S.E.*
3. *Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi*
4. *Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi*
5. *Fundamentals of Physics by Resnick and Halliday & Walker, Asian Book Pvt. Ltd., New Delhi*
6. *Berkeley Physics Course, Vol. I, II & III, Tata McGraw Hill, Delhi*
7. *The Feynman Lectures on Physics by Feynman, Leighton and Sands, Vol. I & II, Narosa Publishing House, Delhi*
8. *Fundamentals of Optics by Francis A. Jenkins & Harvey E White, McGraw Hill International Editions, Physics Series*
9. *A Text Book of Optics by Subramanian and Brij Lal, S Chand & Co., New Delhi*
10. *Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publishers*
11. *Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi*
12. *Applied Physics I & II by RA Banwait & R Dogra, Eagle Parkashan, Jalandhar*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	10
2	12	20
3	14	25
4	06	10
5	10	15
6	10	15
7	04	05
Total	64	100

1.4 APPLIED CHEMISTRY - I

L T P
4 - 2

RATIONALE

The role of chemistry and chemical products in every branch of engineering is expanding greatly. Now a days various products of chemical industries are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behavior when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper and appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstration and with the active involvement of students.

DETAILED CONTENTS

1. **Basic concepts of Chemistry** (10 hrs)
 - 1.1 Units and Dimensions, derived units (with special reference to pressure, volume, temperature, density, specific gravity, surface tension, viscosity and conductivity)
 - 1.2 Matter, element, compound and mixtures, atom, molecule, ion, symbols and formulae (recapitulation only)
 - 1.3 Atomic mass (A), molar mass, mole concept, molar volume of gases
 - 1.4 Solution, strength of solutions in grams per liter, molarity (M), molality (m), mass fraction and mole fraction (numerical problems)
 - 1.5 Chemical equations, thermo-chemical equations, balancing of chemical equations (using partial equation method)
 - 1.6 Numerical problems based on mole concept
 - 1.7 Brief introduction and concept of Volumetry Analysis

2. **Atomic structure and Chemical Bonding** (10 hrs)
 - 2.1 Fundamental particles i.e. electron, proton and neutron (their masses and charges)
 - 2.2 Postulates of Bohr model of atom, success and failures of Bohr model of atom
 - 2.3 Heisenberg's uncertainty principle
 - 2.4 Elementary idea of modern concept of atom, quantum numbers (significance only), definition of shells, sub shells and orbitals, concept of orbitals, shapes of s & p orbitals only. Electronic configuration of elements (atomic number 1 to 30 only) on the basis of Aufbau principle, Pauli's principle and Hund's rule
 - 2.5 Modern periodic law, introduction of periodic table, periods and groups,
 - 2.6 Division of the periodic table into s, p, d, and f blocks (details excluded)
 - 2.7 Chemical bond and cause of bonding

- 2.8 Ionic bond, covalent bond, orbital concept of covalent bonding, valence bond theory, sigma (σ) and pi (π) bonds.
- 2.9 Metallic bonding (electron sea model)
- 2.10 Coordinate bond with examples of ozone, ammonium chloride, $\text{H}_3\text{N}-\text{BF}_3$ complex

3. **Water** (10 hrs)

- 3.1 Sources of water
- 3.2 Hard water, soft water, types of hardness, action of soap on hard water
- 3.3 Degree of hardness in terms of calcium carbonate, Units of hardness in Clark degree, French degree and ppm
- 3.4 Estimation of hardness by EDTA method,
- 3.5 Disadvantages of hard water in domestic and industrial uses
- 3.6 Boiler water: causes and prevention of scale and sludge formation, corrosion, priming & foaming and caustic embitterment
- 3.7 Softening of hard water by premitit and ion exchange processes
- 3.8 Qualities of drinking water and purification of available water for drinking purposes
- 3.9 Chemical analysis: Estimation of alkalinity, estimation of total dissolved solids (TDS), free chlorine, chloride, and dissolved oxygen
- 3.10 Numerical problems

4. **Equilibrium, Acids and Bases.** (10 hrs)

- 4.1 Equilibrium state, equilibrium constant and statement of Le-chatelier's principle with illustration
- 4.2 Ionization of electrolyte in aqueous solution, ionic equilibrium, degree of ionization, self-ionization of water and ionic product of water (K_w)
- 4.3 Concept of pH and pH scale
- 4.4 Arrhenius concept of acids/bases; strong acids/bases, weak acids/bases, dissociation constants of acids/bases. Neutralization, acid base titration, choice of indicators for acid base titration
- 4.5 Hydrolysis of salts, buffer solutions (acidic and basic), buffer action of a buffer solution, applications of buffer solution
- 4.6 Simple numerical problems

5. **Electrochemistry.** (10 hrs)

- 5.1 Electronic concept of oxidation and reduction, redox reactions
- 5.2 Electrolytes and non electrolytes
- 5.3 Electrolysis, Faradays laws of electrolysis
- 5.4 Applications of electrolysis in electrometallurgy, electro-refining and electroplating (numerical)
- 5.5 Galvanic cells (elementary idea) brief description of Daniel cell, Ni-Cd cell, dry cell and lithium iodide cell
- 5.6 Lead storage batteries and maintenance free batteries
- 5.7 Simple numerical problems related to Faraday's laws

6. **Organic Chemistry.** (08 hrs)
6.1 Tetra covalency of carbon, catenation (definition only)
6.2 Structural and condensed formulae of organic compounds
6.3 Homologous series, functional groups and following organic families:
(a) alkanes (b) alkenes (c) alkynes (d) alcohols (e) ethers (f) aldehydes and ketones (g) Carboxylic acids (h) esters (i) amides (with structure, IUPAC names and method of preparation of first member of the series)
7. **Environmental Pollution and its control.** (06 hrs)
7.1 Introduction
7.2 Causes and control of air, water, and soil pollutions
7.3 Noise pollution
7.4 Radio active pollution and its control
7.5 Sewage and its treatment

LIST OF PRACTICALS

1. Introduction to volumetric analysis, apparatus used and molarity based calculations
2. To determine strength of given solution of sodium hydroxide by titrating against standard solution of oxalic acid using phenolphthalein indicator.
3. To determine strength of given solution of sulphuric acid by titrating against standard solution of sodium carbonate using methyl orange indicator (or by conductometrically).
4. Estimation of hardness of water by EDTA method.
5. Estimation of total alkalinity in the given sample of water by titrating against standard solution of sulfuric acid.
6. Determination of the dosage of bleaching powder required for sterilization or disinfection of different samples of water, using standard sodium thiosulfate solution
7. Estimation of chloride ions in the given sample of water by titrating against standard solution of silver nitrate.
8. To determine %age purity of ferrous sulphate in given solution of known strength using potassium permanganate solution.
9. To distinguish between aldehyde and ketone by Tollen's reagent (benzaldehyde and acetone may be used)
10. To prepare iodoform from ethanol or acetone
OR
11. To prepare the Mohr's salt from ferrous sulphate and ammonium sulphate.

RECOMMENDED BOOKS

1. *Chemistry in Engineering* by J.C. Kuricose And J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.
2. *Engineering Chemistry* by P.C.Jain and Monika Jain, Dhanapat Rai Publishing Company New Delhi.
3. *Engineering Chemistry* by Shashi Chawla.
4. *Progressive Applied Chemistry – I* by Dr. G.H. Hugar Eagle Prakashan Jalandhar

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	15
2	10	15
3	10	10
4	10	20
5	10	20
6	08	10
7	06	10
Total	64	100

1.5 ENGINEERING DRAWING - I

L T P
- - 7

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 14 sheets to be prepared*
- iii) Instructions relevant to various drawings may be given along with appropriate demonstrations, before assigning drawing practice to students*

DETAILED CONTENTS

1. **Handling, Use and Care of Drawing Instruments and Materials**
 - 1.1 Drawing Instruments
 - 1.2 Materials
 - 1.3 Layout of drawing sheets

2. **Free Hand Sketching and Lettering** (01 sheets)
 - 2.1 Different types of lines in Engineering drawing as per BIS specifications
 - 2.2 Practice of free hand sketching of vertical, horizontal and inclined lines, geometrical figures such as triangles, rectangles, circles, ellipses and curves

3. **Lettering Technique and Practice** (02 sheets)
 - 3.1 Instrumental single stroke lettering of 35 mm and 70 mm height in the ratio of 7:4
 - 3.2 Free hand lettering (Alphabet and numerals)- lower case and upper case, single stroke, vertical and inclined at 75 degree in different standards, series of 3, 5, 8 and 12 mm heights in the ratio of 7:4

4. **Dimensioning Technique** (01 sheet)
 - 4.1 Necessity of dimensioning, method and principles of dimensioning (mainly theoretical instructions)
 - 4.2 Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes, equally spaced on P.C.D., counter sink holes, counter bored holes, cylindrical parts, narrow spaces and gaps, radii, curves and arches

5. **Scales** (02 sheets)
 - 5.1 Scales - their need and importance (Theoretical instructions).
 - 5.2 Drawing of plain and diagonal scales

6. **Projection** (04 sheets)
 - 6.1 Theory of projections (Elaborate theoretical instructions)
 - 6.2 Drawing 3 views of given objects (Non-symmetrical objects may be selected for this exercise)
 - 6.3 Drawing 6 views of given objects (Non-symmetrical objects may be selected for this exercise)
 - 6.4 Identification of surfaces on drawn views and objects drawn
 - 6.5 Exercises on missing surfaces and views
 - 6.6 Introduction to third angle projections

7. **Sections** (02 sheets)
 - 7.1 Importance and salient features, Methods of representing sections, conventional sections of various materials, classification of sections, conventions in sectioning
 - 7.2 Drawing of full section, half section, partial or broken out sections, Offset sections, revolved sections and removed sections.
 - 7.3 Drawing of different conventions for materials in section, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections
 - 7.4 Exercises on sectional views of different objects.

8. **Isometric Views** (02 sheets)
 - 8.1 Fundamentals of isometric projections (Theoretical instructions)
 - 8.2 Isometric views from 2 or 3 given orthographic views.

9. **Symbols and Conventions** (02 sheets)
 - 9.1 Civil engineering, sanitary fitting symbols
 - 9.2 Electrical fitting symbols for domestic interior installations
 - 9.3 Building plan drawing with electrical and civil engineering symbols, Material symbols and conventions.

RECOMMENDED BOOKS

1. *A Text Book of Engineering Drawing by Surjit Singh, Dhanpat Rai & Co., Delhi*
2. *Engineering Drawing by PS Gill, SK Kataria & Sons, New Delhi*
3. *Elementary Engineering Drawing in First Angle Projection by ND Bhatt, Charactar Publishing House*
4. *Engineering Drawing I & II by JS Layall, Eagle Parkashan, Jalandhar*

1.6 GENERAL WORKSHOP PRACTICE - I

L T P

- - 7

RATIONALE

In order to have a balanced overall development of diploma engineers, it is necessary to integrate theory with practice. General workshop practices are included in the curriculum in order to provide hand on experience about use of different tools and basic manufacturing practices.

This course aims at developing general manual and machining skills in the students. Besides above, the development of dignity of labour, precision, safety at work place, team working and development of right attitude are the other objectives.

DETAILED CONTENTS (PRACTICALS)

The following shops are included in the syllabus:

1. Carpentry and Painting Shop-I
2. Fitting Shop -I
3. Welding Shop-I
4. Electric Shop –I
5. Smithy Shop –I or Electronic Shop-I
6. Sheet Metal Shop-I

Note:

1. *The branches e.g. Civil Engineering, Electrical Engineering, Mechanical Engineering, Automobile Engineering and Instrumentation & Control Engineering will do **Smithy Shop - I** instead of Electronic shop- I*
2. *The branches e.g. Electronics and Communication Engineering, will do **Electronic shop-I** instead of Smithy Shop-I.*

1. Carpentry and Painting Shop – I

- 1.1 Introduction to various types of wood such as Deodar, Kail, Partal, Teak, Hollack, Sheesham, Champ, etc. (Demonstration and their identification).
- 1.2 Demonstration, function and use of commonly used hand tools. Care, maintenance of tools and safety measures to be observed.
Job I Marking, sawing and planing practice
Job II Extensive planing practice on soft wood
Job III Chiseling practice
- 1.3 Introduction to various types of wooden joints, their relative advantages and uses.
Job IV Preparation of half lap joint
Job V Preparation of Mortise and Tenon Joint
- 1.4 Demonstration of various methods of painting wooden items.
Job V Preparation of surface before painting.
Job VI Application of primer coat
Job VII Painting wooden items by brush/roller/spray

2. **Fitting Shop – I**

- 2.1 Introduction to fitting shop, common materials used in fitting shop, Identification of materials. (e.g. Steel, Brass, Copper, Aluminium etc.) Identification of various sections of steel such as Flat, Angle, Tee, Channel, Bar Girder, Square, Z-Section, etc.
- 2.2 Description and demonstration of various types of work benches. Holding devices and files, Precautions while filing. Different types of punches and their uses
Job I Filing practice (Production of flat surfaces) Checking by straight edge.
Job II Marking of jobs, use of marking tools and measuring instruments.
Job III Filing a dimensioned rectangular or Square piece of an accuracy of $\pm 0.25\text{mm}$.
- 2.3 Introduction to chipping, Demonstration on chipping and its applications. Demonstration and function of chipping tools.
Job IV Chipping practice
- 2.4 Care and maintenance of measuring tools like calipers, steel rule, try square, vernier calipers, micrometer, height gauge, combination set, surface plate, universal angle plate. Handling of measuring instruments, checking of zero error, finding of least count.
Job III Preparation of a job by filing on non-ferrous metal upto an accuracy of $\pm 0.1\text{mm}$
Job IV Preparation of job involving thread on GI pipe/ PVC pipe and fixing of different types of elbow, tee union, socket, stopcock, taps, etc.
- 2.5 Description and demonstration of simple operation of hack-sawing, demonstration and description of various types of blades and their specifications, uses and method of fitting the blade.
Job V Making a cutout from a square piece of MS Flat using Hand hacksaw.

3. **Welding Shop – I**

- 3.1 Introduction to welding and its importance in engineering practice; types of welding; common materials that can be welded, introduction to welding equipment e.g. a.c. welding set, d.c. rectifier, Electrode holder, electrodes and their specifications, welding screens and other welding related equipment and accessories.
- 3.2 Electric arc welding, (ac. and dc.) precautions while using electric arc welding, Practice in setting current and voltage for striking proper arc.
Job I Practice of striking arc while using electric arc welding set.
Job II Welding practice job on arc welding for making uniform and straight weld beads.
- 3.3 Various types of joints and end preparation.
Job III Preparation of butt joint by arc welding.
Job IV Preparation of lap joint by arc welding.
Job V Preparation of corner joint by using electric arc welding.
Job VI Preparation of Tee joint by arc welding.

4. **Electric Shop – I**

- 4.1 Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses, ceiling roses, battens, cleats and allied items, tools and accessories.
- 4.2 Study of electrical safety measures and demonstration about use of protective devices.
Job I Identification of phase, neutral and earth of domestic appliances and their connection to two pin/three pin, plugs.
Job II Lay out of complete wiring of a house (i) batten wiring (ii) plastic casing and capping.
- 4.3 Study of common electrical appliances such as electric iron, electric kettle, ceiling fan/ table fan, electric mixer, electric Geyser, desert cooler etc.
Job III Testing and rectification of simulated faults in above said electrical appliances.
- 4.4 Introduction to a Lead-acid battery and its working.
Job IV Installation of a battery and to connect in series and parallel
Job V Charging a battery and testing it with the help of hydrometer and cell tester.

5. **Smithy Shop – I**

- 5.1 Demonstration and detailed explanation of tools and equipment used. Forging operations in Smithy shop. Safety measures to be observed in the smithy shop.
- 5.2 Demonstration and description of bending operation, upsetting operation, description and specification of anvils, swage blocks, hammers, etc.
- 5.3 Demonstration and description of tongs, fullers, swages
Job I To forge a L-Hook.
Job II To prepare a job involving upsetting process
Job III To forge a chisel
Job IV To prepare a cube from a M.S. round by forging method.

OR

5. **Electronic Shop – I**

- 5.1 Identification and familiarization with the following electronic instruments:
 - a) Multimeter digital (Three and half digit)
 - b) Single beam simple CRO, function of every knob on the front panel
 - c) Audio-oscillator sine and square wave output
 - d) Power supply fixed voltage and variable voltage, single output as well as dual output.Job I - Practice in the use of above mentioned equipment through a small experiment
- 5.2 Identification and familiarization with commonly used tools: statement of their uses. Identification and familiarisation with active and passive components; colour code and types of resistor and potentiometers (including VDR, LDR, and thermistor). Identification of components including LED, LCD, UJT, FET, Coils, relays,

switches (SPDT, DPDT, etc.) connectors, micro switches, reed relays, transformers (mains, audio and RF, etc) Linear and Digital ICs, Thyristors, etc.

NOTE: *Demonstration Boards for the above components should be made.*

Job II Cut, strip, join and insulate two length of wires/ cables (repeat with different types of cables/wires)

Job III Cut, strip, connect/solder/crimp different kinds of wires/ cables (including shielded cable) to different types of power/general purpose/Audio Video/Telephone plugs, sockets, jacks, terminals, binding posts, terminal strips, connectors. The tasks should include making complete recording/ playback/ antenna/ speaker leads for common electronic products such as Radio, TV, VCR, Cassette Recorder, Hi-Fi equipment, Head set, microphone

Job IV Cut, bend, tin component, Leads, inserts and solder components (resistor, capacitor, diodes, transistors, IFT type coils, DIL, ICs etc) on a PCB

Job V Wiring of a small circuit on a PCB/tag strip involving lacing, sleeving and use of identifier tags

6. Sheet Metal Shop –I

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

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

6.2 Introduction and demonstration of various machines and equipment used in sheet metal shop e.g. Shearing Machine, Bar Folder, Burring Machine, Nibbling machine, Turning Machine, Wiring Machine, Setting Down Machine, Forming Machine , Punching Machine, Brake, Bending Machine etc.

6.3 Introduction to various raw materials used in sheet metal shop e.g. black-plain sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheets etc.

6.4 Study of various types of Nuts, Bolts, Rivets, Steel Screws etc.

Job I Shearing practice on a sheet using hand shears.

a) Single rivetted lap joint/Double rivetted lap joint

b) Single cover plate chain type/zig-zag type single rivetted Butt Joint

RECOMMENDED BOOKS

1. *Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay*
2. *Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.*
3. *Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd. New Delhi*
4. *Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi*

2.1 ENGLISH AND COMMUNICATION SKILLS - II

L T P
3 - 2

RATIONALE

*Language is the most commonly used medium of self-expression in all spheres of human life – personal, social and professional. A student must have a fair knowledge of English language and skills to communicate effectively to handle the future jobs in industry. The objective of this course is to enable the diploma holders to acquire proficiency, both in spoken (oral) and written language. At the end of the course, the student will be able to develop comprehension skills, improve vocabulary, use proper grammar, acquire writing skills, correspond with others and enhance skills in spoken English. It is expected that each polytechnic will establish a **communication skill laboratory** for conducting practicals mentioned in the curriculum.*

DETAILED CONTENTS

1. **Facets of Literature** (12 hrs)
 - 1.1 Short stories
 - 1.1.1 The Portrait of a Lady - Khushwant Singh
 - 1.1.2 The Refugees – Pearl S. Buck
 - 1.2 Prose
 - 1.2.1 Forgetting- Robert Lynd.
 - 1.2.2 Walking Tours- Robert Louis Stevenson
 - 1.3 Poems
 - 1.3.1 All The World's A Stage – W. Shakespeare
 - 1.3.2 No Men are Foreign- James Kirkup
2. **The Art of Précis Writing** (04 hrs)
3. **Grammar and Usage** (08 hrs)
 - 3.1 Narration
 - 3.2 Voice
 - 3.3 Idioms and Phrases
4. **Correspondence** (06 hrs)
 - 4.1 Business Letters
 - 4.2 Personal letters
 - 4.3 Application for Job
5. **Drafting** (08 hrs)
 - 5.1 Report Writing
 - 5.2 Inspection Notes
 - 5.3 Memos, Circulars
 - 5.4 Telegrams
 - 5.5 Press Release
 - 5.6 Agenda and Minutes of Meetings
6. Glossary of Technical & Scientific Terms (02 hrs)
7. **Communication** (08 hrs)
 - 7.1 Media and Modes of Communication
 - 7.2 Channels of Communication
 - 7.3 Barriers to Communication
 - 7.4 Listening Skills- Types of Listening
 - 7.5 Body language

LIST OF PRACTICALS

1. Practice on browsing information from Internet
2. Group Discussions
3. Mock Interviews
4. Telephone Etiquette – demonstration and practice
5. Situational Conversation with feedback through video recording
6. Presentation on a given theme (using PowerPoint)
7. Exercises leading to personality development like mannerism, etiquettes, body language etc.
8. Reading unseen passages
9. Writing (developing) a paragraph
10. Exercises on writing notices and telephonic messages

Note:-

1. *The Text Book on “English and Communication Skills, Book-II By Kuldeep Jaidka et. al. developed by NITTTR, Chandigarh is recommended to be used for teaching & setting-up the question papers.*
2. *A communication laboratory may be set up consisting of appropriate audio-video system with facility of playing CDs/DVDS and a video camera for recording the performance of each student with play back facility. A set of CDs from any language training organization e.g. British Council etc. may be procured for use of students.*
3. *E Elements of body language will be incorporated in all practicals.*
4. *The practical exercises involving writing may also be included in Theory Examination.*

RECOMMENDED BOOKS:-

1. *English and Communication Skills, Book-II By Kuldeep Jaidka, Alwinder Dhillon and Parmod Kumar Singla, Prescribed by NITTTR, Chandigarh & Published By Abhishek Publication, 57-59, Sector-17, Chandigarh*
2. *Essentials of Business Communication by Pal and Roruaing; Sultan Chand and Sons*
3. *The Essence of Effective Communication, Ludlow and Panthon; Prentice Hall of India*
4. *New Design English Grammar, Reading and Writing Skills by AL Kohli (Course A and course B), Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,*
5. *New Design English Reading and Advanced Writing Skills for Class XI and XII by MK Kohli and AL Kohli; Kohli Publishers, 34 Industrial Area Phase-II, Chandigarh,*
6. *A Practical English Grammar by Thomson and Marlinet*
7. *Spoken English by V Sasikumar and PV Dhamija; Tata McGraw Hill*
8. *English Conversation Practice by Grount Taylor; Tata McGraw Hill*
9. *Developing Communication Skills by Krishna Mohan and Meera Banerji; MacMillan India Ltd., Delhi*
10. *Business Correspondence and Report Writing by RC Sharma and Krishna Mohan; Tata McGraw Hill Publishing Company Ltd. New Delhi*
11. *Communication Skills by Ms R Datta Roy and KK Dhir; Vishal Publication, Jalandhar*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	14	40
2	4	10
3	8	15
4	4	10
5	6	10
6	4	5
7	8	10
Total	48	100

GLOSSARY OF TECHNICAL & SCIENTIFIC TERMS

1. Absolute	परम, अचर, पूर्ण, स्थिर
2. Acceleration	त्वरण, प्रवेग
3. Acid	अम्ल
4. Alkaline	क्षारीय, स्वारा
5. Air Compressor	वायु - संपीडक
6. Air Conditioning	वातानुकूलन
7. Alignment	सरेखन
8. Alternating Current	प्रत्यावर्ती धारा
9. Altimeter	ऊंचाई मापने का यंत्र
10. Alum	फिटकरी
11. Ammeter	अम्मीटर
12. Ampere	ऐम्पियर
13. Amplification	प्रवर्धन
14. Amplitude	आयाम
15. Angle	कोण
16. Angular Velocity	कोणीय वेग
17. Angular Momentum	कोणीय संवेग
18. Annealing	तापानुशीतन
19. Anode	अनोड
20. Apex	शीर्ष, शिखर, शिखाग्र
21. Apparent	स्पष्ट
22. Applied Mechanics	अनुप्रयुक्त यंत्रिकी
23. Applied Science	अनुप्रयुक्त विज्ञान
24. Archimedes's Principle	आर्किमिडीज़ का सिद्धांत
25. Architecture	वास्तुकला, स्थापत्यकला
26. Armature	आर्मेचर
27. Atom	परमाणु
28. Automatic	स्वचलित
29. Axis	अक्ष
30. Axle	धुरी
31. Balance (Scale)	तुला, तराजू
32. Ball Bearing	बाल - बेयरिंग
33. Bar magnet	छड़ - चुम्बक
34. Barometer	वायुदाबमापी
35. Base	आधार
36. Base Plate	आधार पट्टिका
37. Battery	बैटरी
38. Beaker	बीकर
39. Bending Moment	वक्रण आघूर्ण
40. Blast Furnace	झोका भट्टी
41. Bleach	विरंजक
42. Boiler	उबालक
43. Bridge	पुल
44. Burette	ब्यूरेट
45. Callipers	कैलिपर्स
46. Calorie	कैलोरी
47. Canal	नहर
48. Capacitance	धारिता
49. Carburettor	कार्बुरेटर
50. Cast Iron	ढलवा लोहा

51.	Catalyst	उत्प्रेरक
52.	Cathode	कैथोड
53.	Centre of Gravity	गुरुत्वाकर्षण - केन्द्र
54.	Centrifugal	उपकेन्द्रीय
55.	Centripetal	अभिकेन्द्रीय
56.	Centroid	केन्द्रीय
57.	C.G.S. System	सी.जी.एस. पद्धति
58.	Chemical Action	रासायनिक क्रिया
59.	Chai	श्रृंखला, माला
60.	Change of State	अवस्था परिवर्तन
61.	Characteristics	लक्षण
62.	Charge (n)	आवेश
63.	Choke	चोक
64.	Chord, Major	गुरु स्वर - संघात
65.	Chord, Minor	लघु स्वर - संघात
66.	Circular	वृत्ताकार, वर्तुल
67.	Clock-wise	दक्षिणा वर्त
68.	Coagulation	स्कंदन
69.	Coefficient of Expansion	प्रसार गुणांक
70.	Coil	कुंडली
71.	Combustion	दहन
72.	Compass	दिशासूचक
73.	Compound	यौगिक
74.	Concave	अवतल
75.	Convex	उत्तल
76.	Concentrated (Solution)	गाढ़ा, सांद्रित (घोल)
77.	Concrete	कंकरीट
78.	Conduction	चालन
79.	Conductor	चालक
80.	Cone	शंकु
81.	Connection	सम्बंध, जोड़
82.	Constant (Adj.)	स्थिर, अचल, एकसमान
83.	Convection	संवहन
84.	Coulomb	कूलोम (विद्युत शक्ति की इकाई)
85.	Couple	बल युग्म
86.	Crane	क्रेन
87.	Crystalline	रवेदार
88.	Dehydrate	निर्जल करना
89.	Distil	आसहन करना
90.	Effervescence	बुदबुदाहट
91.	Element	तत्त्व, मूलतत्त्व
92.	Empirical Formula	मूलअनुपाती सूत्र
93.	Equivalent Weight	तुल्यांकी - भार
94.	Flame Test	ज्वाला - परीक्षण
95.	Flash Point	प्रज्वलन - ताप
96.	Flask	फ्लास्क
97.	Spring Balance	कमानी तुला
98.	Soluble	विलयशील
99.	Viscosity	गाढ़ापन
100.	Volumetric Analysis	आयतनी विश्लेषण

2.2 APPLIED MATHEMATICS - II

L T P
5 - -

RATIONALE

Applied mathematics forms the backbone of engineering students. Basic elements of Differential calculus and integral calculus and statistics 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.

DETAILED CONTENTS

1. **Algebra** (12 hrs)
 - 1.1 Determinants: Elementary properties of determinants up to 3rd order, consistency of equations, Cramer's rule.
 - 1.2 Matrix: Algebra of matrices, Inverse of a matrix, matrix inverse method to solve a system of linear equations in 3 variables.

2. **Co-Ordinate Geometry** (20 hrs)
 - 2.1 Cartesian and Polar coordinates (two dimensional), conversion from cartesian to polar coordinates and vice-versa, distance between two points (cartesian co-ordinates), section formulae
 - 2.2 Area of triangle when its vertices are given, co-ordinates of centroid, in center of a triangle when the vertices are given, simple problems on locus.
 - 2.3 Equation of straight line in various standard forms (without proof), inter section of two straight lines, angle between two lines. Parallel and perpendicular lines, perpendicular distance formula
 - 2.4 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;

3. **Integral Calculus** (30 hrs)
 - 3.1 Integration as inverse operation of differentiation
 - 3.2 Simple integration by substitution, by parts and by partial fractions (for linear factors only)
 - 3.3 Applications of integration for :
 - (a) Simple problem on evaluation of area bounded by a curve and axes.
 - (b) Calculation of Volume of a solid formed by revolution of an area about axes. (Simple problems).
 - (c) To calculate average and root mean square value of a function

4. **Vector Algebra** (12 hrs)
 a) Definition notation and rectangular resolution of a vector.
 b) Addition and subtraction of vectors.
 c) Scalar and vector products of 2 vectors.
 d) Simple problems related to work, moment and angular velocity
5. **Differential Equations** (06 hrs)
 Solution of first order and first degree differential equation by variable separation method (simple problems)

RECOMMENDED BOOKS

1. *Elementary Engineering Mathematics by BS Grewal, Khanna Publishers, New Delhi.*
2. *Engineering Mathematics by Vol. I & II by S Kohli, IPH, Jalandhar*
3. *Applied Mathematics by Dr. RD Sharma*
4. *Applied Mathematics, Vol. I & II by SS Sabharwal & Sunita Jain/ M.L. Moudgil & P.C. Chopra, Eagle Parkashan, Jalandhar*
5. *Comprehensive Mathematics, Vol. I & II by Laxmi Publications*
6. *Engineering Mathematics by Dass Gupta*
7. *Engineering Mathematics by C Dass Chawla, Asian Publishers, New Delhi*
8. *Comprehensive Mathematics, Vol. I & II by Laxmi Publications*
9. *Engineering Mathematics, Vol I, II & III by V Sundaram et.al, Vikas Publishing House (P) Ltd., New Delhi*
10. *Engineering Mathematics by N.Ch.S.N Iyengar et.al, Vikas Publishing House (P) Ltd., New Delhi*
11. *Engineering Mathematics, Vol I & II by SS Sastry, Prentice Hall of India Pvt. Ltd.,*
12. *Engineering Mathematics, Vol I & II by AK Gupta, Macmillan India Ltd., New Delhi*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	12	20
2	20	20
3	30	40
4	12	10
5	06	10
Total	80	100

2.3 APPLIED PHYSICS – II

L T P
3 - 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

DETAILED CONTENTS

Section – A : Waves and Applications

1. **Waves and vibrations** (10 hrs)
 - 1.1 Wave motion with examples, generation of waves by vibrating particles
 - 1.2 Types of wave motion - transverse and longitudinal wave motion with examples, sound and light waves, velocity, frequency and wave length of a wave. Relationship between wave velocity, frequency and wave length.
 - 1.3 Simple harmonic motion: definition, expression for displacement, velocity, acceleration, time period, frequency in S.H.M.
 - 1.4 Vibration of cantilever and beam, determination of time period of a cantilever
 - 1.5 Free, forced and resonant vibrations with examples
2. **Applications of sound waves** (05 hrs)
 - 2.1 Acoustics of buildings – reverberation, reverberation time, echo, noise, coefficient of absorption of sound, methods to control reverberation time
 - 2.2 Ultrasonics – production (magnetostriction and piezoelectric methods) and their engineering applications
3. **Light** (10 hrs)

Electromagnetic Waves, properties of Electromagnetic waves, Electromagnetic Spectrum interference of light, types of interference, young's double slit experimentm Coherent source of Light, Diffraction of light, Difference between diffraction and interference.

Section – B : Electrical Circuits and Electromagnetism

4. **Electrostatics** (08 hrs)
- 4.1 Coulombs law, unit charge
 - 4.2 Electric flux and Gauss's Law, Electric field intensity and electric potential
 - 4.3 Electric field of point charge, charged sphere (conducting and non-conducting), straight charged conductor, plane charged sheet
 - 4.4 Capacitance, types of capacitors, capacitance of parallel plate capacitor, series and parallel combination of capacitors, charging and discharging of capacitor, their behaviour under AC and DC
 - 4.5 Dielectric and its effect on capacitors, dielectric constant and dielectric break down
5. **DC Circuits** (08 hrs)
- 5.1 Concept of electricity, various applications of electricity
 - 5.2 Current, voltage and resistance, potential difference, power, electrical energy and their units, advantages of electrical energy over other forms of energy
 - 5.3 Ohm's law
 - 5.4 Series and parallel combination of resistors, specific resistance, effect of temperature on resistance, co-efficient of resistance
 - 5.5 Kirchhoff's laws, wheatstone bridge principle and its applications
 - 5.6 Heating effect of current and concept of electric power
6. **Electromagnetism** (08 hrs)
- 6.1. Magnetic field and its units
 - 6.2. Biot-Savart Law, magnetic field around a current carrying straight conductor, circular loop and solenoid
 - 6.3. Force on a moving charge and current in a magnetic field, force between two current carrying parallel conductors
 - 6.4. Moving coil galvanometer, conversion of galvanometer into ammeter and voltmeter
 - 6.5. Permeability, dia, para and ferro-magnetic materials

Section – C : Advanced Physics

7. **Semiconductor physics** (05 hrs)
- 7.1 Energy bands, intrinsic and extrinsic semiconductors, p-n junction diode and its characteristics
 - 7.2 Diode as rectifier – half wave and full wave rectifier
8. **Modern Physics** (10 hrs)
- 8.1 Lasers: concept of energy levels, ionization and excitation potentials; spontaneous and stimulated emission; lasers and its characteristics, population inversion, types of lasers, helium – neon and ruby lasers and applications
 - 8.2 Fibre optics: introduction, optical fiber materials, types, light propagation and applications
 - 8.3 Superconductivity: phenomenon of superconductivity, effect of magnetic field, critical field, type I and type II superconductors and their applications

LIST OF PRACTICALS (To perform minimum eight experiments)

1. To determine and verify the time period of cantilever by drawing graph between load (w) and depression (d)
2. To verify Ohm's law
3. Determination of voltage-current relationship in a dc circuit under specific physical conditions and to draw conclusions
4. To verify laws of resistances in series and in parallel
5. To convert a galvanometer into an ammeter of a given range
6. To convert a galvanometer into a voltmeter of a given range
7. To study the capacitance of a parallel plate capacitor
8. To study characteristics of a pn junction diode
9. To find the wavelength of a He-Ne laser
10. To compare capacitance using DeSauty bridge
11. To determine ionization potential of Mercury
12. To determine high resistance by substitution method
13. To plot sine wave, square wave on CRO and to determine wavelength and velocity of waves

RECOMMENDED BOOKS

1. *Test Book of Physics for Class XI (Part-I, Part-II) N.C.E.R.T*
2. *Test Book of Physics for Class XII (Part-I, Part-II) N.C.E.R.T*
3. *Applied Physics, Vol. I and Vol. II, TTTI Publications, Tata McGraw Hill, Delhi*
4. *Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd. New Delhi*
5. *Fundamentals of Physics by Resnick, Halliday and Walker, Asian Book Pvt. Ltd., New Delhi*

6. *Berkeley Physics Course, Vol. I, II & III, Tata McGraw Hill, Delhi*
7. *The Feynman Lectures on Physics by Feynman, Leighton and Sands, Vol. I & II, Narosa Publishing House, Delhi*
8. *Fundamentals of Optics by Francis A. Jenkins & Harvey E White, McGraw Hill International Editions, Physics Series*
9. *A Text Book of Optics, Subramanian and Brij Lal, S Chand & Co., New Delhi*
10. *Comprehensive Practical Physics, Vol, I & II, JN Jaiswal, Laxmi Publishers*
11. *Engineering Physics by PV Naik, Pearson Education Pvt. Ltd, New Delhi*
12. *Applied Physics I & II by RA Banwait & R Dogra, Eagle Parkashan, Jalandhar*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	15
2	05	10
3	10	15
4	08	10
5	08	10
6	08	15
7	05	10
8	10	15
Total	64	100

2.4 APPLIED CHEMISTRY - II

L T P
3 - 2

RATIONALE

The role of chemistry and chemical products in every branch of engineering is expanding greatly. Now a day various products of chemical industries are playing important role in the field of engineering with increasing number of such products each successive years. The strength of materials, the chemical composition of substances, their behavior when subjected to different treatment and environment, and the laws of heat and dynamic energy have entered in almost every activity of modern life. Chemistry is considered as one of the core subjects for diploma students in engineering and technology for developing in them scientific temper and appreciation of chemical properties of materials, which they have to handle in their professional career. Effort should be made to teach this subject through demonstration and with the active involvement of students.

DETAILED CONTENTS

1. **Metallurgy** (10 hrs)
 - 1.1 General metallurgical terms/operations
 - 1.2 Extraction of pure iron, copper and aluminium from their chief ores
 - 1.3 Manufacture of wrought iron from pig iron, manufacture of steel by open hearth process and L.D. process
 - 1.4 Alloys: Types of alloys (ferrous and non ferrous) purposes of alloying, composition, properties and uses of – invar steel, nichrome, stain less steel, brass, bronze, gun metal, duralumin, alnico, german silver, magnalium

2. **Corrosion.** (06 hrs)
 - 2.1 Definition and electro chemical theory of corrosion, passivity of metals (e.g. Ti, Cr, Fe and Al)
 - 2.2 Preventions and control measures: (i) Internal measures (purification of metals, alloying with corrosion resistant elements, heat treatment) (ii) External measures (application of inhibitors, alteration of corrosion environments, protective coatings – (a) Metallic (b) Non-metallic coating and sacrificial anode)

3. **Fuels.** (12 hrs)
 - 3.1 Introduction, combustion, classification of fuels, characteristics of good fuel
 - 3.2 Calorific value, determination of calorific value by Bomb calorimeter, and Dulong's formula (equation to be assumed, numerical problems)
 - 3.3 Proximate and Ultimate analysis of coal
 - 3.4 Fuel rating: Octane number, cetane number, influence of chemical composition and structure on fuel rating
 - 3.5 Gaseous fuels : Natural gas, LPG, CNG, Hydrogen, Composition, manufacture and uses of water gas, producer gas, biogas,
 - 3.6 Merits and demerits of gaseous fuels over solid and liquid fuels
 - 3.7 Numerical problems (of section 3.1 (only on combustion), 3.2 and 3.3)

4. **Lubricants.** (04hrs)
4.1 Definition and classification of lubricants
4.2 Mechanism of lubrication
4.3 Characteristics of good lubricants
4.4 Properties of lubricants: such as oiliness, emulsification, flash and fire point, volatility, viscosity and viscosity index, cloud and pour point, acidity value, soapification value, coke number.
5. **Paints and Varnishes.** (04hrs)
5.1 Constituent of paints, characteristics of good paint
5.2 Constituent and characteristics of varnishes
5.3 Constituent of enamels
5.4 Uses of paints varnishes and enamels
6. **Refractories** (04 hrs)
6.1 Introduction and characteristics of good refractory materials
6.2 Types and chemical composition of acidic, basic and neutral refractories
6.3 Applications of refractories
7. **Polymers, Plastics and Adhesives.** (08 hrs)
7.1 Polymerization, degree of polymerization (DP). Addition and condensation polymers with suitable examples
7.2 Definition, structure and applications of thermoplastics and thermosetting plastics with examples of each type
7.3 Plasticizer, fillers and binders
7.4 Definition and examples of fibers and elastomers (natural and synthetic rubber)
7.5 Adhesives, synthetic resins (both thermosetting and thermoplastic)

LIST OF PRACTICALS

1. Estimation of copper in the given copper ore solution by titrating against standard solution of sodium thiosulfate/ or spectrophotometrically.
2. Estimation of total dissolved salts in the given sample of water gravimetrically.
3. Estimation of moisture in the given coal sample gravimetrically
4. Estimation of ash in the given coal sample gravimetrically
5. Determination of viscosity of given liquid by Red Wood viscometer
6. Determination of flash / fire point of the given lubricant using Able' s flash point apparatus
7. Determination of total acid value (Total acid number TAN) of a lubricating oil

RECOMMENDED BOOKS

1. *Chemistry in Engineering by J.C. Kuricose and J. Rajaram, Tata McGraw Hill, Publishing Company Limited, New Delhi.*
2. *Engineering Chemistry by P.C.Jain and Monika Jain, Dhanapat Rai Publishing Company New Delhi.*

3. *Engineering Chemistry by Shashi Chawla/A.D. Sharma*
4. *Progressive Applied Chemistry – II by Dr. G.H. Hugar, Eagle Prakashan Jalandhar.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	17
2	06	10
3	12	25
4	04	10
5	04	10
6	04	10
7	08	18
Total	48	100

2.5 BASICS OF INFORMATION TECHNOLOGY

L T P
- - 4

RATIONALE

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

Note:

1. *There will be no theory examination.*
2. *Explanation of Introductory part should be dovetailed with practical work so that following topics may be explained in the laboratory along with the practical exercises.*

DETAILED CONTENTS

- (1) Information Technology – its concept and scope
- (2) Computers for information storage, information seeking, information processing and information transmission
- (3) Elements of computer system, computer hardware and software; data – numeric data, alpha numeric data; contents of a program, processing
- (4) Computer organization, block diagram of a computer, CPU, memory
- (5) Input devices; keyboard, Scanner, mouse etc; output devices; VDU and Printer, Plotter
- (6) Electrical requirements, inter-connections between units, connectors and cables
- (7) Secondary storage; magnetic disks – tracks and sectors, optical disk (CD, CD-RW and DVD Memory), primary and secondary memory: RAM, ROM, PROM etc., Capacity; device controllers, serial port, parallel port, system bus
- (8) Installation concept and precautions to be observed while installing the system and software
- (9) Introduction about Operating Systems such as Windows, Windows NT etc.
- (10) About the internet – server types, connectivity (TCP/IP, shell); applications of internet like: e-mail and browsing
- (11) Various Browsers like WWW (World wide web); hyperlinks; HTTP (Hyper Text Transfer Protocol); FTP (File Transfer Protocol)
- (12) Basics of Networking – LAN,WAN, Topologies

LIST OF PRACTICALS

1. Given a PC, name its various components and list their functions
2. Identification of various parts of a computer and peripherals
3. Practice in installing a computer system by giving connection and loading the system software and application software
4. Installation of DOS and simple exercises on TYPE, REN, DEL, CD, MD, COPY, TREE, BACKUP commands
5. Exercises on entering text and data (Typing Practice)
6. Installation of Windows 98 or 2000 or NT or XP.
 - (1) Features of Windows as an operating system
 - Start
 - Shutdown and restore
 - Creating and operating on the icons
 - Opening closing and sizing the windows
 - Using elementary job commands like – creating, saving, modifying, renaming, finding and deleting a file
 - Creating and operating on a folder
 - Changing setting like, date, time color (back ground and fore ground)
 - Using short cuts
 - Using on line help
7. **MS-Word**
 - File Management:
Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, Giving password protection for a file
 - Page Set up:
Setting margins, tab setting, ruler, indenting
 - Editing a document:
Entering text, Cut, copy, paste using tool- bars
 - Formatting a document:
Using different fonts, changing font size and colour, changing the appearance through bold/ italic/ underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods
 - Aligning of text in a document, justification of document ,Inserting bullets and numbering
 - Formatting paragraph, inserting page breaks and column breaks, line spacing
 - Use of headers, footers: Inserting footnote, end note, use of comments
 - Inserting date, time, special symbols, importing graphic images, drawing tools
 - Tables and Borders:
Creating a table, formatting cells, use of different border styles, shading in tables, merging of cells, partition of cells, inserting and deleting a row in a table
 - Print preview, zoom, page set up, printing options

- Using Find, Replace options
- Using Tools like:
Spell checker, help, use of macros, mail merge, thesaurus word content and statistics, printing envelopes and labels
- Using shapes and drawing toolbar,
- Working with more than one window in MS Word,
- How to change the version of the document from one window OS to another
- Conversion between different text editors, software and MS word

8. **MS-Excel**

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

9. **MS PowerPoint**

- a) Introduction to Powerpoint
 - How to start Powerpoint
 - Working environment: concept of toolbars, slide layout, templates etc.
 - Opening a new/existing presentation
 - Different views for viewing slides in a presentation: normal, slide sorter etc.
- b) Addition, deletion and saving of slides
- c) Insertion of multimedia elements
 - Adding text boxes
 - Adding/importing pictures
 - Adding movies and sound
 - Adding tables and charts etc.
 - Adding organisational chart

- d) Formatting slides
 - Using slide master
 - Text formatting
 - Changing slide layout
 - Changing slide colour scheme
 - Changing background
 - Applying design template
 - e) How to view the slide show?
 - Viewing the presentation using slide navigator
 - Slide transition
 - Animation effects etc.
10. Internet and its Applications
- a) Log-in to internet
 - b) Navigation for information seeking on internet
 - c) Browsing and down loading of information from internet
 - d) Sending and receiving e-mail
 - Creating a message
 - Creating an address book
 - Attaching a file with e-mail message
 - Receiving a message
 - Deleting a message

RECOMMENDED BOOKS

1. *Fundamentals of Computer* by V Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi
2. *Computers Today* by SK Basandara, Galgotia publication Pvt ltd. Daryaganj, New Delhi.
3. *MS-Office 2000 for Everyone* by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., New Delhi
4. *Internet for Every One* by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
5. *A First Course in Computer* by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
6. *Mastering Windows 95*, BPB Publication, New Delhi
7. *Computer Fundamentals* by PK Sinha; BPB Publication, New Delhi
8. *Fundamentals of Information Technology* by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi
9. *On Your Marks - Net...Set...Go... Surviving in an e-world* by Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi
10. *Learning MS Office XP* by Ramesh Bangia, Khanna Book Publishing Co. (P) Ltd., New Delhi.
11. *Fundamentals of Information Technology* by Vipin Arora, Eagle Parkashan, Jalandhar

2.6 ENGINEERING DRAWING - II

L T 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:

1. *First angle projection is to be followed*
2. *Minimum 15 sheets to be prepared*
3. *SP 46 -1988 should be followed*
4. *Instructions relevant to various drawings may be given along with appropriate demonstration, before assigning drawing practice to the students*
5. *20 percent of drawing sheets to be prepared on the third angle projection*

DETAILED CONTENTS

1. **Detail and Assembly Drawing** (02 sheets)
 - 1.1 Principle and utility of detail and assembly drawings
 - 1.2 Practical exercise on drawing from detail to assembly or vice versa using wooden joints as example
2. **Threads** (Min.02 sheets)
 - 2.1 Nomenclature of threads, types of threads (metric). Single and multiple start threads
 - 2.2 Forms of various external thread sections such as V, Square, Acme, Knuckle, Metric, Seller and Buttress thread
 - 2.3 Simplified conventions of left hand and right hand threads, both external and internal threads
3. **Nuts and Bolts** (Min.02 sheets)
 - 3.1 Different views of hexagonal and square headed bolts and nuts
 - 3.2 Assembly of nuts and bolts with washers
4. **Locking Devices** (01 sheet)
 - 4.1 Lock nuts, Castle nuts, Sawn nuts, Split pin lock nut
 - 4.2 Spring washers, Locking plates.

5. **Screws, Studs and Washers** (01 sheet)
 - 5.1 Drawing various types of machine screws
 - 5.2 Drawing various types of studs
 - 5.3 Drawing various types of washers

6. **Keys and Cotters** (Min.03 sheets)

Various types of keys and their application. Preparation of drawings of various keys and cotters

 - 6.1 Various types of joints (a) Sleeve and Cotter joint (b) Kunckle joint (c) Spigot and Socket joint

7. **Coupling** (02 sheets)

Flange coupling (protected and unprotected coupling)

 - 7.1 Pin type flexible coupling

8. **Rivets and Rivetted Joints** (02 sheets)
 - 8.1 Types of general purpose rivet heads
 - 8.2 Types of rivetted joints - lap, butt (single cover plate and double cover plate), chain and zig-zag riveting.
 - 8.3 Caulking and fullering of rivetted joints.

9. **Welded Joints** (01 sheet)
 - 9.1 Various conventions and symbols of welded joints (IS 696)
 - 9.2 Practical application of welded joints say joints of steel frames, windows, doors and furniture.

10. Introduction to AutoCAD (not to be included in examination)

RECOMMENDED BOOKS

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

2.7 GENERAL WORKSHOP PRACTICE - II

L T P
- - 6

RATIONALE

As we know that, the psychomotor skills are mastered through practice, an opportunity therefore, has been extended to students through this course to refine their skills in different trades. The basic skills developed during first semester will be refined during this course by doing higher order skills jobs. In addition to developing general manual and machining skills in the students, the objective of development of sense of dignity of labour, precision, safety at work places, team working and right attitude among the students will also be met.

DETAILED CONTENTS (PRACTICALS)

The following shops are included in the syllabus. Student can opt relevant shops depending upon the need of his/her branch of diploma programme :

1. Carpentry and painting shop-II
2. Fitting shop -II
3. Welding shop -II
4. Electric shop -II
5. Smithy shop –II or Electronic shop-II
6. Sheet Metal Shop –II

Note:

1. *The branches e.g. Civil Engineering, Electrical Engineering, Mechanical Engineering, Automobile Engineering will do **Smithy Shop -II** instead of Electronic shop- II*

And

2. *The branches e.g. Electronics and Communication Engineering, Instrumentation and Control will do **Electronic shop- II** instead of Smithy Shop- II*

1. Carpentry and Painting Shop - II

- 1.1 Introduction to joints, their relative advantages and uses.
Job I Preparation of Dovetail joint and glued joint.
Job II Preparation of Mitre Joint
Job III Preparation of a lengthening Joint
Job IV Preparation of atleast one utility job with and without lamination.
- 1.2 Demonstration of job showing use of Rip Saw, Bow saw and Tenon saw, method of sharpening various saws.
- 1.3 Demonstration of job on Band Saw and Circular Saw, Jig Saw, Chain and Chisel, Universal wood working machine, Saw re-sharpening machine, Saw Brazing unit.
- 1.4 Importance and need of polishing wooden items, Introduction to polishing materials.
Job V Preparation of surface before polishing.
Job VI Application of primer coat.
Job VII Polishing on wooden items

2. **Fitting Shop – II**

- 2.1 Introduction to various types of threads (internal, external)-single start, multi-start, left hand and right hand threads.
- 2.2 Description and demonstration of various types of drills, taps and dies Selection of dies for threading, selection of drills and taps for tapping operations.
Job I Making internal and external threads on a job by tapping and dieing operations manually)
- 2.3 Precautions while drilling soft metals, e.g. copper, Brass, Aluminium etc.
Job II Drilling practice on soft metals (Aluminum, Brass and copper)
- 2.4 Introduction and demonstration of dial type indicator, sine bar and U block with clamps

3. **Welding Shop – II**

- 3.1 Introduction to gas welding, spot welding and seam welding and machinery and equipment used. Adjustments of different types of flames in gas welding demonstration and precautions about handling welding equipment.
Job I Practice in handling gas welding equipment (Low pressure and High pressure) and welding practice.
- 3.2 Common welding joints generally made by gas welding.
Job II Preparation Butt joint by gas welding.
Job III Preparation of small cot frame from conduit pipe by electric arc welding/gas welding.
Job IV Preparation of square pyramid from MS rods by welding (type of welding to be decided by students themselves).
Job V Exercise job on spot/seam welding machine.

4 **Electric Shop – II**

- 4.1 Importance of three-phase wiring and its effectiveness.
Job I Laying out 3 phase wiring for an electric motor or any other 3 phase machine.
- 4.2 Estimating and costing of power consumption.
Job II Connecting single-phase energy meter and testing it. Reading and working out the power consumption and the cost of energy.
Job III Checking continuity of connection (with tester and lamp) location of faults with a multimeter) and their rectification in simple machines and/or other electric circuits fitted with earthing.
- 4.3 Demonstration of dismantling, servicing and reassembling a table fan/ceiling fan/air cooler/mixer/electric iron, Electric heater, geyser, electric oven, air conditioner etc.
Job IV Dismantling, servicing serving and reassembling of any of the above electrical appliances.

- Job V Testing Single phase/three phase electrical motor by using voltmeters, ammeter, clip on meter, tachometer etc.
 Job VI Reversing the rotation of a motor.

5. Smithy Shop – II

- 5.1 Introduction to various heat treatment processes e.g annealing, hardening, tempering, normalizing etc.
 5.2 Description of various types of power hammers and their usage (Demonstration only).

Job I To forge a ring to acquaint the students with forge welding

Job II To forge a chisel and acquaint the students with simple idea of hardening and tempering.

Job III To forge squares on both ends of a circular rod

Job IV To forge a single/double ended spanner.

Job V To prepare a job involving drawing down process

OR

5. Electronic Shop- II

- 5.1 Demonstrate the jointing methods of mounting and dismantling as well as uses of the items mentioned below:

a) Various types of single, multi-cored insulated screened power, audio video, co-axial, general purpose wires/cables

b) Various types of plugs, sockets connectors suitable for general purpose audio and video use, 2 and 3 pin mains plug and sockets.

Banana-plugs, and sockets, BNG, RCA, DIN, UHF, Ear phone speaker connector, telephone jacks and similar male and female connectors and terminal strips.

c) Various types of switches such as: normal/ miniature toggle, slide, push button piano key, rotary, micro switches, SPST, SPDT, DPST, DPDT, band selector, multi way Master Mains Switch.

d) Various types of protective devices such as : Wire fuse, cartridge fuse, slow acting/fast acting fuse, HRC fuse, thermal fuse, single/multiple circuit breakers, over and under current relays.

- 5.2 Identification and familiarisation with active and passive components; colour code and types of resistor, capacitors and potentiometers (including VDR, LDR, and thermistor). Identification of components including LED, LCD, UJT, FET, Coils, relays, switches (SPDT, DPDT, etc.) connectors, micro switches, read relays, transformers (mains, audio and RF, etc) Linear and Digital ICs, Thyristors, etc.

- 5.3 Demonstrate the following:

1. To make faultless solder joints and soldering on PCBs

2. To remove components/wires by unsoldering.
3. To assemble components on boards, chassis, tape strips.
4. Various laying methods of cables
5. Exposure to modern soldering and de-soldering processes
6. Field visits to relevant work-places

Job I De-solder, remove and clean all the components, wires from a given equipment, a PCB or a tap strip using the following

Job II Soldering Iron

Job III Temperature Control soldering Iron

Job IV De-soldering pump

Job V De-soldering strip

Job VI Wiring of a small circuit on a PCB/tag strip involving lacking, sleeving and use of identifier tags

6. Sheet Metal Shop-II

6.1 Introduction to various metal forming processes e.g. Spinning, Punching, Blanking, cup drawing

6.2 Introduction to soldering and brazing.

6.3 Introduction to metal spinning process.

Job I Preparation of job involving shearing, circular shearing, rolling, folding, beading and soldering process e.g. Funnel or any other job involving above operations.

Job II Exercise on job involving brazing process

Job III Spinning a bowl/cup/saucer

Job IV Visit to an sheet metal industry e.g. coach builders etc.

RECOMMENDED BOOKS

1. *Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay*
2. *Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.*
3. *Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd. New Delhi*
4. *Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi.*

3.1 FLUID MECHANICS

L T P
4 - 2

RATIONALE

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

DETAILED CONTENTS

THEORY

1. **Introduction:** (1 hrs)
 - 1.1 Fluids: Real and ideal fluids
 - 1.2 Fluid Mechanics, Hydrostatics, Hydrodynamics, Hydraulics
2. **Properties of Fluids (definition only)** (3 hrs)
 - 2.1 Mass density, specific weight, specific gravity, viscosity, surface tension - cohesion, adhesion and, capillarity, vapour pressure and compressibility.
 - 2.2 Units of measurement and their conversion
3. **Hydrostatic Pressure:** (8 hrs)
 - 3.1 Pressure, intensity of pressure, pressure head, Pascal's law and its applications.
 - 3.2 Total pressure, resultant pressure, and centre of pressure.
 - 3.3 Total pressure and centre of pressure on horizontal, vertical and inclined plane surfaces of rectangular, triangular, trapezoidal shapes and circular.
4. **Measurement of Pressure:** (5 hrs)
 - 4.1 Atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure.
 - 4.2 Piezometer, simple manometer and differential manometer, Bourden gauge and dead weight pressure gauge.
5. **Fundamentals of Fluid Flow:** (6 hrs)
 - 5.1 Types of Flow: Steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow
 - 5.2 Discharge and continuity equation (flow equation)
 - 5.3 Types of hydraulic energy: Potential energy, kinetic energy, pressure energy
 - 5.4 Bernoulli's theorem; statement and description (without proof of theorem)
 - 5.5 Venturimeter
6. **Flow Measurements (brief description with simple numerical problems)** (6 hrs)
 - 6.1 Venturimeter and mouthpiece.
 - 6.2 Pilot tube.
 - 6.3 Orifice and Orifice meter.
 - 6.4 Current meters
 - 6.5 Notches and weirs(simple numerical problems)

7. **Flow through Pipes:** (8 hrs)
- 7.1 Definition of pipe flow; Reynolds number, laminar and turbulent flow - explained through Reynold's experiment
 - 7.2 Critical velocity and velocity distributions in a pipe for laminar
 - 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 Flow from one reservoir to another through a long pipe of uniform cross section (simple problems)
 - 7.6 Pipes in series and parallel
 - 7.7 Water hammer phenomenon and its effects (only definition and description)
8. **Flow through open channels:** (9 hrs)
- 8.1 Definition of an open channel, uniform flow and non-uniform flow
 - 8.2 Discharge through channels using
 - i) Chezy's formula (no derivation)
 - ii) Manning's formula (no derivation)
 - 8.3 Most economical channel sections (no derivation)
 - i) Rectangular
 - ii) Trapezoidal
 - 8.4 Head loss in open channel due to friction
9. **Hydraulic Pumps:** (2 hrs)
- Hydraulic pump, reciprocating pump, centrifugal pumps (No numericals and derivations) (may be demonstrated with the help of working models)

PRACTICAL EXERCISES

- i) To verify Bernoulli's Theorem
- ii) To find out venturimeter coefficient
- iii) 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
- iv) To perform Reynold's experiment
- v) To verify loss of head in pipe flow due to
 - a) Sudden enlargement
 - b) Sudden contraction
- vi) Demonstration of use of current meter and pitot tube
- vii) To determine coefficient of discharge of a rectangular notch/triangular notch.

INSTRUCTIONAL STRATEGY

Hydraulics 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.

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. Likhi SK., Laboratory Manual in Hydraulics, Delhi Wiley Eastern.
5. Fluid Mechanics by Birinder Singh, Kaptian Publishing, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	1	1
2	3	5
3	8	16
4	5	10
5	6	13
6	6	13
7	8	18
8	9	20
9	2	4
Total	48	100

3.2 APPLIED MECHANICS

L T P
3 - 2

RATIONALE

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

DETAILED CONTENTS

1. **Introduction** (06 hrs)
 - 1.1 Concept of engineering mechanics (Applied Mechanics), definition of mechanics, statics, dynamics, application of engineering mechanics in practical fields.
 - 1.2 Definition of mass and weight basic quantities and derived quantities of basic units and derived units
 - 1.3 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, effects of force, characteristics of a force
 - 2.2 Different force systems (coplanar and non-coplanar), principle of transmissibility of forces, law of super-position
 - 2.3 Composition and resolution of coplanar concurrent forces, resultant force, method of composition of forces, laws of forces, triangle law of forces, polygon law of forces - graphically, analytically, resolution of forces, resolving a force into two rectangular components
 - 2.4 Free body diagram
 - 2.5 Equilibrant force and its determination
 - 2.6 Lami's theorem (concept only)
[Simple problems on above topics]

3. **Moment** (08 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, balance 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** (08 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, friction in simple screw jack
 - 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** (06 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 Lifting Machines** (10 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 inclined plane, wheel and axle, different pulley blocks, 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 following laws:
 - a) Parallelogram law of forces
 - b) Triangle law of forces
 - c) Polygon law of forces
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 (M.A), velocity ratio (V.R) and efficiency (η) 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 M.A, V.R, and η of :
 - (i) First system of pulleys
 - (ii) Second system of pulleys
 9. To find out center of gravity of regular lamina and irregular lamina.
 10. To determine coefficient of friction between three pairs of given surface.

RECOMMENDED BOOKS

1. *A Text Book of Applied Mechanics by S Ramamurtham, Dhanpat Rai Publishing Co. Ltd.*
2. *Applied Mechanics By, Col. Harbhajan Singh, TL Singla and Parmod Kumar Singla Published By Abhishek Publication, 57-59, Sector-17, Chandigarh*
3. *A Text Book of Engineering Mechanics (Applied Mechanics) by RK Khurmi; S Chand and Co. Ltd., New Delhi.*
4. *Text Book of Applied Mechanics by Birinder Singh, Kaption Publishing House, New Delhi.*
5. *Engineering Mechanics by Parsad, Standard Publications, New Delhi.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	10
2	10	22
3	8	18
4	8	18
5	6	10
6	10	22
Total	48	100

3.3 SURVEYING - I

L T P
2 - 6

RATIONALE

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

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

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

DETAILED CONTENTS THEORY

1. **Introduction:** (2 hrs)
 - 1.1 Basic principles of surveying
 - 1.2 Concept and purpose of surveying, measurements-linear and angular, units of measurements
 - 1.3 Instruments used for taking these measurements, classification based on surveying instruments
2. **Chain surveying:** (3 hrs)
 - 2.1 Introduction, advantages and disadvantages
 - 2.2 Direct and indirect ranging offsets and recording of field notes
3. **Compass surveying:** (6 hrs)
 - 3.1 Purpose of compass surveying. Use of prismatic compass: Setting and taking observations
 - 3.2 Concept of following with simple numerical problems:
 - a) Meridian - Magnetic and true
 - b) Bearing - Magnetic, True and Arbitrary
 - c) Whole circle bearing and reduced bearing
 - d) Fore and back bearing
 - e) Magnetic dip and declination
 - 3.3 Local attraction - causes, detection, errors and corrections, problems on local attraction, magnetic declination and calculation of included angles in a compass traverse
4. **Leveling:** (8 hrs)
 - 4.1 Purpose of levelling, concept of a level surface, horizontal surface, vertical surface, datum, reduced level and bench marks
 - 4.2 Identification of various parts of Dumpy level and use of Dumpy level
 - 4.3 Concepts of line of collimation, axis of the bubble tube, axis of the telescope and vertical axis
 - 4.4 Levelling staff: single piece, folding, invar precision staff, telescopic
 - 4.5 Temporary adjustment: temporary adjustment of dumpy level

- 4.6 Concept of back sight, foresight, intermediate sight, change point, to determine reduce levels
 - 4.7 Level book and reduction of levels by
 - 4.7.1 Height of collimation method and
 - 4.7.2 Rise and fall method
 - 4.8 Arithmetic checks, problem on reduction of levels, fly levelling, check leveling and profile levelling (L-section and X-section), errors in levelling, permissible limits, reciprocal leveling. Numerical problems.
 - 4.9 Computations of Areas of regular figures and irregular figures. Simpson's rule: prismatic formula and graphical method use of planimeter for computation of areas, numerical problems
5. **Plane Table Surveying** (8 hrs)
- 5.1 Purpose of plane table surveying, equipment used in plane table survey:
 - 5.2 Setting of a plane table:
 - (a) Centering
 - (b) Levelling
 - (c) Orientation
 - 5.3 Methods of plane table surveying
 - (a) Radiation,
 - (b) Intersection
 - (c) Traversing
 - (d) Resection
 - 5.4 Two point problem
 - 5.5 Three point problem by
 - a) Mechanical Method(Tracing paper)
 - b) Bessel's Graphical Method
 - 5.6 Errors in plane table survey and precautions to control them. Testing and adjustment of plane table and alidade
6. **Auto Level** (5 hrs)
- Introduction, principle of auto level, use of auto level, advantages and disadvantages of auto level

PRACTICAL EXERCISES

I. Chain surveying:

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

II. Compass Surveying:

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

III. Levelling:

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

IV. Plane Table Surveying:

- i) a) Study of the plane table survey equipment
- b) Setting the plane table
- c) Marking the North direction
- d) Plotting a few points by radiation method
- ii) a) Orientation by
 - Trough compass
 - Back sighting
- b) Plotting few points by intersection, radiation and resection method
- iii) Traversing an area with a plane table (at least five lines)
- iv) a) Two point problem
- b) Three point problem by
 - Tracing paper method
 - Bessel's graphical method
 - Trial and Error method

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	7
2	3	9
3	6	20
4	8	25
5	8	25
6	5	14
Total	32	100

3.4 CONSTRUCTION MATERIALS

L T P
3 - 2

RATIONALE

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

DETAILED CONTENTS THEORY

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 General characteristics of stones – Marble, Kota stone, Granite, Sand, Trap, Basalt stone, Lime stone and Slate
 - 1.3 Requirements of good building stones
 - 1.4 Various uses of stones in construction
2. **Bricks:** (10 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 Stacking of bricks at site
3. **Cement:** (08 hrs)
 - **3.1 Introduction, raw materials, flow diagram of manufacturing of cement by wet process
 - 3.2 Various types of Cements, their uses: Ordinary portland cement, rapid hardening cement, low heat cement, high alumina cement, blast furnace slag cement, white and coloured cement, portland

pozzolana cement, super sulphate cement, Test of cement – fineness, soundness, initial and final setting time etc.

- 3.3 Properties of Compounds of cement
4. **Lime:** (04 hrs)
- 4.1 Introduction: Lime as one of the cementing materials
 - 4.2 Classification and types of lime as per BIS Code
 - 4.3 Calcination and slaking of lime
 - 4.4 Manufacture of lime
 - 4.5 Process of setting and hardening action of lime
5. **Timber and Wood Based Products:** (08 hrs)
- 5.1 Identification and uses of different types of timber: Teak, Deodar, Shisham Sal, Mango, Kail, Chir, Fur, Willow
 - ** 5.2 Market forms of converted timber as per BIS Code
 - 5.3 Seasoning of timber: Purpose, methods of seasoning as per BIS Code
 - 5.4 Properties of timber and specifications of structural timber
 - 5.5 Defects in timber, decay in timber
 - 5.6 Preservation of timber and methods of treatment as per BIS
 - 5.7 Other wood based products, their brief description of manufacture and uses: laminated board, block board, fibre board, hard board, sunmica, plywood, veneers, nu-wood and study of the brand name and cost of the wood based products available in the market.
6. **Paints and Varnishes:** (06 hrs)
- 6.1 Introduction, purpose and use of paints
 - 6.2 Types, ingredients, properties and uses of oil paints, water paints and cement paints
 - 6.3 Covering capacity of various paints
 - 6.4 Types, properties and uses of varnishes
 - 6.5 Trade name of different products.
7. **Miscellaneous Materials:** (08hrs)
- 7.1 Asbestos – Introduction, specification and uses of asbestos in roofing sheets, pipes and tanks. The difference of merits and demerits between galvanized iron sheets and asbestos cement sheets
 - 7.2 Construction chemicals like water proofing compound, epoxies, polymers
 - 7.3 Water proofing and fire resistance materials – types and uses
 - 7.4 Materials used in interior decoration works like POP, methods of doing POP

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

PRACTICAL EXERCISES:

- i) To identify the stones used in building works by visually examination
- ii) To determine the crushing strength of bricks
- iii) To determine the water absorption of bricks
- iv) To determine fineness (by sieve analysis) of cement
- v) To conduct field test of cement.
- vi) To determine normal consistency of cement

- vii) To determine initial and final setting times of cement
- viii) To determine soundness of cement
- ix) To determine compressive strength of cement
- x) The students should submit a report work on the construction materials, covering water proofing material, cements, steel, paints and timber products available in the local market. They will also show the competitive study based upon the cost, brand name, sizes available in the local market.

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

- 1) Sharma, SK; and Mathur, GC; "Engineering Materials;" Delhi-Jalandhar, S. Chand and Co.
- 2) Surendra Singh; "Engineering Materials;" New Delhi, Vikas Publishing House Pvt. Ltd.
- 3) Chowdhuri, N; "Engineering Materials;" Calcutta, Technical Publishers of India.
- 4) Bahl, SK; "Engineering Materials;" Delhi, Rainbow Book Co.
- 5) TTTI, Chandigarh "Civil Engineering Materials;" New Delhi Tata McGraw Hill Publication
- 6) Kulkarni, GJ; "Engineering Materials;" Ahmedabad, Ahmedabad Book Depot.
- 7) Shahane; "Engineering Materials"; Poona, Allied Book Stall.
- 8) Gurcharan Singh; "Engineering materials", Delhi Standard Publishers Distributors
- 9) SC Rangawala, "Construction Materials", Charotar Publishers
- 10) Alam Singh, "Construction Materials"
- 11) Dr. Hemant Sood "Lab Manual in Testing of Engineering Materials", New Age International (P) Ltd., New Delhi
- 12) Handbook of Civil Engineering by PN Khanna.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	10
2	10	20
3	8	16
4	4	10
5	8	16
6	6	12
7	8	16
Total	48	100

3.5 BUILDING CONSTRUCTION

L T P
4 - 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.

DETAILED CONTENTS

THEORY:

1. Introduction: (1 hr)
 - 1.1 Definition of a building, classification of buildings based on occupancy
 - 1.2 Different parts of a building
2. **Foundations:** (8 hrs)
 - 2.1 Concept of foundation and its purpose
 - 2.2 Types of foundation-shallow and deep
 - **2.2.1 Shallow foundation - constructional details of: Spread foundations for walls, thumb rules for depth and width of foundation and thickness of concrete block, stepped foundation, masonry pillars and concrete columns
 - 2.3 Earthwork
 - 2.3.1 Layout/setting out for surface excavation, cutting and filling
 - 2.3.2 Excavation of foundation, trenches, shoring, timbering.
3. **Walls:** (8 hrs)
 - 3.1 Purpose of walls
 - 3.2 Classification of walls - load bearing, non-load bearing, dwarf wall, retaining, breast walls and partition walls
 - 3.3 Partition walls: Constructional details, suitability and uses of brick and wooden partition walls
 - 3.4 Mortars: types, selection of mortar and its preparation
4. **Masonry** (10 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
 - 4.1.1 Bond – meaning and necessity; English, flemish bond and other types of bonds
 - 4.1.2 Construction of brick walls –methods of laying bricks in walls, precautions observed in the construction of walls, methods of bonding new brick work with old (toothing, raking, back and block bonding), Expansion and contraction joints
 - 4.1.3 Importance towards special care during execution on: soaking of bricks, maintenance of bonds and plumb, filling of horizontal and vertical joints, masonry work, restriction height

of construction on a given day, every fourth course, earthquake resistance measure, making of joints to receive finishes

- 4.2 Stone Masonry
 - 4.2.1 Glossary of terms – natural bed, bedding planes, string course, corbel, cornice, block in course grouting, moulding, templates, corner stone, bond stone, throating, through stone, parapet, coping, pilasters and buttress
 - 4.2.2 Types of stone masonry: rubble masonry - random and coursed; Ashlar masonry, principles to be observed in construction of stone masonry walls
 - 4.2.3 Importance towards special care during execution of stone masonry work on dressing of stone, size and placing of bond and corner stones, filling joints, proper packing of internal cavities of rubble masonry wall, raking of joints to receive finishes

- 5. **Arches and Lintels:** (6 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, voussoiers, springer, springing line, crown, key stone, skew back, span, rise, depth of an arch, haunch, spandril, jambs, bearing, thickness of lintel, effective span
 - 5.3 Arches:
 - 5.3.1 Types of Arches - Semi circular, segmental, elliptical and parabolic, flat, inverted and relieving
 - 5.3.2 Stone arches and their construction
 - 5.3.3 Brick arches and their construction
 - 5.4 Lintels
 - 5.4.1 Purpose of lintel
 - 5.4.2 Materials used for lintels
 - 5.4.3 Cast-in-situ and pre-cast lintels
 - 5.4.4 Lintel along with sun-shade or chhajja

- **6. **Doors, Windows and Ventilators:** (5 hrs)
 - 6.1 Glossary of terms with neat sketches
 - 6.2 Classification based on materials i.e. wood, metal and plastic and their suitability for different situations. Different type of doors- panel door, flush door, flazed door, rolling shutter, steel door, sliding door, plastic and aluminium doors
 - 6.3 Window – Panel window, glazed windows (fixed and openable) ventilators, sky light window, Louvres shutters, plastic and aluminium windows.
 - 6.4 Door and window frames – materials and sections, door closures, hold fasts

- *7. **Damp Proofing and Water Proofing** (8 hrs)
 - 7.1 Dampness and its ill effects on bricks, plaster, wooden fixtures, metal fixtures and reinforcement, damage to aesthetic appearance,

damage to heat insulating materials, damage to stored articles and health, sources and causes of dampness

- 7.2 Sources of dampness - moisture penetrating the building from outside e.g. rainwater, surface water, ground moisture. Moisture entrapped during construction i.e. moisture in concrete, masonry construction and plastering work etc. Moisture which originates in the building itself i.e. water in kitchen and bathrooms etc.
- 7.3 Damp proofing materials and their specifications: rich concrete and mortar, bitumen, bitumen mastic, polymer coating, use of chemicals
- **8. **Floors** (7 hrs)
 - 8.1 Glossary of terms-floor finish, topping, under layer, base course, rubble filling and their purpose
 - 8.2 Types of floor finishes - cast-in-situ, concrete flooring (monolithic, bonded) Terrazzo tile flooring, stone (marble and kota) flooring, PVC flooring, Terrazzo flooring, glazed tiles flooring, Timber flooring, description with sketches. The methods of construction of concrete, terrazzo and timber floors and their BIS specifications
 - 8.3 Special emphasis on level/slope/reverse slope in bathrooms, toilets, kitchen, balcony and staircase
- 9. **Roofs** (6 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, plaster boards, cellotex, fibre boards
 - 9.4 Special emphasis on maintenance of slopes, overlaps of roofing materials, applicability and problems of wind ties, size of anchoring bolts
- 10. **Stairs** (5 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
 - 10.4 Various types of layout - straight flight, dog legged, open well, quarter turn, half turn (newel and geometrical stairs), bifurcated stair, spiral stair
- 11. **Surface Finishes** (6 hrs)
 - 11.1 Plastering - classification according to use and finishes like plain plaster, grit finish, rough cast, pebble dashed, concrete and stone cladding etc., dubbing, proportion of mortars used for different plasters, techniques of plastering and curing
 - 11.2 Pointing - different types of pointing and their methods
 - 11.3 Painting - preparation of surface, primer coat and application of paints on wooden, steel and plastered wall surfaces

- 11.4 Selection of appropriate paints/finishes for interior and exterior surfaces
- 11.5 Importance of preparation of surfaces such as hacking, grooving etc before application of surface finishes
- 12. **Anti Termite Measures (As per IS 6313 –I – III)** (4 hrs)
 - 12.1 Introduction, site preparation and chemicals used in anti-termite treatment
 - 12.2 Treatment of masonry foundation
 - 12.3 Treatment of junction of walls and floors
 - 12.4 Treatment along external perimeter of building
 - 12.5 Treatment in existing buildings
- 13. **Building Planning** (6 hrs)
 - 13.1 Site selection: Factors to be considered for selection of site for residential, commercial, industrial and public building
 - 13.2 Basic principles of building planning, arrangement of doors, windows, cupboards etc for residential building
 - 13.3 Planning of building services
 - 13.4 Introduction to National Building code.

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

- i) Demonstration of tools and plants used in building construction
- ii) Layout of a building: two rooms building with front verandah
- iii) 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
- iv) Demonstration of following items of work at construction site:
 - a) Low Cost Housing
 - b) Damp proof courses
 - c) Construction of masonry walls
 - d) Flooring: Laying of flooring on an already prepared lime concrete base
 - e) Plastering and pointing
 - f) Use of special type of shuttering/cranes/heavy machines in construction work
 - g) RCC work
 - h) Pre-construction and post construction termite treatment of building and woodwork

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. Gupta, Sushil Kumar, Singla, DR, and Juneja BM; "A Text Book of Building Construction"; Ludhiana, Katson Publishing House.
2. Deshpande, RS and Vartak, GV; "A Text Book of Building Construction"; Poona, United Book Corporation.
3. Rangwala, SC: "Building Construction"; Anand, Charotar Book Stall
4. Kulkarni, GJ; "A Text Book of Building Construction"; Ahmedabad Book Depot
5. Arora, SP and Bindra, SP; "A Text Book of Building Construction"; New Delhi Dhanpt Rai and Sons.
6. Sharma,SK and Kaul, BK; "A Text Book of Building Construction"; Delhi, S Chand and Co.
7. Sushil Kumar; "Building Construction"; Standard Publishers Distributors, Delhi
8. Moorthy, NKR; "A Text Book of Building Construction"; Poona, Engineering Book Publishing Co.
9. SP – 62 Hand Book of BIS
10. B.I.S. – 6313 Part 1, 2, 3
11. National Building Code
12. Handbook of Civil Engineering by PN Khanna

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	1	1
2	8	9
3	8	9
4	10	10
5	6	8
6	5	5
7	8	9
8	7	9
9	6	9
10	5	8
11	6	9
12	4	8
13	6	6
Total	80	100

3.6 BUILDING DRAWING

L T P
- - 6

RATIONALE

Drawing is the language of engineers. Engineering is absolutely 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.

DETAILED CONTENTS

Section-I

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 have to be shown in the drawing.

Drawing No. 2: (one sheet)

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

Drawing No. 3: (2 sheets)

Elevation, sectional plan and sectional side elevation of flush door, panelled door with wire gauge shutter. Sketches of various joints of different members

Section-II

Drawing No. 4: (2 sheet)

Drawing plan, elevation of a one room building from the given site plan, the foundation detail and sectional elevation.

Drawing No.5: (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

Drawing No. 6 (one sheet)

Drawings of following floors

Cement concrete floor on ground

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

Section-III

Drawing No.7 (one sheet)

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

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. *Civil Engineering Drawing by RS Malik, Asia Publishing House*
2. *Civil Engineering Drawing by V.B.Sikka. Katson Publishing, Ludhiana*
3. *Civil Engineering Drawing by NS Kumar; IPH, New Delhi*
4. *Principles of Building Drawing by MG Shah and CM Kale, MacMillan, Delhi*
5. *Building Construction by Moorthy NRK*
6. *Civil Engg Drawing by Loyal*
7. *Zaidi, SKA and Siddiqui, Suhail; Drawing and Design of Residential and Commercial Buildings, Standard Publishers and Distributors, Delhi.*
8. *SP : 20*
9. *National Building Code*

ECOLOGY AND ENVIRONMENTAL AWARENESS CAMP

A diploma holder must have knowledge of different types of pollution caused due to industries and constructional activities so that he may help in balancing the eco system and controlling pollution by pollution control measures. He should also be aware of environmental laws related to the control of pollution.

This is to be organized at a stretch for 3 to 4 days. Lectures will be delivered on following broad topics. There will be no examination for this subject.

1. Basics of ecology, eco system and sustainable development
2. Conservation of land reforms, preservation of species, prevention of advancement of deserts and lowering of water table
3. Sources of pollution - natural and man made, their effects on living and non-living organisms
4. Pollution of water - causes, effects of domestic wastes and industrial effluent on living and non-living organisms
5. Pollution of air-causes and effects of man, animal, vegetation and non-living organisms
6. Sources of noise pollution and its effects
7. Solid waste management; classification of refuse material, types, sources and properties of solid wastes, abatement methods, methods of vermicomposting
8. Mining, blasting, deforestation and their effects
9. Legislation to control pollution and protect environment
10. Environmental Impact Assessment (EIA), Elements for preparing EIA statements
11. Current issues in environmental pollution and its control
12. Role of non-conventional sources of energy in environmental protection

4.1 CONCRETE TECHNOLOGY

L T P
3 - 2

RATIONALE

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

DETAILED CONTENTS THEORY

1. **Introduction:** Definition of concrete, uses of concrete in comparison to other building materials. (2 hrs)
2. **Ingredients of Concrete:** (6 hrs)
 - 2.1 Brief Introduction
 - 2.2 Aggregates:
 - 2.2.1 Classification of aggregates according to size and shape
 - 2.2.2 Characteristics of aggregates: Particle size and shape, surface texture, specific gravity of aggregate; bulk density, water absorption, surface moisture, bulking of sand, deleterious materials soundness
 - 2.2.3 Grading of aggregates: coarse aggregate, fine aggregate; All-in- aggregate; fineness modulus; interpretation of grading charts
 - 2.3 Water: Quality requirements as per IS:456-2000
3. **Water Cement Ratio:** (2 hrs)
 - 3.1 Hydration of cement principle of water-cement ratio, Duff Abram's Water-cement ratio law: Limitations of water-cement ratio law and its effects on strength of concrete
4. **Workability:** (4 hrs)
 - 4.1 Workability factors affecting workability, Measurement of workability: slump test, compacting factor and Vee Bee consistometer; Recommended slumps for placement in various conditions as per IS:456-2000/SP-23
5. **Properties of Concrete:** (8 hrs)
 - 5.1 Properties in plastic state: Workability, Segregation, Bleeding and Harshness
 - 5.2 Properties in hardened state: Strength, Durability, Impermeability, Dimensional changes;

6. **Proportioning for Normal Concrete:** (4 hrs)
 - 6.1 Objectives of mix design, introduction to various grades as per IS:456-2000; proportioning for nominal mix design as prescribed by IS 456-2000
 - 6.2 Adjustment on site for: Bulking of fine aggregate, water absorption of aggregate, workability
 - 6.3 Difference between nominal and controlled concrete

7. **Introduction to Admixtures (chemicals and minerals) for improving performance of concrete** (3 hrs)

8. **Special Concretes (only features)** (6 hrs)
 - 8.1 Concreting under special conditions, difficulties and precautions before, during and after concreting
 - 8.1.1 Cold weather concreting
 - 8.1.2 Under water concreting
 - 8.1.3 Hot weather concreting

 - 8.2 Ready mix concrete

 - 8.3 Fibre reinforced concrete

 - 8.4 Polymer Concrete

 - 8.5 Fly ash concrete

 - 8.6 Sillica fume concrete

9. **Concreting Operations:** (12 hrs)
 - **9.1 Storing of Cement:
 - 9.1.1 Storing of cement in a warehouse
 - 9.1.2 Storing of cement at site
 - 9.1.3 Effect of storage on strength of cement
 - 9.1.4 Determination of warehouse capacity for storage of Cement
 - **9.2 Storing of Aggregate: Storing of aggregate on site
 - 9.3 Batching (to be shown during site visit also)
 - 9.3.1 Batching of Cement
 - 9.3.2 Batching of aggregate by:
 - 9.3.2.1 Volume, using gauge box (farma) selection of proper gauge box
 - 9.3.2.2 Weight spring balances and by batching machines
 - 9.3.3 Measurement of water
 - ** 9.4 Mixing:
 - 9.4.1 Hand mixing
 - 9.4.2 Machine mixing - types of mixers, capacities of mixers, choosing appropriate size of mixers, operation of mixers
 - 9.4.3 Maintenance and care of machines

- **9.5 Transportation of concrete: Transportation of concrete using pans, wheel barrows, transit mixers, chutes, belt conveyors, pumps, tower crane and hoists etc.
- 9.6 Placement of concrete:
Checking of form work, shuttering and precautions to be taken during placement
- ** 9.7 Compaction:
 - 9.7.1 Hand compaction
 - 9.7.2 Machine compaction - types of vibrators, internal screed vibrators and form vibrators
 - 9.7.3 Selection of suitable vibrators for different situations
- 9.8 Finishing concrete slabs - screeding, floating and trowelling
- 9.9 Curing:
 - 9.9.1 Objective of curing, methods of curing like ponding, membrane curing, steam curing, chemical curing
 - 9.9.2 Duration for curing and removal of form work
- 9.10 Jointing: Location of construction joints, treatment of construction joints, expansion joints in buildings - their importance and location
- 9.11 Defects in concrete: Identification of and methods of repair
- 10. **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:

- i) To determine flakiness and elongation index of coarse aggregates
- ii) Method to determine silt in fine aggregate
- iii) Determination of specific gravity and water absorption of aggregates
- iv) Determination of bulk density and voids of aggregates
- v) To determine surface moisture in fine aggregate by displacement method
- vi) Determination of particle size distribution of fine, coarse and all in aggregate by sieve analysis (grading of aggregate)
- vii) To determine necessary adjustment for bulking of fine aggregate
- viii) To determine workability by slump test:
- ix) To verify the effect of water, fine aggregate/coarse aggregate ratio and aggregate/Cement ratio on slump
- x) Compaction factor test for workability
- xi) Non destructive test on concrete by:
 - a) Rebound Hammer Test
 - b) Ultrasonic Pulse Velocity Test
- xii) Tests for compressive strength of concrete cubes for M-20

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.

RECOMMENDED BOOKS

- i) Kulkarni, PD; Ghosh, RK and Phull, YR; "Text Book of Concrete Technology"; New Delhi Oxford and IBH Publishing Co.
- ii) Krishnamurthy, KT; Rao, A Kasundra and Khandekar, AA; "Concrete Technology"; Delhi, Dhanpat Rai and Sons.
- iii) Gupta BL and Gupta Amit; "Text Book of Concrete Technology"; Standard Publishers Distributors, Delhi.
- iv) Varshney, RS;"Concrete Technology";New Delhi, Oxford and IBH Publishing
- v) Neville, AM; "Properties of Concrete" London, Pitman (ELBS Edition available)
- vi) Orchard; "Concrete Technology"; Vol I, II, and III
- vii) Handoo, BL; and Puri, LD;"Concrete Technology"; New Delhi, Satya Prakashan
- viii) Sood, Hemant, Mittal LN and Kulkarni PD; "Laboratory Manual on Concrete Technology", CBS Publishers, New Delhi, 2002
- ix) Vazirani, VN; and Chandola, SP; "Concrete Technology"; Delhi, Khanna Publishers
- x) Gambhir, ML; "Concrete Technology"; New Delhi, MacMillan India Ltd.
- xi) Siddique, R., "Special Structural Concretes", New Delhi, Galgotia Publishers Pvt. Ltd. Delhi
- xii) Birinder Singh, "Concrete Technology", Ludhiana, Kaption Publications
- (xiii) Module on 'Special Concretes by Dr Hemant Sood , NITTTTR Chandigarh
- (xiv) Concrete Technology by P Dayaratman

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	6	12
3	2	4
4	4	8
5	8	18
6	4	8
7	3	7
8	6	12
9	12	25
10	1	2
Total	48	100

4.2 WATER SUPPLY AND WASTE WATER ENGINEERING

L T P
5 - 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 specialised operations.

DETAILED CONTENTS

THEORY

A. WATER SUPPLY

1. **Introduction** (2 hrs)
 - 1.1 Necessity and brief description of water supply system.
2. **Quantity of Water** (6 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)
 - 2.4 Population Forecasting
3. **Quality of Water** (4 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)** (9 hrs)
 - **4.1 Sedimentation - purpose, types of sedimentation tanks
 - **4.2 Coagulation flocculation - usual coagulation and their feeding
 - **4.3 Filtration - significance, types of filters, their suitability
 - 4.4 Necessity of disinfection of water, forms of chlorination, break point chlorine, residual chlorine, application of chlorine.
 - 4.5 Flow diagram of different treatment units, functions of (i) Aeration fountain (ii) mixer (iii) flocculator, (iv) classifier, (v) slow and rapid sand filters (vi) chlorination chamber.
5. **Conveyance of Water** (9 hrs)
 - **5.1 Different types of pipes - cast iron, PVC, steel, asbestos cement, concrete and lead pipes. Their suitability and uses, types of joints in different types of pipes.

- 5.2 Appurtenances: Sluice, air, reflux valves, relief valves, scour valves, bib cocks, stop cocks, fire hydrants, water meters their working and uses
- 5.3 Distribution site: Requirement of distribution, minimum head and rate, methods of layout of distribution pipes
 - 5.3.1 Systems of water supply - Intermittent and continuous service reservoirs - types, necessity and accessories.
 - 5.3.2 Wastage of water - preventive measures
 - 5.3.3 Maintenance of distribution system
 - 5.3.4 Leakage detection

- 6. **Laying out Pipes** (6 hrs)
 - 6.1 Setting out alignment of pipes
 - 6.2 Excavation for laying of pipes and precautions to be taken
 - 6.3 Handling, lowering beginning and jointing of pipes
 - 6.4 Testing of pipe lines
 - 6.5 Back filling
 - 6.6 Use of boring rods

- 7. **Building Water Supply** (2 hrs)
 - 7.1 General principles as per Bureau of Indian Standards
 - 7.2 Connections to water main
 - **7.3 Water supply fixtures and installations and terminology related to plumbing

- B. WASTE WATER ENGINEERING**
- 8. **Introduction** (4 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
 - 8.6 (a) Surface drains (only sketches) : various types, suitability
(b) Types of sewage: Domestic, industrial, storm water and its seasonal variation

- 9. **Sewerage System** (5hrs)
 - 9.1 Types of sewerage systems, materials for sewers, their sizes and joints
 - 9.2 Appurtenance: Location, function and construction features. Manholes, drop manholes, lamp hole, catch basin, inverted siphon, flushing tanks grease and oil traps, storm regulators, ventilating shafts

- 10. **Laying and Construction of Sewers:** (6 hrs)
 - 10.1 Setting out/alignment of sewers
 - 10.2 Excavations, checking the gradient with boning rods preparation of bedding, handling and jointing testing and back filling of sewers/pipes.
 - 10.3 Construction of surface mains and different sections required

11. **Sewage characteristics:** (4hrs)
 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** (5 hrs)
 12.1 General composition of sewage and disposal methods
 12.2 Disposal by dilution
 12.3 Self purification of stream
 12.4 Disposal by land treatment
 12.5 Nuisance due to disposal
13. **Sewage Treatment** (9 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
14. **Building Drainage** (9 hrs)
 14.1 Aims of building drainage and its requirements
 14.2 General layout at house drainage arrangement as per BIS: 1742
 **14.3 Different sanitary fittings and installations
 14.4 Traps, seals, causes of breaking seals
 14.5 Testing of house drainage.

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

LIST OF PRACTICALS

- 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
- 9) Study of water purifying process by visiting a field lab/ Sewerage Treatment Plant.

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.

REFERENCES

1. Duggal, KN; “Elements of Public Health Engineering”; New Delhi, S. Chand and Co.
2. Rangwala, SC; “Water Supply and Sanitary Engineering”; Anand Charotar Book Stall
3. Kshirsagar, SR; “Water Supply Engineering”; Roorkee Publishing House
4. Kshirsagar, SR; “Sewage and Sewage Treatment”; Roorkee, Roorkee Publishing House
5. Hussain, SK; “Text Book of Water Supply and Sanitary Engineering”; New Delhi, Oxford and IBH Publishing Co
6. Birdie, GS; “Water Supply and Sanitary Engineering”; Delhi Dhanpat Rai and Sons
7. Garg, Santosh Kumar; “Water Supply Engineering”; Delhi Khanna Publishers
8. Garg, Santosh Kumar; “Sewage and Waste Water Disposal Engineering”; Delhi Khanna Publishers
9. Steel, EW; “Water Supply and Sewerage”; McGraw Hill.
10. Duggal, Ajay K and Sharma, Sanjay, “A Laboratory Manual in Public Health Engineering”, New Delhi, Galgotra Publications, 2006.
11. Gurjar, B.R. “Sludge Treatment & Disposal” Oxford and IBH Co Pvt Ltd New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	3
2	6	7
3	4	5
4	9	12
5	9	11
6	6	7
7	2	3
8	4	5
9	5	6
10	6	7
11	4	5
12	5	6
13	9	12
14	9	11
Total	80	100

4.3 SOIL AND FOUNDATION ENGINEERING

L T P
4 - 2

RATIONALE

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

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

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

DETAILED CONTENTS

THEORY

1. **Introduction:** (3 hrs)
 - 1.1 Importance of soil studies in Civil Engineering
 - 1.2 Geological origin of soils with special reference to soil profiles in India: residual and transported soil, alluvial deposits, lake deposits, local soil found in H.P., dunes and loess, glacial deposits, conditions in which above deposits are formed and their engineering characteristics.
 - 1.3 Names of organizations dealing with soil engineering work in India, soil map of India
2. **Physical Properties of Soils:** (4 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, dry unit weight of soil grains and correlation between them
 - 2.3 Simple numerical problems with the help of phase diagrams
3. **Classification and Identification of Soils** (4 hrs)
 - 3.1 Particle size, shape and their effect on engineering properties of soil, particle size classification of soils
 - 3.2 Gradation and its influence on engineering properties
 - 3.3 Relative density and its use in describing cohesionless soils
 - 3.4 Behaviour of cohesive soils with change in water content, Atterberg's limit - definitions, use and practical significance
 - 3.5 Field identification tests for soils
 - 3.6 Soil classification system as per BIS 1498; basis, symbols, major divisions and sub divisions, groups, plasticity chart; procedure for classification of a given soil
 - 3.7 Black cotton soils (Introduction and limitations only)
4. **Flow of Water Through Soils:** (4 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
 - 4.4 Measurement of permeability in the laboratory

5. **Effective Stress: (Concept only)** (4 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:
 - a) Consolidation and settlement
 - b) Creep
 - c) Plastic flow
 - d) Heaving
 - e) Lateral movement
 - f) Freeze and thaw of soil
 - 6.2 Definition and practical significance of compression index, coefficient of consolidation, degree of consolidation.
 - 6.3 Meaning of total settlement, uniform settlement and differential settlement; rate of settlement and their effects
 - 6.4 Settlement due to construction operations and lowering of water table
 - 6.5 Tolerable settlement for different structures as per BIS

7. **Strength Characteristics of Soils:** (9 hrs)
 - 7.1 Factors contributing to shear strength of soils, Coulomb's law
 - 7.2 Determination of shearing strength by direct shear test, unconfined compression test and vane shear test
 - 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
 - 7.6 Numerical problems

8. **Compaction:** (4 hrs)
 - 8.1 Definition and necessity of compaction
 - 8.2 Laboratory compaction test (standard and modified proctor test as per IS) definition and importance of optimum water content, maximum dry density; moisture dry density relationship for typical soils with different compactive efforts
 - 8.3 Compaction control; Density control, measurement of field density by core cutter method and sand replacement method, moisture control, Proctor's needle and its use, thickness control, jobs of an embankment supervisor in relation to compaction

9. **Soil Exploration:** (8 hrs)
 - 9.1 Purpose and necessity of soil exploration
 - 9.2 Reconnaissance, methods of soil exploration, Trial pits, borings (auger, wash, rotary, percussion to be briefly dealt)
 - 9.3 Sampling; undisturbed, disturbed and representative samples; selection of type of sample; thin wall and piston samples; area ratio, recovery ratio of samples and their significance, number and quantity of samples, resetting, sealing and preservation of samples.
 - 9.4 Presentation of soil investigation results

10. **Bearing Capacity of soil** (10 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
 - 10.6 Plate load test (no procedure details) and its limitations
 - 10.7 Applications of SPT, unconfined compression test and direct shear test in estimation of bearing capacity
 - 10.8 Soil properties governing choice of foundation type
 - 10.9 Improvement of bearing capacity by sand drain method compaction, use of geotextiles.
11. **Foundation Engineering:** (10 hrs)
- Concept of shallow and deep foundation; types of shallow foundations and their suitability. Factors affecting the depth of shallow foundations, deep foundations, type of piles and their suitability; pile classification on the basis of material, pile group and pile cap.

PRACTICAL EXERCISES

1. **To determine the moisture content of the given sample of soil**
2. **Auger Boring and Standard Penetration Test**
 - a) Identifying the equipment and accessories
 - b) Conducting boring and SPT at a given location
 - c) Collecting soil samples and their identification
 - d) Preparation of boring log and SPT graphs
 - e) Interpretation of test results
3. **Extraction of Disturbed and Undisturbed Samples**
 - a) Extracting a block sample
 - b) Extracting a tube sample
 - c) Extracting a disturbed samples for mechanical analysis.
 - d) Field identification of samples
4. **Field Density Measurement (Sand Replacement and Core Cutter Method)**
 - a) Calibration of sand
 - b) Conducting field density test at a given location
 - c) Determination of water content
 - d) Computation and interpretation of results
5. **Liquid Limit and Plastic Limit Determination:**
 - a) Identifying various grooving tools
 - b) Preparation of sample
 - c) Conducting the test
 - d) Observing soil behaviour during tests
 - e) Computation, plotting and interpretation of results
6. **Mechanical Analysis**
 - a) Preparation of sample
 - b) Conducting sieve analysis
 - c) Computation of results
 - d) Plotting the grain size distribution curve
 - e) Interpretation of the curve

7. **Laboratory Compaction Tests (Standard Proctor test)**
 - a) Preparation of sample
 - b) Conducting the test
 - c) Observing soil behaviour during test
 - d) Computation of results and plotting
 - e) Determination of optimum moisture and maximum dry density

9. **Demonstration of:**

To find permeability of fine and coarse grained soils using permissibility test apparatus.

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"; Delhi Standard Publishers Distributors.
2. Bharat Singh and Shamsher Prakash; "Soil Mechanics and Foundations Engineering"; Roorkee, Nem Chand and Bros.
3. Sehgal, SB; "A Text Book of Soil Mechanics"; Delhi, CBS Publishers and Distributors
4. Bowles, Joseph E; "Engineering Properties of soils and their Measurement"; Delhi, Tata McGraw Hill.
5. Gulati, SK and Manoj Dutta; "Geotechnical Engineering ", Delhi, Tata McGraw Hill
6. Khan, Iqbal H, "A Text Book of Geotechnical Engineering", Delhi, Prentice Hall of India
7. Ranjan Gopal and Rao ASR "Basic and Applied Soil Mechanics", New Age Publication (P) Ltd., New Delhi
8. S Mittal and JP Shukla, "Soil Testing for Engineers", Khanna Publishers Ltd.
9. Duggal, AK., Ramana, TR., Krishnamurthy, S., "Soil Sampling and Testing - A Laboratory Manual, Galgotra Publications, 2006
10. BIS Codes IS 6403 (latest edition) and IS 1498 (latest edition)
11. Jagroop Singh, Soil and Foundation Engineering, Eagle Parkashan, Jalandhar
12. Rabinder Singh" Soil and foundation engg SK Kataria and sons, Ludiana
13. Shallow Foundations, NITTTR Chandigarh

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	3	5
2	4	6
3	4	6
4	4	6
5	4	6
6	4	6
7	9	14
8	4	6
9	8	16
10	10	12
11	10	17
Total	64	100

4.4 SURVEYING – II

L T P
2 - 6

RATIONALE

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

While framing the curriculum for the subject of surveying, stress has been given to the development of knowledge and skill in theodolite surveying, tachometry surveying, curves and use of minor and modern instruments have been included in this subject.

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

DETAILED CONTENTS

1. **Contouring:** (5 hrs)
Concept of contours, purpose of contouring, contour interval and horizontal equivalent, factors effecting contour interval, characteristics of contours, methods of contouring: Direct and indirect, use of stadia measurements in contour survey, interpolation of contours; use of contour map, Drawing cross section from a contour map; marking alignment of a road, railway and a canal on a contour map, computation of earth work and reservoir capacity from a contour map
2. **Theodolite Surveying:** (9 hrs)
Working of a transit vernier theodolite, axes of a theodolite and their relation; temporary adjustments of a transit theodolite; concept of transiting, swinging, face left, face right and changing face; measurement of horizontal and vertical angles. Prolonging a line (forward and backward) measurement of bearing of a line; traversing by included angles and deflection angle method; traversing by stadia measurement, theodolite triangulation, plotting a traverse; concept of coordinate and solution of omitted measurements (one side affected), errors in theodolite survey and precautions taken to minimize them; limits of precision in theodolite traversing. Height of objects – accessible and non-accessible bases
3. **Tacho-metric surveying** (4 hrs)
Tachometry, Instruments to be used in tachometry, methods of tachometry, stadia system of tachometry, general principles of stadia tachometry, examples of stadia tachometry and Numerical problems.
4. **Curves:** (12 hrs)
 - 4.1 Simple Circular Curve:
 - * Need and definition of a simple circular curve; Elements of simple circular curve - Degree of the curve, radius of the curve, tangent length, point of intersection (Apex point), tangent point, length of

curve, long chord deflection angle, Apex distance and Mid-ordinate.

Setting out of simple circular curve:

- a) By linear measurements only:
 - Offsets from the tangent
 - Successive bisection of arcs
 - Offsets from the chord produced
- b) By tangential angles using a theodolite

4.2 Transition Curve:

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

4.3 Vertical curve

Setting out of a vertical curve

5. **Introduction to the use of Modern Surveying equipment and techniques such as:** (2 hrs)

- a) Auto level
- b) Digital planimeter
- c) Digital theodolite
- d) Total station
- e) Introduction to remote sensing and GPS

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

PRACTICAL EXERCISES

I. **Contouring:**

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

II. **Theodolite:**

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

III. Curves

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

IV. Minor instruments:

- i) Demonstration and use of minor instruments like Ceylon Ghat Tracer, Tangent Clinometer, Pantagraph, Abney level.
- ii) Use of planimeter for computing areas

V. Total Station (Demonstration).

INSTRUCTIONAL STRATEGY

This is highly practice-oriented course. While imparting theoretical instructions, teachers are expected to demonstrate the use of various instruments in surveying, stress should be laid on correct use of various instruments so as to avoid/minimize errors during surveying. It is further recommended that more emphasis should be laid in conducting practical work by individual students

RECOMMENDED BOOKS

1. Hussain, SK and Nagraj, MS; "Text Book of Surveying"; New Delhi, S Chand and Co Ltd.
2. Deshpande, RS; "A Text Book Surveying and Levelling"; Poona, United Book Corporation
3. Kocher, CL; "A Text Book of Surveying"; Ludhiana, Katson Publishing House
4. Kanetkar, TP and Kulkarni, SV., "Surveying and Leveling", Poona, AVG Parkashan
5. Kanetkar, TP; and Kulkarni, SV; "Surveying and Leveling-Vol.2" Poona, AVG Prakashan
6. Punima, BC; "Surveying and Leveling ", Delhi Standard Publishers Distributors, Delhi
7. Shahai, PB; "A Text Book of Surveying ", Oxford and IBH Publishing Co.
8. Lilly Sant "Remote Sensing and Image Interpretation"

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	5	16
2	9	28
3	4	12
4	10	34
5	2	5
6	2	5
Total	32	100

4.5 STRUCTURAL MECHANICS

L T P
4 - 2

RATIONALE

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

DETAILED CONTENTS

THEORY:

1. **Properties of Materials** (2 hrs)
 - 1.1 Classification of materials, elastic materials, plastic materials, ductile materials, brittle materials.
 - 1.2 Introduction to tensile test, compressive test, impact test, fatigue test, torsion test on metals.

2. **Simple Stresses and Strains:** (12 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
 - 2.3 Hooke's law, moduli of elasticity and rigidity, Bulk modulus of elasticity, relationship between the elastic constants.
 - 2.4 Stresses and strains in bars subjected to tension and compression. Extension of uniform bar under its own weight, stress produced in compound bars (two or three) due to axial load.
 - 2.5 Stress-strain diagram for mild steel and HYSD steel, mechanical properties, factor of safety.
 - 2.6 Temperature stresses and strains

3. **Shear Force and Bending Moment:** (16 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
 - 3.5 Relationship between load, shear force and bending moment, point of maximum bending moment, and point of contraflexure.

4. **Moment of Inertia:** (4 hrs)
 Concept of moment of inertia and second moment of area and radius of gyration, theorems of parallel and perpendicular axis, second moment of area of common geometrical sections: rectangle, triangle, circle (without derivations). Second moment of area for L, T and I sections, section modulus.
5. **Bending Stresses in Beams:** (6 hrs)
 - 5.1 Concept of pure/simple bending
 - 5.2 Assumptions made in the theory of simple bending, derivation and application of bending equation to circular cross-section, I section, T&L sections only
 - 5.3 Moment of resistance
 - 5.4 Calculations of bending stresses in simply supported beam
6. **Combined Direct and Bending Stresses:** (6 hrs)
 - 6.1 Concentric and eccentric loads single axis eccentricity only
 - 6.2 Effect of eccentric load on the section stresses due to eccentric loads, Numerical in the case of short columns.
 - 6.3 Simple problems on stability of masonry dams and retaining walls
7. **Shear Stresses in Beams** (4 hrs)
 - 7.1 Concept of shear stresses in beams, shear stress distribution in rectangular, circular I, T, L sections (Formula to be stated, no derivation)
8. **Slope and Deflection:** (4 hrs)
 - 8.1 Necessity for determination of slope and deflection
 Moment area theorem (no derivation, numerical problems)
9. **Columns:** (4 hrs)
 - 9.1 Theory of columns
 - 9.2 Eulers and Rankine Formula
10. **Analysis of Trusses:** (6 hrs)
 - 10.1 Concept of a perfect, redundant and deficient frames
 - 10.2 Assumptions and analysis of trusses by:
 - 10.2.1 Method of joints
 - 10.2.2 Graphical method

PRACTICAL EXERCISES

- i) 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
- ii) Testing of HYSD Steel
- iii) Determination of Young's modulus of elasticity for steel wire with sear'l's apparatus
- iv) Determination of modulus of rupture of a concrete beam

- v) Determination of maximum deflection and young's modulus of elasticity in simply supported beam with load at middle third
- vi) 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

- i) Ramamrutham, S., "Strength of Materials", New Delhi Dhanpat Rai and Sons.
- ii) Ram Chandra, "Applied Mechanics and Strength of Materials", Delhi: Standard Publishers.
- iii) Punmia, BC., "Strength of Materials", Delhi, Standard Publishers Distributors.
- iv) VS Prasad " Structural mechanics Galgotia publications Pvt Ltd
- v) Sadhu Singh "Strengths of Materials" Standard Publishers, New Delhi
- vi) Structural Mechanics by Birinder Singh Kaption Publishers Ludhiana
- vii) Structure Mechanics by Prof. Harbhajan Singh, Abhishek Publishers, Chandigarh
- viii) Design of Masonry and Timber Structures by Prof. Harbhajan Singh, Abhishek Publishers, Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	12	17
3	16	27
4	4	4
5	6	10
6	6	10
7	4	6
8	4	6
9	4	6
10	6	10
Total	64	100

4.6 PUBLIC HEALTH ENGINEERING DRAWING

L T P
- - 4

RATIONALE

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

DETAILED CONTENTS

Drawings Exercises

PART A : WATER SUPPLY AND WASTE WATER ENGINEERING DRAWING

1. Drains and Sewers

- 1.1 Cross section of standard types of open drains (circular, v-shaped and U-shaped) with their foundations
- 1.2 Cross section of earthen ware and RCC sewer pipes
- 1.3 Cross sections of masonry sewers (circular and egg shaped)

2. Traps, manholes and inspection chamber

- 2.1 Detailed section of floor trap and gully trap
- 2.2 Detailed plan and section of an inspection chamber
- 2.3 Detailed plan and section of a manhole

3. Septic Tank and Soak Pit

- 3.1 Detailed plan and cross sections of a domestic septic tank with soak pit for 5-10 users

4. Bath room and W.C connections:

- 4.1 Cross-section through the external wall of lavatories at ground and first floor showing the one and two pipe system and the connections of the lavatory to inspection chamber
- 4.2 Plan of a bathroom showing positions of lavatory, bath tub, wash-basin, taps and showers

5. Draw sectional elevation of a two storeyed building showing details of one pipe and two pipes systems with sanitation system.

6. Practice of reading water supply and sanitary engineering working drawings (PWD/urban Development agencies) including hot water and cold water supply system of a two room set.

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 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. *Civil Engineering Drawing by JS Loyal, Satya Parkashan, New Delhi*
2. *Civil Engineering Drawings by RP Chandel*
3. *Civil Engineering Drawing by NS Kumar; IPH, New Delhi*
4. *Civil Engineering Drawing by RS Malik and GA Meo; Asian Publishing House, New Delhi*

ENTREPRENEURIAL AWARENESS CAMP

The employment opportunities for diploma holders especially in public sector are dwindling. The diploma holders need to explore the possibilities of becoming entrepreneurs. For this, they must be acquainted with entrepreneurship development, scope of setting up small-scale industry, existing business opportunities, financial support available and various aspects of managing business. In this context, an entrepreneurial awareness camp is suggested. During the camp, experts from various organizations such as banks, financial corporations, service institutes etc. may be invited to deliver expert lectures. Successful entrepreneurs may also be invited to interact with the students. Students may be encouraged to read papers or give seminar during the camp on Entrepreneurship Development related topics.

The camp 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 self 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

5.1 RCC DESIGN AND DRAWINGS

L T P
4 - 4

RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise RCC 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). He must be able to read and interpret structural drawings of different elements. This subject thus deals with elementary design principles as per BIS code of practice and their relevant drawings.

Note: BIS Code of Practice IS:456-2000 and Limit State Method of design will be used.

DETAILED CONTENTS

- (a) **Theory**
1. **Introduction** (2 hrs)
 - 1.1 Concept of Reinforced Cement Concrete (RCC)
 - 1.2 Reinforcement Materials:
 - Suitability of Steel as reinforcing material
 - Properties of mild steel and HYSD steel
 2. **Introduction to following Methods of RCC designing and their comparison** (3 hrs)
 - 2.1 Working stress method
 - 2.2 Limit state method
 3. **Shear and Development Length** (5 hrs)
 - 3.1 Shear as per IS:456-2000
 - i) Shear strength of concrete without shear reinforcement
 - ii) Maximum shear stress
 - iii) Shear reinforcement
 - 3.2 Development length of bars
 4. **Concept of Limit State Method** (8 hrs)
 - 4.1 Definitions and assumptions made in limit state of collapse (flexure), partial factor of safety for materials strength and design strength, partial factor of safety for load and design load
 - 4.2 Loading on structure as per BIS: 875
 - 4.3 BIS specifications regarding spacing of reinforcement, cover to reinforcement, minimum reinforcement, lapping & anchoring effective span for beams and slabs.
 5. **Design of Singly Reinforced Beams** (8 hrs)
 - 5.1 Basic assumptions and stress strain curve, neutral axis, balanced, under-reinforced and over-reinforced beams, moment of resistance for singly reinforced sections.

- 5.2 Design of singly reinforced simply supported and cantilever beams including sketching showing reinforcement details.
6. **Doubly Reinforced Beam and T-Beam** (8 hrs)
- 6.1 M.R.for doubly reinforced beam and T-beams
- 6.2 Steps for design consideration of doubly reinforced beams
- 6.3 Steps for design consideration of T and L-beams(No numerical problems)
7. **One Way Slab** (8 hrs)
- 7.1 Analysis and Design of simply supported one way slab including sketching showing reinforcement details (plan and sections).
8. **Two Way Slab** (8 hrs)
- 8.1 Design of two-way simply supported slab with corners free and no provision to resist torsion including sketching showing reinforcement details (plan and sections)
9. **Design of Axially Loaded Column** (10 hrs)
- 9.1 Definition and classification of columns, effective length of column, specifications for minimum reinforcement cover, maximum reinforcement, number of bars, main and lateral reinforcement for column.
- 9.2 Assumptions made in limit state of collapse (compression)
- 9.3 Design of axially loaded square, rectangular and circular columns and sketch the reinforcement details
- 9.4 Concept of isolated square and circular footings
10. **Prestressed Concrete** (4 hrs)
- 10.1 Concept of pre-stressed concrete, Methods of pre-stressing “ Pre tensioning and Post tensioning. Advantages and disadvantages of prestressed concrete. Losses in Pre-stress.

B. RCC DRAWING

1. Reinforcement details from given data for the following with bar bending schedules:
- Rectangular beams – singly reinforcement, doubly reinforcement and cantilever beams
 - Slabs – one way slab
 - Columns – square, rectangular and circular column with isolated footing of uniform depth and varying depth (sloped footings)
2. Details of reinforcement in a three bay two storeyed RCC portal frame with the details of reinforcement at the column – beam junctions from the given design data

Very Important Note:

Examiner will be setting questions of 100 marks from part (A) and drawing questions of 50 marks from part (B). Students should get minimum pass marks from both theory and drawing separately. 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, practice of reading structural drawings is another important feature of this course. Commentary on BIS:456 may be referred along with code for relevant clauses.

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	04
2	03	04
3	05	08
4	08	12
5	08	12
6	08	13
7	08	13
8	08	13
9	10	15
10	04	06
Total	64	100

5.2 TRANSPORTATION ENGINEERING

L T P
4 - 2

RATIONALE

Construction of roads is one of the area in which diploma holders in Civil Engineering may get employment. These 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.

DETAILED CONTENTS

THEORY

1. **Introduction** (2 hrs)
 - 1.1 Importance of Highway engineering
 - 1.2 Functions of IRC, CRRI, MORT&H, NHA
 - 1.3 IRC classification of roads

2. **Road Geometrics** (8 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 passing sight distance
 - 2.3 Necessity of curves, horizontal and vertical curves including transition curves. Super elevation and methods of providing super elevation
 - 2.4 Sketch of typical cross-sections in cutting and filling on straight alignment and at a curve
(Note: No design/numerical problem to be taken)

3. **Highway Surveys and Plan** (8 hrs)
 - 3.1 Topographic map, reading the data given on a topographic map
 - 3.2 Basic considerations governing alignment for a road in plain and hilly area
 - 3.3 Highway location; marking of alignment

4. **Road Materials** (8 hrs)
 - 4.1 Different types of road materials in use; soil, aggregate, binders – bitumen, cutback, Emulsion and Modified Bitumen (CRMB, PMB0
 - 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

5. **Road Pavements** (8 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:

Setting out alignment of road, setting out bench marks, control pegs for embankment and cutting, borrow pits, making profiles of embankment, construction of embankment, compaction, preparation of subgrade, methods of checking camber, gradient and alignment as per recommendations of IRC, equipment used for subgrade preparation. Stabilization of subgrade. Types of stabilization mechanical stabilization, lime stabilization, cement stabilization, fly ash stabilization etc.(introduction only)

5.4 Base Course:

Granular base course:

(a) Water Bound Macadam (WBM)

(b) Wet Mix Macadam (WMM)

Bitumen Courses:

(a) Bituminous Macadam

(b) Dense Bituminous Macadam (DBM)

*Methods of construction as per MORT&H

5.5 Surfacing:

* Types of surfacing

a) Prime coat and tack coat

B) Surface dressing with seal coat

c) Open graded premix carpet

d) Mix seal surfacing

E) Semi dense bituminous concrete

f) Asphaltic concrete

f) Bituminous Penetration Macadam (reference only)

* 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:** (6 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 geogrids, geoflexbiles, 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:** (5 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:** (5 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 seal-coat, patch-work and resurfacing.
 - 8.3 Maintenance of concrete roads-filling cracks, repairing joints, maintenance of shoulders (berms), maintenance of traffic control devices
9. **Road Construction Equipment:** (4 hrs)
- 9.1* An expert may be invited from field/industry for extension lecture on this topic.
- 10 **Airport Engineering :-** (10 hrs)
- 10.1 Necessity of study of airport engineering aviation transport scenario in India.
 - 10.2 Factors to be considered while selecting a site for an airport with respect to zoning laws.
 - 10.3 Introduction to Runways, Taxiways and Apron

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. Visit to Hot mix plant
7. Visit to highway construction site for operation of:
Tipper, tractors (wheel and crawler) scraper, bulldozer, dumpers, shovels, grader, roller, dragline, road pavers, JCB etc. Mixing and spraying equipment

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

- i) *Khanna, SK and Justo, CEG, "Highway Engineering" Roorkee, Nem Chand and Bros.*
- ii) *Vaswani, NK, "Highway Engineering" Roorkee, Roorkee Publishing House.*
- iii) *Priyani, VB, "Highway and Airport Engineering" Anand, Charotar Book Stall*
- iv) *Sehgal, SB; and Bhanot, KL; "A Text Book on Highway Engineering and Airport" Delhi, S Chand and Co*
- v) *Bindra, SP; "A Course on Highway Engineering" New Delhi, Dhanpat Rai and Sons*
- vi) *Sharma, RC; and Sharma, SK; "Principles and Practice of Highway Engineering", New Delhi, Asia Publishing House*
- viii) *Duggal AK, Puri VP., "Laboratory Manual in Highway Engineering", Delhi, New Age Publishers (P) Ltd*
- xi) *NITTTTR, Chandigarh "Laboratory Manual in Highway Engineering", 2004*
- ix) *RK Khitoliya, "Principles of Highway Engineering (2005)", Dhanpat Rai Publishing Co. New Delhi*
- x) *Rao, GV' Transportation Engineering*
- xii) *Duggal AK, "Maintenance of Highway – a Reader", NITTTTR, Chandigarh*
- xiii) *Duggal AK Types of Highway constitution a Reader, NITTTTR Chandigarh 2006*
- xiv) *Rao, Airport Engineering*

IRC Publications

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	4
2	8	12
3	8	12
4	8	12
5	8	12
6	6	10
7	5	10
8	5	10
9	4	8
10	10	10
Total	64	100

5.3 SURVEY CAMP

7 Days Duration

Purpose

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

Task:

Preparation of topographical plan of a given area. The survey camp will be organized for a duration of 7 days time span.

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

The students should be divided in the groups consisting of 5-7 in numbers. They are required to submit the report of work done, during survey camp, which will be dully examined, while awarding the internal assessment.

5.4 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

L T P
- - 6

RATIONALE

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

DETAILED CONTENTS

PRACTICAL EXERCISES

1. Introduction and use of software like Autocad etc for making 2D Drawings and develop plan, section and elevation of 2 rooms building..
2. Demonstration of various civil engineering softwares like STAAD-Pro or any other equivalent software for above mentioned softwares

Note:

- i) *The polytechnic may use any other software available with them for performing these exercises*
- ii) *If the above softwares are not available in the institution, the demonstration of the above said software should be arranged outside the institute.*

5.5 EARTHQUAKE RESISTANT BUILDING CONSTRUCTION

L T P
3 - -

RATIONAL

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

DETAILED CONTENTS

- 1. Elements of Engineering Seismology** (08 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**(07 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.**
(08 hrs)
- 4. Introduction to IS: 4326, IS: 13828, IS: 1893(Part 1), 154326 and IS: 13920 (latest edition)**
(05 hrs)
- 5. Seismic Provision of Strengthening and Retrofitting Measures for Traditionally-Built Constructions, Brick and RCC Structures** (08 hrs)
- 6. Provision of reinforcement detailing in masonry and RC constructions** (06 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.** (06hrs)

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

- Elements of Earthquake Engineering by Jai Krishana and AR Chandrasekaran; Sarita Parkashan, Meerut.*

2. *Building Construction by BL Gupta and NL Arora, Satya Prakashan, New Delhi*
3. *Manual Published by Earthquake Engineering department, IIT Roorkee / IIT Kanpur*
4. *IS 13920, IS: 13827, IS: 13828, IS 1893-2002, IS 4326 (latest edition)*
5. *Earthquake Engineering by RL Weigel, Prentice Hall Inc., N.I., 1970*
6. *Dynamics of Structure by AK Chopra, Prentice Hall Inc. New Delhi*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	08	19
2	07	15
3	08	17
4	05	10
5	08	19
6	06	08
7	06	12
Total	48	100

5.6 IRRIGATION ENGINEERING AND DRAWING

L T P

4 - 2

RATIONALE

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

DETAILED CONTENTS

A) THEORY

1. **Introduction:** (2 hrs)
 - 1.1 Definition of irrigation
 - 1.2 Necessity of irrigation
 - 1.3 History of development of irrigation in India
 - 1.4 Major, medium and minor irrigation projects

2. **Water Requirement of Crops** (5 hrs)
 - 2.1 Principal crops in India and their water requirements
 - 2.2 Crop seasons – Kharif and Rabi
 - 2.3 Soil water, soil crop and crop water relationships, Duty, Delta and Base Period, their relationship
 - 2.4 Gross commanded area (GCA), culturable commanded area (CCA), Intensity of Irrigation, Irrigable area

3. **Hydrological Cycle Catchment Area and Run-off** (5 hrs)

Rainfall , definition rain-gauges – automatic and non-automatic, methods of estimating average rainfall (Arithmetic system); catchment area runoff, factors affecting runoff, hydrograph, basic concept of unit hydrograph.

4. **Methods of Irrigation** (8 hrs)
 - 4.1 Flow irrigation - its advantages and limitations
 - 4.2 Lift Irrigation – Tubewell, submersible and well irrigation advantages and disadvantages
 - 4.3 Sprinkler irrigation conditions favourable and essential requirements for sprinkler irrigation, sprinkler system – classification and component parts
 - 4.4 Drip irrigation, suitability of drip irrigation, layout, component parts, advantages

5. **Canals** (5 hrs)
 - 5.1 Classification, apurtenancs of a canal and their functions, sketches of different canal cross-sections
 - 5.2 Various types of canal lining - their related advantages and disadvantages, sketches of different lined canal x-sections
 - 5.3 Breaches and their control
 - 5.4 Maintenance of lined and unlined canals

6. **Tube Well Irrigation** (9 hrs)
- 6.1 Introduction, occurrence of ground water, location and command, advantages and disadvantages, comparison with canal irrigation
- 6.2 Tube wells, explanation of terms: water table, radius of influence, depression head, cone of depression, confined and unconfined aquifers. Yield of a well and methods of determining yield of well
- 6.3 Types of tube wells and their choice-cavity, strainer and slotted type;
- 6.4 Method of boring, installation of well assembly, development of well, pump selection and installation and maintenance
7. **Dams** (6 hrs)
- 7.1 Classification of dams; earth dams - types, causes of failure; cross-section of zoned earth dam, method of construction, gravity dams – types, cross-sections of a dam, method of construction
- 7.2 Concept of small and micro dams
- 7.3 Concept of spillways and energy dissipators
8. **Canal Head Works and Regulatory Works** (6 hrs)
- Definition, object, general layout, functions of different parts of head works. Difference between weir and barrage
9. **Cross Drainage Works** (5 hrs)
- 9.1 Functions and necessity of the following types: aqueduct, super passage, level crossing, inlet and outlet
- 9.2 Sketches of the above cross drainage works
10. **Definitions of following Hydraulic Structures with Sketches** (3 hrs)
- 10.1 Falls
- 10.2 Cross and head regulators
- 10.3 Outlets
- 10.4 Canal Escapes
11. **River Training Works** (5 hrs)
- Methods of river training, guide banks, retired (levees) embankments, groynes and spurs, pitched island, cut-off
12. **Water Logging and Drainage and Ground Water Re-charge** (5 hrs)
- 12.1 Definition of water logging – its causes and effects, detection, prevention and remedies
- 12.2 Surface and sub-surface drains and their layout
- 12.3 Concept and various techniques used for ground water re-charge

B) IRRIGATION ENGINEERING DRAWING:

1. **Typical cross-section of a channel**
- L-section of a channel for given data
 - Typical cross section of an unlined and lined channel in cutting, partly cutting and partly filling and fully in filling with given design data.
2. Layout plan of a canal head works.
3. Draw the X-section of an Earthen Dam

- i) Homogeneous
 - ii) Zoned type
 - iii) Diaphragm type
4. Cross section of a tube well

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. Bharat Singh, 'Fundamentals of Irrigation Engineering', Roorkee, Nem Chand and Bros
2. Garg, Santosh Kumar, 'Irrigation Engineering and Hydraulics Structures', Delhi, Khanna Publishers
3. Punmia, BC; and Pande Brij Bansi Lal, 'Irrigation and Water Power Engineering', Delhi, Standard Publishers Distributors
4. Sharma, RK; 'Text Book of Irrigation Engineering and Hydraulics Structures', New Delhi, Oxford and IBH Publishing Company
5. Sharma, SK; 'Principles and Practice of Irrigation Engineering', New Delhi, Prentice Hall of India Pvt. Ltd.
6. Varshney RS, Gupta SC, Gupta RL etc. "Theory and Design of Irrigation Structures", Vol. I and II
7. Saharsabudhe SR, "Irrigation Engineering and Hydraulic Structures"
8. Priyani BB, 'The Fundamental Principles of Irrigation and Water Power
9. BIS Codes
10. Wan. E. Houk, "Irrigation Engineering" Vol. I and II

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	2	3
2	5	8
3	5	8
4	8	11
5	5	8
6	9	13
7	6	9
8	6	9
9	5	8
10	3	7
11	5	9
12	5	7
Total	64	100

5.7 GENERIC SKILLS AND ENTREPRENEURSHIP DEVELOPMENT

L T 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 aim 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 passouts for enhancing their employability and self confidence.

DETAILED CONTENTS

1. **Introduction to Generic Skills** (4 hrs)
 - 1.1 Importance of Generic Skill Development (GSD)
 - 1.2 Global and Local Scenario of GSD
 - 1.3 Life Long Learning (LLL) and associated importance of GSD.

2. **Managing Self** (8 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
 - Reading: Purpose of reading, different styles of reading, techniques of systematic reading.
 - Note Taking: Importance of note taking, techniques of note taking
 - Writing: Writing a rough draft, review and final draft.
 - 2.4 Managing Self – Psychological
 - Stress, Emotions, Anxiety-concepts and significance
 - Techniques to manage the above

3. **Managing in Team** (6 hrs)
 - 3.1 Team - definition, hierarchy, team dynamics
 - 3.2 Team related skills- sympathy, empathy, co-operation, concern, lead and negotiate, work well with people from culturally diverse background
 - 3.3 Communication in group - conversation and listening skills

- 4 **Task Management** (3 hrs)
- 4.1 Task Initiation, Task Planning, Task execution, Task close out
- 4.2 Exercises/case studies on task planning towards development of skills for task management
5. **Problem Solving** (5 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**
- 6.1 Introduction (22 hrs)
- Concept/Meaning and its need
 - Competencies/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 Market Survey and Opportunity Identification (Business Planning)
- How to start a small scale industry
 - Procedures for registration of small-scale industry
 - List of items reserved for exclusive manufacture in small-scale industry
 - Assessment of demand and supply in potential areas of growth.
 - Understanding business opportunity
 - Considerations in product selection
 - Data collection for setting up small ventures.
- 6.3 Project Report Preparation
- Preliminary Project Report
 - Techno-Economic Feasibility Report
 - Exercises regarding “Project Report Writing” for small projects

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. *Generic skill Development Manual, MSBTE, Mumbai.*
2. *Lifelong learning, Policy Brief (www.oecd.org)*
3. *Lifelong learning in Global Knowledge Economy, Challenge for Developing Countries – World Bank Publication*
4. *Towards Knowledge Society, UNESCO Paris Publication*
5. *Your Personal Pinnacle of Success by DD Sharma, Sultan Chand and Sons, New Delhi*
6. *Human Learning, Ormrod*
7. *A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)*
8. *Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi*
9. *Handbook of Small Scale Industry by PM Bhandari*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs)	Marks Allotted (%)
1.	4	5
2.	8	15
3.	6	10
4.	3	10
5.	5	10
6.	22	50
Total	48	100

5.8 MINOR PROJECT WORK (CONSTRUCTION SITE ORIENTED)

L T P
- - 4

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. 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.
- x) Low Cost Housing

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 visit one or more sites mentioned above. 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. External examiner will ask the questions on the construction, working, processes observed by the students during their visit: Shortcomings in the works (site) and their remedial measures should be suggested by the students. Presentation of their technical report in their respective class for internal assessment.

6.1 BASICS OF MANAGEMENT

L T P
3 - -

RATIONALE

Since the diploma holders are expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Some topics like Structure of Organization, Leadership, Motivation, Customer Relationship Management (CRM), Legal Aspects of Business, Environmental Considerations, Accident and Safety: Total Quality Management (TQM), Intellectual Property Rights (IPR) etc. have been included in the subject.

DETAILED CONTENTS

1. **Introduction:** (8 Hrs)
Definition and concept of Management, functions of management viz. planning, organizing, staffing, coordinating, controlling; Various areas of management - Human Resource Management (HRM), Financial Management, Marketing Management, Material Management etc.
2. **Structure of Industrial Organization** (4 Hrs)
Concept and structure of an organization, hierarchical management structure (top, middle and lower level management) and functional management structure.
3. **Leadership** (4 Hrs)
Concept, importance, types and qualities of a good leader
4. **Motivation** (4 Hrs)
Concept and importance of motivation - drives and incentives, intrinsic and extrinsic motivation, brief about theories of motivation.
5. **Customer Relationship Management (CRM)** (6 Hrs)
Need, various types of customers, customer satisfaction, life- long customer, Customer Satisfaction Index (CSI) and its significance in playing effective role of engineers in changing scenario.
6. **Legal Aspects of Business** (12 Hrs)
 - a) Elementary knowledge of Income Tax, Sales Tax, Excise Rules, Provident Fund
 - b) Elementary knowledge of Factory Act, 1948 and Payment of Wages Act 1936, Workmen Compensation Act, Industrial Dispute act 1947, Employees State Insurance Act 1978.
 - c) Labour Welfare schemes including wage payment-types, system of wage payment and incentives.
 - d) Intellectual Property Rights (IPR): Concepts, definition, infringements and remedies related to patents, copyrights, trademarks, and designs. Introduction to registering procedure, patent rules.
 - e) Accident and Safety: Classification, precaution and treatment after accident, safety practices promotion, personal protection equipment (PPEs) for safety at work places.

7. Introduction to Total Quality Management (TQM) and steps to achieve this. (2 hrs)
8. Environmental Considerations (8 Hrs)
 - a) Concept of ecology and environment
 - b) Factors contributing to Air, Water, Noise Pollution
 - c) Pollution Control Board
 - d) Disaster Management-basic idea

INSTRUCTIONAL STRATEGY

It is observed that the diploma holders generally take up middle level managerial positions, therefore, their exposure to basic management principles is very essential. Accordingly students may be given conceptual understanding of different topics related to management. Some of the topics may be taught using question answer, assignment or seminar. The teacher will discuss success stories and case studies with students, which in turn, will develop appropriate managerial qualities in the students. In addition, expert lectures may also be arranged from within the institutions or from management organisations. Appropriate extracted reading material and handouts may be provided.

RECOMMENDED BOOKS

1. *Principles of Management by Philip Kotler TEE Publication*
2. *Principles and Practice of Management by Shyamal Bannerjee: Oxford and IBM Publishing Co, New Delhi.*
3. *Financial Management by MY Khan and PK Jain, Tata McGraw Hill Publishing Co.: 7, West Patel Nagar , New Delhi.*
4. *Modern Management Techniques by SL Goel: Deep and Deep Publications Pvt Limited , Rajouri Garden, New Delhi.*
5. *Management by James AF Stoner, R Edward Freeman and Daniel R Gilbert Jr. : Prentice Hall of India Pvt Ltd, New Delhi.*
6. *Essentials of Management by H Koontz, C O' Daniel , Mc Graw Hill Book Company, New Delhi.*
7. *Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi*
8. *Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.*
9. *Intellectual Property Rights and the Law by Dr. GB Reddy.*
10. *Service Quality Standards, Sales & Marketing Department, Maruti Udyog Ltd.*
11. *Customer Relationship Management: A step-by-step approach, Mohamed & Sagadevan Oscar Publication, Delhi*
12. *Customer Relation Management, Sugandhi RK, Oscar Publication, Delhi*
13. *Environment Engineering by GN Pandey & GC Pandey, Tata McGraw Hill Publication.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (hrs)	Marks Allotted (%)
1.	8	15
2.	4	10
3.	4	10
4.	4	12
5.	6	10
6.	12	15
7.	2	08
8.	8	20
Total	48	100

6.2 STEEL STRUCTURES DESIGN AND DRAWING

L T P
4 - 4

RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise steel construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials. He must be able to read and interpret structural drawings of different elements. This subject thus deals with elementary design principles as per IS code of practice IS: 800 and their relevant drawings.

DETAILED CONTENTS

- A) Steel Theory and Design**
1. **Structural Steel and Sections:** (02 hrs)
 - 1.1 Properties of structural steel as per IS Code
 - 1.2 Designation of structural steel sections as per IS handbook and IS:800
 2. **Riveted Connections:** Types of rivets, permissible stresses in rivets, types of riveted joints, specifications for riveted joints as per IS 800. Failure of a riveted joint. Assumptions in the theory of riveted joints. Strength and efficiency of a riveted joint. Design of riveted joints for axially loaded members (No Staggered riveting). (08 hrs)
 3. **Welded connections:** Types of welds and welded joints, advantages and disadvantages of welded joints design of fillet and butt weld. Plug and slot welds (Descriptive No numerical on plug and slot welds) (08 hrs)
 4. **Tension Members** (10 hrs)
Analysis and design of single and double section tension members and their rivetted and welded connections with gusset plate as per IS:800
 5. **Compression Members** (10 hrs)
Analysis and design of single and double angle sections compression members (struts) and their rivetted and welded connections with gusset plate as per IS:800
 6. **Roof Trusses** (06 hrs)
Form of trusses, pitch of roof truss, spacing of trusses, spacing of purlins, connection between purlin and roof covering. Connection between purlin and principal rafter (no design, only concept)
 7. **Columns:** (10 hrs)
 - 7.1 Concept of buckling of columns, effective length and slenderness ratio, permissible stresses in compression as per IS:800 for different end conditions. Analysis and Design of axially loaded single section steel column
 - 7.2 Types of column bases (Descriptive only)
 - 7.3 Beam and column, frame and seated connections (descriptive only, no design)

8. **Beams** (10 hrs)
Analysis and design of single section simply supported laterally restrained steel beams. Introduction to plate girder and functions of various elements of a plate girder
- B) Steel Structures Drawing**
1. Details of splicing for steel columns.
 2. Column Beam Connection Drawings:
 - a) Beam to beam connections (Seated and framed)
 - b) Beam to column (Seated and framed)
 - c) Column bases (Slab base, and gusseted base)
 3. Detailed drawing showing plan and elevation for a riveted plate girder with the given design data regarding the sizes of its parts, with details at the supports and connections of stiffeners, flange angles and cover plates with the web
 4.
 - a) Preparation of drawing of a steel roof truss with details of joints for the given span, shape of the truss and the design data regarding the size of the members and the connections. Fixing details of purlins and roof sheet
 - b) Drainage arrangement for a pitched roof

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. Practice of reading structural drawings is another important feature of this course. Commentary on BIS:800 may be referred along with code for relevant clauses

RECOMMENDED BOOKS

1. "Design of Steel Structures" by Duggal SK, Standard Publishers Distributors.
2. "Structures Design and Drawing" by Birinder Singh, Kaptian Publishing House, Ludhiana
3. "Design of Steel Structures" by Ram Chandra, Delhi, Standard Publishers Distributors
4. "Design of Steel Structure" by LS Negi, Tata McGraw Hill, New Delhi
5. "Design of Steel Structures", by S Ramamurthan

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	02	03
2	08	12
3	08	12
4	10	16
5	10	16
6	06	09
7	10	16
8	10	16
Total	64	100

6.3 QUANTITY SURVEYING

L T P
5 - -

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.

DETAILED CONTENTS

1. Introduction to quantity surveying and its importance. Duties of quantity surveyor (4 hrs)
2. **Types of estimates** (3 hrs)
 - 2.1 Preliminary estimates
 - Plinth area estimate
 - Cubic rate estimate
 - Estimate per unit base
 - 2.2 Detailed estimates
 - Definition
 - Stages of preparation – details of measurement and calculation of quantities and abstract
3. **Measurement** (3 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. **Preparation of Detailed and Abstract Estimates from Drawings for** (20 hrs)
 - 4.1 Earthwork for plain and hill roads
 - 4.2 RCC work in beams, slab, column foundations
 - 4.3 10 users septic tank
 - 4.4 Preparation of detailed estimates-complete with detailed reports, specifications, abstract of cost and material statement for a small residential building(Maximum three rooms) with a flat roof.
5. **Calculation of quantities of materials for** (10 hrs)
 - 5.1 Cement mortars of different proportion
 - 5.2 Cement concrete of different proportion
 - 5.3 Brick/stone masonry in cement mortar
 - 5.4 Plastering and pointing
 - 5.5 White washing, painting
6. **Analysis of Rates** (12 hrs)
 - 6.1 Steps involved in the analysis of rates. Requirement of material, labour, sundries, contractor's profit and overheads
 - 6.2 Analysis of rates for finished items when data regarding labour, rates of material and labour is given:

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

- 7 **Contractorship** (8 hrs)
- 7.1 Meaning of contract
 - 7.2 Qualities of a good contractor and their qualifications
 - 7.3 Essentials of a contract
 - 7.4 Types of contracts, their advantages, dis-advantages and suitability, system of payment
 - 7.5 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
- 8 **Preparation of Tender Document based on Common Schedule Rates (CSR)** (16 hrs)
- 8.1 Introduction to CSR and calculation of cost based on premium on CSR
 - 8.2 Exercises on writing detailed specifications of different types of building works from excavation to foundations, superstructure and finishing operation
 - 8.3 Exercises on preparing tender documents for the following
 - 8.3.1 Earth work
 - 8.3.2 Construction of a small house as per given drawing
 - 8.3.3 RCC works
 - 8.3.4 Pointing, plastering and flooring
 - 8.3.5 White-washing, distempering and painting
 - 8.3.6 Wood work including polishing
 - 8.3.7 Tile flooring including base course
9. **Exercises on preparation of comparative statements for item rate contract** (4 hrs)

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)", Delhi, New Asian Publishers
2. Rangwala, BS; Estimating and Costing". Anand, Charotar Book Stall
3. Kohli, D; and Kohli, RC; "A Text Book on Estimating and Costing (Civil) with Drawings", Ambala Ramesh Publications
4. Chakraborti, M; "Estimating, Costing and Specification in Civil Engineering", Calcutta

5. *Dutta, BN; "Estimating and Costing*
6. *Estimating and Costing by Mahajan, Satya Parkashan.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	3
2	3	4
3	3	4
4	20	19
5	10	12
6	12	17
7	8	12
8	16	19
9	4	3
Total	80	100

6.4 CONSTRUCTION MANAGEMENT AND ACCOUNTS

L T P
5 - -

RATIONALE

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

DETAILED CONTENTS THEORY

CONSTRUCTION MANAGEMENT:

1. **Introduction:** (6 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 Classification of construction into light, heavy and industrial construction
 - 1.5 Stages in construction from conception to completion
 - 1.6 The construction team: owner, engineer, architect and contractors, their functions and inter-relationship

2. **Construction Planning:** (12 hrs)
 - 2.1 Importance of construction planning
 - 2.2 Stages of construction planning
 - Pre-tender stage
 - Contract stage
 - 2.4 Scheduling construction works by bar charts
 - Definition of activity, identification of activities though
 - Preparation of bar charts for simple construction work
 - Preparation of schedules for labour, materials, machinery and finances for small works
 - Limitations of bar charts
 - 2.5 Scheduling by network techniques
 - Introduction to network techniques; PERT and CPM, differences between PERT and CPM terminology

3. **Organization:** (6 hrs)
 - 3.1 Types of organizations: Line, line and staff, functional and their characteristics

4. **Site Organization:** (6 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:** (8 hrs)
 - 5.1 Conditions of construction workers in India, wages paid to workers
 - 5.2 Important provisions of the following Acts:
 - Labour Welfare Fund Act 1936 (as amended)
 - Payment of Wages Act 1936 (as amended)
 - Minimum Wages Act 1948 (as amended)

6. **Control of Progress:** (4 hrs)
 - 6.1 Methods of recording progress
 - 6.2 Analysis of progress
 - 6.3 Taking corrective actions keeping head office informed
 - 6.4 Cost time optimization for simple jobs - Direct and indirect cost, variation with time, cost optimization

7. **Inspection and Quality Control:** (8hrs)
 - 7.1 Need for inspection and quality control
 - 7.2 Principles of inspection
 - 7.3 Stages of inspection and quality control for
 - Earth work
 - Masonry
 - RCC
 - Sanitary and water supply services

8. **Accidents and Safety in Construction:** (10 hrs)
 - 8.1 Accidents – causes and remedies
 - 8.2 Safety measures for
 - Excavation work
 - Drilling and blasting
 - Hot bituminous works
 - Scaffolding, ladders, form work
 - Demolitions
 - 8.3 Safety campaign and safety devices

ACCOUNTS

9. **Public Work Accounts:** (20 hrs)

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

definition of cash, precaution in custody of cash book, imprest account, temporary advance, treasury challan, preparation of final bills.

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", New Delhi, East West Press*
2. *Harpal Singh, "Construction Management and Accounts", New Delhi, Tata McGraw Hill Publishing Company.*
3. *Peurifoy, RL, "Construction Planning, Equipment and Methods" Tokyo, McGraw Hill*
4. *Wakhlo, ON; "Civil Engineering Management", New Delhi Light and Life Publishers*
5. *Verma, Mahesh; "Construction Equipment and its Planning and Application*
6. *Dharwadker, PP; "Management in Construction Industry", New Delhi, Oxford and IBH Publishing Company.*
7. *Gahlot PS; Dhir, BM; "Construction Planning and Management", Wiley Eastern Limited, New Delhi*
8. *MS Project – Microsoft USA or Primavera or Bentley Company*
9. *Primavera*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	6	9
2	12	14
3	6	9
4	6	8
5	8	12
6	4	6
7	8	9
8	10	11
9	20	22
Total	80	100

(Elective)

6.5(a) REPAIR AND MAINTENANCE OF BUILDINGS

L T 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.

DETAILED CONTENTS

1. **Need for Maintenance** (7 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)** (7 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** (7 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** (7 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** (7 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** (13 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., Sanjay Sharma, *Building Defects and Maintenance Management* by CBS Publishers New Delhi
2. Nayak, BS; *"Maintenance Engineering for Civil Engineers"*, Khanna Publishers, Delhi
3. Ransom, WH; *"Building Failures - Diagnosis and Avoidance"*, Publishing E and F.N. Span
4. Hutchinson, BD;etc, *"Maintenance and Repair of Buildings"*, Published by Newness – Butterworth

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	7	15
2	7	15
3	7	15
4	7	15
5	7	15
6	13	25
Total	48	100

6.5(b) ENVIRONMENTAL ENGINEERING

L T P
3 - -

RATIONALE

Civil Engineering diploma holders must have the knowledge of different types of environmental aspects related to development activities so that they may help in maintaining the ecological balance and control pollution. They should also be aware of the related environmental laws for effectively combating environmental pollution. The class room instructions should be supplemented by field visits to show the pollution caused by urbanization and the combatment measures being adopted at site. Extension lectures by experts may be encouraged.

DETAILED CONTENTS

1. **Study of Importance of Environmental Engineering** (4 hrs)
Importance of clean environment, control of environmental pollution with respect to air, land and water. Conservation of natural resources, environmental education and awareness, sustainable development.
2. **Environments and Ecology** (4 hrs)
Definition and understanding of environment and ecology concept, ecosystem and types of ecosystems, energy flow in an ecosystem, food chain, ecological pyramids, consortium and ecological balance
3. **Water Pollution** (4 hrs)
Causes of pollution in surface and underground water eutrophication of lakes and its preventing measure; BIS standards for water quality.
4. **Air Pollution** (6 hrs)
Definition, principal air pollutants, atmospheric parameters influencing air pollution, types of air contaminants and their sources, effects of air pollution on human beings, plants, animals, automobile pollution, BIS ambient air quality standards and measures to combat air pollution
5. **Noise Pollution** (3 hrs)
Definition, unit of measurement of noise, sources and effects of noise pollution and control of noise pollution
6. **Effects of mining, blasting and deforestation** (5 hrs)
Ill effects of mining, blasting and deforestation on the environment human life and wild life.
7. **Land Use** (6 hrs)
Effect of land use on environmental quality, land use and natural disasters,(land slides etc) soil degradation problems - erosion, water logging, soil pollution etc.

8. **Environmental Impact Assessment** (4 hrs)
Definition and requirements, environmental impact assessment. Flow chart of environmental impact assessment methodology. Describe the need and importance of EIA.
9. **Legislation to Control Environmental Pollution (idea)** (4hrs)
Indian legislative acts for water, land and air pollution control – provisions, scope and implementation
10. **Global Issues of Environmental Engineering** (4 hrs)
Global warming, ozone depletion, acid rain, oil pollution; radiation hazards and their control
11. **Renewable Source of Energy** (4 hrs)
Role of non-conventional sources of energy (biogas, solar, wind etc) in environmental protection. Conservation of energy resources like coal, oil etc., alternative fuels, bio-diesel etc.

INSTRUCTIONAL STRATEGY

Students should be encouraged to undertake project work related to environmental problems. They should visit industrial effluent treatment plant, water treatment plant and environmental engineering laboratory and study the impact of utilization of reclaimed by products

RECOMMENDED BOOKS

1. *Environmental Engineering by Deswal and SS Deswal; Dhanpat Rai and Company (P) Ltd., Delhi*
2. *Odum EP, "Fundamentals of Ecology", Amarind publication Co., Delhi*
3. *Environmental Engineering and Management by SK Dhamija; SK kataria and Sons, Delhi*
4. *De AK, "Engineers Chemistry", New Age Publication, Delhi*
5. *Kendeigh SC, "Ecology", Prentice Hall of India, Delhi*
6. *RK Khitoliya, Environmental Pollution, (2007), S Chand & Co. Ltd., New Delhi*
7. *Bhatia HS A text book of environmental pollution and control Galogotia.*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	4	8
2	4	8
3	4	8
4	6	12
5	3	4
6	5	12
7	6	12
8	4	9
9	4	9
10	4	9
11	4	9
Total	48	100

6.5(c) PRESTRESSED CONCRETE

L T P
3 - -

RATIONALE

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

DETAILED CONTENTS

- 1. Introduction** (10 hrs)
Basic concept of prestressed concrete, advantages of prestressed concrete in comparison with RCC application of prestressed 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** (12 hrs)
Concept of bending and shear capacity of prestressed members. Calculation of bending stresses in rectangular simply supported beams with straight and parabolic 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

RECOMMENDED BOOKS

- 1. Prestressed Concrete by N Krishna Raju, Tata McGraw Hill, Delhi*
- 2. Prestressed Concrete by P Dayaratnam*
- 3. Prestressed Concrete by S Ramamurtham*

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	10	20
2	8	16
3	8	16
4	12	32
5	10	16
Total	48	100

6.5(d) RAILWAYS, BRIDGES AND TUNNELS

L T P
4 - -

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

DETAILED CONTENTS

PART – I: RAILWAYS

(28 hrs)

1. Introduction to Indian Railways
2. Railway surveys: Factors influencing the railways route, brief description of various types of railway survey
3. Classification of permanent way describing its component parts
4. Rail Gauge: Definition, types, practice in India
5. Rails – types of rails
6. Rail Fastenings: Rail joints, types of rail joints, fastenings for rails, fish plates, bearing plates
7. Sleepers: Functions of sleepers, types of sleepers, requirements of an ideal material for sleepers.
8. Ballast: Function of ballast, requirements of an ideal material for ballast
9. Crossings and signalings: Brief description regarding different types of crossings/ signalings
10. Maintenance of track: Necessity, maintenance of track, inspection of soil, track and fixtures; maintenance and boxing of ballast maintenance gauges, tools
11. Earth work and drainage: Features of rail road, bed level, width of formation, side slopes, drains, methods of construction, requirement of drainage system

PART-II: BRIDGES

(28 hrs)

12. Introduction

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

13. Classification of Bridges

Their structural elements and suitability:

13.1 According to life-permanent and temporary

13.2 According to deck level – Deck, through and semi-through

13.3 According to material –timber, masonry, steel, RCC, pre-stressed

13.4 **According to structural form;**

- Beam type –RCC, T-Beam, steel girder bridges, plate girder and box girder, balanced cantilever, Trussed bridges.

- Arch type – open spandrel and filled spandrel barrel and rib type
- Suspension type – unstiffened and stiffened and table (its description with sketches)
- According to the position of highest flood level submersible and non submersible

13.5 IRC classification

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

15. **Piers, Abutments and Wingwalls**

15.1 Piers-definition, parts; types –solid (masonry and RCC), open

15.2 Abutments and wing walls – definition, types of abutments (straight and tee), abutment with wing walls (straight, splayed, return and curved)

16. **Bridge bearings**

Purpose of bearings; types of bearings – fixed plate, rocker and roller,

17. Maintenance of Bridges

17.1 Inspection of bridges

17.2 Routine maintenance

PART - III: TUNNELS

(8 hrs)

18. Definition and necessity of tunnels

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

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

21. Drainage method of draining water in tunnels

22. 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 their construction of railway track, bridges and tunnel.

RECOMMENDED BOOKS

1. Vaswani, NK; “Railway Engineering”, Roorkee Publishing House
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. Victor Johnson, “Essentials of Bridge Engineering” Oxford and IBH
6. Rangwala, “Bridge Engineering”, Aand, Charotar Book Stall
7. IRC Bridge Codes
8. MORTH drawings for various types of bridges
9. MORTH pocket books for bridge Engineers, 2000 (First Revision)
10. Subhash C Saxena “Tunnal Engineering Dhanpat Rai and Sons

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	28	43
2	28	43
3	8	14
Total	64	100

6.6 MAJOR PROJECT WORK (INDUSTRY/FIELD ORIENTED - PRACTICE BASED)

L T P
- - 10

As far as possible students should be given live project problems with a view to :

- i) 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.
- ii) Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
- iii) Provide first hand experience to develop confidence amongst the students to enable them to use and apply classroom based knowledge and skills to solve practical problems of the world of work.
- iv) Develop special skills and abilities like interpersonal skills, communication skills, attitudes and values.

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

Effort should be made to identify actual field problems to be given as project work to the students. Project selected should not be too complex which is beyond the comprehension level of the students. The placement of the students for such a practical cum project work should match with the competency profile and interest of students. Students may be assessed both by industry and polytechnic faculty. The suggested performance criteria is given below:

- | | |
|---------------------------|-----|
| a) Performance Evaluation | 60% |
| b) Report Writing | 20% |
| c) VIVA | 20% |

Some of suggested projects are given below: These are only guidelines, teacher may take any project related to Civil Engineering depending upon the availability of projects. Preference should be given to practical oriented projects.

According to the need of the polytechnic, the following major projects are suggested:

1. 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 and 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

2. **Water Supply system for a one or two villages**
 - 2.1 Surveying
 - 2.2 Design of water requirements and water distribution system
 - 2.3 Preparation of drawing of overhead tank
 - 2.4 Material estimating and costing
 - 2.5 Specifications
 - 2.6 Technical report writing
3. Construction of seating benches in polytechnic campus
4. Welding of angle iron and Expanded metal jali to prepare fencing in polytechnic campus
5. Construction of toilets and baths for a shopping complex in a township
6. Construction of bridal path 4 kms long
7. Construction of shopping complex detailing of RCC drawings, estimating and costing of material
8. **Rainwater harvesting**
 - 8.1 Assessment of catchment's area
 - 8.2 Intensity of rainfall
 - 8.3 Collection of water
 - 8.4 Soak pit design
 - 8.5 Supply of water
 - 8.6 Monitoring during rainy season
9. Design and construction of septic tank with soak pit for 100 users
10. Preparing plumbing detailed drawings of a two storey building and material estimate and costing
11. Planning and design of sports stadium in a township or cluster of villages
12. 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
13. Concrete Mix Design
14. **Construction of concrete cubes by mixing with appropriate quantity of fly ash with fibres**
 - (i) the fibres like polypropylene, carbon, steel etc. can be used
 - (ii) students will show the comparison between concrete mixed with fibres versus the controlled quality concrete.
15. **Estimation and designing of a State Highway Road**
 - (i) Reconnaissance survey of proposed road
 - (ii) To take L and cross sections
 - (iii) Fixing of grades
 - (iv) Estimation of cutting and filling of earth mass
 - (v) Plantabing of proposed road
 - (vi) Estimation of proposed road
16. **Designing a small height gravity dam**
 - (i) Constructing of catchment tree
 - (ii) Calculating the reservoir capacity
 - (iii) Designing of gravity dam by taking the account various forces
17. Designing of ferro-cement water tank and toilet. Testing of the ferro-cement products in civil engineering labs.

Note: The projects undertaken should be field oriented

6.7 PRACTICE IN COMMUNICATION SKILLS

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RATIONALE

For successful completion of diploma programme, a student should possess adequate command on language and communication skills so that he/she is able to express himself/herself with ease and felicity. The language used by the student should be appropriate to objectives and occasion. The contents of this subject shall provide practical training to the students through language laboratory.

LIST OF PRACTICAL EXERCISES

1. Exercises on phonetics
2. Interactive session (case studies)
3. Presentation of periodic progress reports (written/oral) and maintaining daily diary
4. Exercises on self assessment using tools like SWOT analysis.
5. Communication empowerment through breaking language Barriers.
6. Internet communication
7. **Correspondence**
 - 7.1 Resume writing
 - 7.2 Covering letter
 - 7.3 Follow-up correspondence
 - 7.4 Internal and External business Correspondence
8. Practice on public relation skills with live examples.
9. Practice on listening skills.
10. Speaking exercises with emphasis on voice modulation (reading and extempore)
11. Demonstration and practice on Body language and Dress sense.
12. Exercises on etiquettes and mannerism in difficult situations like business meetings, table manners, telephone etiquettes and manners related to opposite gender.
13. Exercises on wit and humour in conversations and creating lively environment.
14. Role play for effective Communication.
15. Cross-cultural Communication
16. Group Discussion
17. Mock interviews (telephonic/personal)