NSQF ALIGNED

CURRICULUM FOR THREE YEARS (SIX SEMESTER)

DIPLOMA COURSE IN

CARPET TECHNOLOGY

Effective from session 2023-24

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SEMESTER SYSTEM

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PREPARED BY

CURRICULUM DEVELOPMENT CELL

INSTITUTE OF RESEARCH DEVELOPMENT
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PREFACE

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

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

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

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

Director

Institute of Research Development and Training, U.P.

Kanpur

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6. Faculty/Subject Experts from different departments of U.P. Government polytechnics for content updating.

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

1. SALIENT FEATURES OF DIPLOMA PROGRAMME IN CARPET TECHNOLOGY

1.	Name of the Programme	:	Diploma Programme in Carpet Technology
2.	Duration of the Programme	:	Three years (Six Semesters)
3.	Entry Qualification	:	Matriculation or equivalent NSQF Level as Prescribed by State Board of Technical Education, UP
4.	Intake	:	60 (or as prescribed by the Board)
5.	Pattern of the Programme	:	Semester Pattern
6.	NSQF Level	:	Level - 5
7.	Ratio between theory and practical	:	45 :55 (Approx.)

8. Industrial Training:
   a. Four weeks of Professional training is included after IV semester during summer vacation. Total marks allotted to industrial training will be 50.

9. Ecology and Environment :
   a. As per Govt. of India directives, a subject on Environmental Studies has been incorporated in the curriculum.

10. Energy Conservation:
   a. A subject on Energy Conservation has been incorporated in the curriculum.

11. Entrepreneurship Development:
   a. A full subject on Construction Management, Accounts and Professional Practice has been incorporated in the curriculum.

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

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

2. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN CARPET TECHNOLOGY

Major clusters for carpet production in India are Panipat, Bhadohi, Mirzapur, Bhatinda, Ludhiana etc. There are very few colleges in India that are providing diploma engineering course in 'Carpet Technology'. Industry always required trained diploma engineers for smooth functioning and further development. The students completing this diploma course should get employment opportunities in following work profiles in different carpet producing clusters on India -

1. In carpet manufacturing industry primarily in private sector and Carpet Clusters.
2. In Carpet allied industries.
3. May become an entrepreneur with his/her own start up.
4. Merchandising and marketing and after sales service of carpets
5. As quality engineers in carpet industries.
6. As designer in Carpet industry or freelance designer.
7. As Carpet Engineer in carpet manufacturing industries.
8. Various other opportunities in carpet industry.

3. LEARNING OUTCOME OR COMPETENCY PROFILE OF DIPLOMA HOLDERS IN CARPET TECHNOLOGY

After undergoing this programme, students will be able to

Sr.No.	Learning Outcomes
1.	Prepare and interpret drawings engineering components.
2.	Communicate effectively in English in oral and written form with others.
3.	Apply basic principles of mathematics and science to solve engineering problems.
4.	Learning of basic operation of Eng.
5.	Understanding of properties and identification of Man-Made Textile fibers
6.	Understanding of properties and identification of Natural Textile fibers
7.	Use cutting tools for machines and machine tools.
8.	Carry out welding and different shop floor operation.
9.	To know origin and history of carpets
10.	Prepare process plan for given part.
11.	Carry out work measurement and method study to improve productivity.
12.	Apply inventory control techniques to reduce
13.	Manage activities related to procurement, Stacking, storage, and preservation of materials.
14.	Prepare maintenance schedules.
15.	To learn basic electrical and electronics machines
16.	Utilize computer and IT tools for document creation, spreadsheet development, and presentation design.
17.	Learning brief idea of manufacturing of yarn
18.	Learning manufacturing of carpet yarn
19.	Learning different textile testing instrument and their uses

20.	Application and development of Basic carpet Design
21.	Application and development of Advance carpet Design
22.	To learn different motions of Loom
23.	To learn machinery involved in manufacturing of fabrics
24.	To different kind of carpet manufacturing process
25.	Application of different dyes on Carpet
26.	To learn different kind of chemical coating and finishing on carpet
27.	To learn different method of manufacturing of non-Woven
28.	To learn modern machinery of carpet manufacturing
29.	Utilize appropriate practices for conserving energy and preventing environmental pollution.
30.	Interpret factory acts and laws.
31.	Manage resources effectively at workplace.
32.	Plan and execute given task/project as a team member or leader.
33.	Prepare detailed project proposal and report.
34.	Solve real life problems by application of acquired knowledge and skills.
35.	Handle the customers effectively.

4. DERIVING CURRICULUM AREAS FROM LEARNING OUTCOME/ COMPETENCY PROFILE

The following curriculum areas/subjects have been derived from learning outcomes:

Sr. No.	Learning Outcomes	- Curriculum Areas/Subjects
1.	Prepare and interpret drawings of engineering components.	- Engineering Drawing
2.	Communicate effectively in English in oral and written form with others.	- Communication Skills - Student Centered Activities (SCA)
3.	Apply basic principles of Mathematics and Science to solve engineering problems.	- Applied Mathematics - Applied Physics - Applied Chemistry
4.	Learning of Basic operation of Engg.	- General Mechanical Eng.
5.	Understanding of properties and identification of Man Made /Natural Textile fibers	- Textile Fiber
6.	Use cutting tools for machines and Carry out welding and different shop floor operation	- Workshop Practice
7.	To know origin and History of carpets	- Introduction to carpet
8.	Manage activities related to procurement, Stacking, storage, and preservation of materials.	- Industrial Safety
9.	To learn basic electrical and electronics machines	- Electrical Technology & Electronics
10.	Use computer and IT tools for creating document, making spread sheet, and making presentation.	- - Introduction to Computer
11.	Learning brief idea of manufacturing of yarn	- Yarn Manufacturing Process
12.	Learning Manufacturing of carpet yarn	- Carpet yarn Manufacturing
13.	Learning different textile testing instrument and their uses	- Textile Testing
14.	Application and development of Basic carpet Design	- Carpet Design
15	Application and development of Advance carpet Design	- Carpet Design
16	To learn different motions of Loom and machinery involved in manufacturing of fabrics	- Fabric manufacturing System

17	To different kind of carpet manufacturing process	- Carpet manufacturing
18	Application of different dyes on Carpet	- Carpet Chemical Processing
19	To learn different kind of chemical coating and finishing on carpet	- Carpet Finishing and Maintenance
20	To learn different method of manufacturing of non-Woven	- Non-Woven
21	To learn modern machinery of carpet manufacturing	- Modern Carpet Technology
22	Use appropriate practices for conservation of energy and prevention of environment pollution.	- Environmental Studies - Energy Conservation
23	Interpret factory acts and laws / Manage resources effectively at workplace.	- Industrial Management and Entrepreneurship Development
24	Plan and execute given task/project as a team member or leader.	- Industrial Safety
25	Solve real life problems by application of acquired knowledge and skills.	- Industrial Training -6 weeks
26	Prepare detailed project proposal and report.	- Project Work

5. ABSTRACT OF THE CURRICULUM AREAS

a) General Studies

1. Communication Skills-I and II
2. Energy Conservation
3. Environmental Studies
4. Universal Human Values
5. Industrial Management & Entrepreneurship Development

b) Applied Sciences

6. Applied Mathematics
7. Applied Physics
8. Applied Chemistry

c) Basic Courses in Carpet Technology

9. Introduction to Carpet
10. Carpet Finishing and Maintenance
11. Carpet Manufacturing

d) Applied Courses in Carpet Technology

12. General Mechanical Eng.
13. Engineering Drawing
14. Textile Fibre-I & II
15. Workshop Practice
16. Industrial Safety
17. Electrical Technology & Electronics
18. Basics of Information Technology
19. Yarn Manufacturing Process
20. Carpet Yarn Manufacturing
21. Carpet Design –I & II
22. Textile Testing
23. Fabric Manufacturing System
24. Carpet Chemical Processing
25. Industrial Training- 6 weeks
26. Non-Woven
27. Carpet Testing
28. Modern Carpet Technology
29. Project Work

6. HORIZONTAL AND VERTICAL ORGANIZATION OF THE SUBJECTS

Sr. No.	Subjects	Distribution of Periods / week in					
		I	II	III	IV	V	VI
1.	*Communication Skills-I & II	6	-	-	6	-	-
2.	*Applied Mathematics –I & II	5	5	-	-	-	-
3.	*Applied Physics-I & II	7	7	-	-	-	-
4.	General Mechanical Engg.	10	-	-	-	-	-
5.	*Engineering Drawing	10	-	-	-	-	-
6.	Textile Fibre-I & II	8	8	-	-	-	-
7.	*Applied Chemistry	-	7	-	-	-	-
8.	Introduction to Carpet	-	6	-	-	-	-
9.	Workshop Practice	-	10	-	-	-	-
10.	Industrial Safety	-	-	4	-	-	-
11.	Electrical Technology & Electronics	-	-	7	-	-	-
12.	Yarn Manufacturing Process	-	-	6	-	-	-
13.	Carpet Yarn manufacturing	-	-	16	-	-	-
14.	Basics of Information Technology	-	-	6	-	-	-
15.	Carpet Design –I & II	-	-	-	10	12	-
16.	Textile Testing	-	-	-	11	-	-
17.	Fabric Manufacturing System	-	-	-	4	-	-
18.	Carpet Manufacturing	-	-	-	10	-	-
19.	*Energy Conservation	-	-	-	5	-	-
20.	*Industrial management & Entrepreneurship Development	-	-	-	-	5	-
21.	Carpet Chemical Processing	-	-	-	-	12	-
22.	Carpet Finishing and Maintenance	-	-	-	-	6	-
23.	Universal Human Values	-	-	-	-	3	-
24.	Industrial Training - 6 weeks	-	-	-	-	2	-
25.	*Environmental Studies	-	-	-	-	-	5
26.	Non-Woven	-	-	-	-	-	6
27.	Carpet Testing	-	-	-	-	-	16
28.	Modern Carpet Technology	-	-	-	-	-	6
29.	Project Work (i)Viva- Voce	-	-	-	-	-	10
30.	#Student Centered Activities (SCA)	2	4	4	2	4	3
Total		**48**	**47**	**43**	**48**	**44**	**46**

7. EVALUATION SCHEME FOR DIPLOMA PROGRAMME IN CARPET TECHNOLOGY

FIRST SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
1.1	*Communication Skills-I	4	-	2	4	20	10	30	50	2.5	20	3	70	100
1.2	*Applied Mathematics -I	5	-	-	4	20	-	20	50	2.5	-	-	50	70
1.3	*Applied Physics-I	5	-	2	5	20	10	30	50	2.5	20	3	50	100
1.4	General Mechanical Engg.	6	-	4	6	20	20	40	50	2.5	40	3	90	130
1.5	*Engineering Drawing	-	-	10	4	20	-	20	50	3	-	-	50	70
1.6	Textile Fibre-I	4	-	4	6	20	20	40	50	2.5	40	3	90	130
#Student Centered Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		**24**	**-**	**24**	**30**	**120**	**90**	**210**	**300**	**-**	**120**	**-**	**420**	**630**

* Common with other diploma programmes.

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

SECOND SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
2.1	*Applied Mathematics -II	5	-	-	4	20	-	20	50	2.5	-	-	50	70
2.2	*Applied Physics-II	5	-	2	5	20	10	30	50	2.5	20	3	70	100
2.3	*Applied Chemistry	5	-	2	5	20	10	30	50	2.5	20	3	70	100
2.4	Textile Fibres-II	4	-	4	6	20	20	40	50	2.5	40	3	90	130
2.5	Introduction to Carpet	6	-	-	6	20	-	20	50	2.5	-	-	50	70
2.6	Workshop Practice	-	-	10	4	-	30	30	-	-	60	4	60	90
#Student Centered Activities (SCA)		-	-	4	1	-	30	30	-	-	-	-	-	30
Total		**25**	**-**	**22**	**31**	**100**	**100**	**200**	**250**	**-**	**140**	**-**	**390**	**590**

* Common with other diploma programmes

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

THIRD SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	Industrial Safety	4	-	-	4	20	-	20	50	2.5	-	-	50	70
3.2	Electrical Technology & Electronics	5	-	2	6	20	20	40	50	2.5	40	3	90	130
3.3	Yarn manufacturing Process	4	2	-	5	20	-	20	50	2.5	-	-	50	70
3.4	Carpet Yarn manufacturing	6	2	8	8	20	20	40	50	2.5	40	3	90	130
3.5	*Basics of Information Technology	-	-	6	2	-	40	40	-	-	60	3	60	100
#Student Centered Activities (SCA)		-	-	4	1	-	30	30	-	-	-	-	-	30
Total		**19**	**4**	**20**	**26**	**80**	**110**	**190**	**200**	**-**	**140**	**-**	**340**	**530**

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

FOURTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	*Communication Skills-II	4	-	2	4	20	10	30	50	2.5	20	3	70	100
4.2	Carpet Design -I	6	-	4	7	20	20	40	50	2.5	40	3	90	130
4.3	Textile Testing	4	1	6	7	20	20	40	50	2.5	40	6	90	130
4.4	Fabric manufacturing System	4	-	-	4	20	-	20	50	2.5	-	-	50	70
4.5	Carpet Manufacturing	4	1	5	6	20	20	40	50	2.5	40	4	90	130
4.6	*Energy Conservation	3	-	2	3	20	10	30	50	2.5	20	3	70	100
#Student Centered Activities (SCA)		-	-	2	1	-	30	30	-	-	-	-	-	30
Total		**25**	**2**	**21**	**32**	**120**	**110**	**230**	**300**	**-**	**160**	**-**	**460**	**690**

* Common with other Diploma Programmes

- 6 Weeks Industrial Training (Field Exposure) will be organized after 4th Semester exam. The evaluation of Industrial Training (Field Exposure) will be done in 5th semester.

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

FIFTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
5.1	*Industrial management & Entrepreneurship Development	5	-	-	4	20	-	20	50	2.5	-	-	50	70
5.2	Carpet Chemical Processing	4	2	6	8	20	30	50	50	2.5	60	6	110	160
5.3	Carpet Design II	4	2	6	8	20	30	50	50	2.5	60	6	110	160
5.4	Carpet Finishing and Maintenance	4	2	-	6	20	-	20	50	2.5	-	-	50	70
5.5	*Universal Human Values	2	-	1	1	-	20	20	-	-	30	3	30	50
5.6	Industrial Training (6 weeks)	-	-	2	2	-	40	40	-	-	80	Viva	80	120
#Student Centered Activities (SCA)		-	-	4	1	-	30	30	-	-	-	-	-	30
Total		**19**	**6**	**19**	**30**	**80**	**150**	**230**	**200**	**-**	**230**	**-**	**430**	**660**

* Common with another diploma programme

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

SIXTH SEMESTER

Sr. No.	SUBJECTS	STUDY SCHEME			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
		Periods/Week				INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
		L	T	P/drg		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
6.1	*Environmental Studies	3	-	2	3	20	10	30	50	2.5	20	3	70	100
6.2	Non-Woven	4	2	-	6	20	-	20	50	2.5	-	-	50	70
6.3	Carpet Testing	6	2	8	8	20	40	60	50	2.5	80	4	130	190
6.4	Modern Carpet Technology	6	-	-	5	20	-	20	50	2.5	-	-	50	70
6.5	Project Work Viva	2	-	8	8	-	50	50	-	-	100	Viva	100	150
#Student Centered Activities (SCA)		-	-	3	1	-	30	30	-	-	-	-	-	30
Total		**21**	**4**	**21**	**31**	**80**	**130**	**210**	**200**	**-**	**200**	**-**	**400**	**610**

* Common with another diploma programme

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

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

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

2) 10 Marks for general behavior and discipline
   (By HODs in consultation with all the teachers of the department)

3) 5 Marks for attendance as per following:
   (By HODs in consultation with all the teachers of the department)

4) 15 Marks maximum for Sports/NCC/Cultural/Co-curricular/ NSS activities as per following:
   (By In-charge Sports/NCC/Cultural/Co-curricular/NSS)

   i) 15 - State/National Level participation

   ii) 10 - Participation in two of above activities

   iii) 5 - Inter-Polytechnic level participation

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

9. DETAILED CONTENTS OF VARIOUS SUBJECTS

FIRST SEMESTER

1.1 COMMUNICATION SKILLS - I

L	T	P
4	-	2

RATIONALE

Knowledge of the English language plays an important role in career development. This subject aims to introduce basic concepts of communication and emphasizes the development of listening, speaking, reading, and writing skills as part of Communication Skill.

LEARNING OUTCOMES

- After completing this subject, students will be able to:
- Understand the importance of effective communication
- Describe the process of communication
- Communicate effectively in different contexts
- Identify parts of speech
- Write correct sentences using appropriate vocabulary
- Reproduce and match words and sentences in a paragraph
- Write various types of paragraphs, notices for different purposes, and compositions on pictures with appropriate format
- Read unseen texts with comprehension

DETAILED CONTENTS

1. Basics of Communication (13 periods)
   - 1.1. Definition and process of communication
   - 1.2. Types of communication: formal and informal, oral and written, verbal and non-verbal
   - 1.3. Communications barriers and how to overcome them
   - 1.4. Barriers to Communication
   - 1.5. Tools of Communication

2. Application of Grammar (18 periods)
   - 2.1. Parts of Speech: Noun, verb, adjective, adverb, and modals
   - 2.2. Sentences and its types
   - 2.3. Tenses
   - 2.4. Active and Passive Voice
   - 2.5. Punctuation
   - 2.6. Direct and Indirect Speech

3. Reading Skill (10 periods)
   - 3.1. Unseen passage for comprehension
   - 3.2. One-word substitution, prefixes, suffixes, antonyms, synonyms, etc. based upon the passage to be covered under this topic

4. Writing Skill (15 periods)
   - 4.1. Picture composition
   - 4.2. Writing paragraphs
   - 4.3. Notice writing

LIST OF PRACTICALS

Note: The teaching-learning process should focus on the use of the language in writing reports and making presentations. Topics such as effective listening, effective note-taking, group discussions, and regular presentations by the students need to be taught in a project-oriented manner where the learning happens as a byproduct.

Listening and Speaking Exercises:

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

INSTRUCTIONAL STRATEGY

Students should be encouraged to participate in role play and other student-centered activities in the classroom and actively engage in listening exercises.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. Excellent General English - R.B. Varshnay, R.K. Bansal, Mittal Book Depot, Malhotra.
5. The Functional aspects of Communication Skills – Dr. P. Prasad, S.K. Katria & Sons, New Delhi.
6. Q. Skills for success – Level & Margaret Books, Oxford University Press.
7. E-books/ e-tools/ relevant software to be used as recommended by AICTE/ BTEUP/ NITTTR.

Websites for Reference:

1. http://www.mindtools.com/page8.html – 99k
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/
5. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

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

1.2 APPLIED MATHEMATICS-I

L	T	P
5	-	-

RATIONALE

The contents of this course provide a fundamental base for understanding elementary mathematics and their uses in solving engineering problems. The course covers topics such as logarithms, partial fractions, matrices, basic 2D curves, and their applications in solving various engineering problems across all fields.

LEARNING OUTCOMES

After completing this course, students will be able to:

• Apply the Binomial theorem to solve engineering problems.
• Apply determinant properties and Cramer's rule to solve engineering problems.
• Apply dot and cross products of vectors to find solutions to engineering problems.
• Use complex numbers in various engineering problems.
• Apply differential calculus and higher-order derivatives to solve engineering problems.
• Find velocity, acceleration, errors, and approximations in engineering problems using derivatives.

DETAILED CONTENTS

1. Algebra - I (12 Periods)

    1.1. Series: Arithmetic Progression (AP) and Geometric Progression (GP); Sum, nth term, Mean. Binomial theorem for positive, negative, and fractional indices (without proof). Application of the Binomial theorem.
    1.2. Determinants: Elementary properties of determinants of order 2 and 3. Multiplication system of algebraic equations, Consistency of equations, Cramer's rule.

2. Algebra – II (12 Periods)

    2.1. Vector algebra: Dot and cross product, Scalar and vector triple product. Complex numbers: Representation, Modulus, and amplitude. De Moivre's theorem, its application in solving algebraic equations. Modulus function and its properties.

3. Trigonometry (10 Periods)

    3.1. Relations between sides and angles of a triangle: Statement of various formulas showing the relationship between sides and angles of a triangle. Inverse circular functions: Simple cases only.

4. Differential Calculus - I (18 Periods)

    4.1. Functions, limits, continuity, functions and their graphs, range and domain.

Elementary methods of finding limits (right and left). Elementary test for continuity and differentiability. Methods of finding derivatives. Trigonometric functions, exponential function, function of a function, logarithmic differentiation, differentiation of inverse trigonometric functions, differentiation of implicit functions.

5. Differential Calculus - II (18 Periods)

5.1. Higher-order derivatives, Leibnitz's theorem (without proof). Simple applications. Application: Finding tangents, normal, points of maxima/minima, increasing/decreasing functions, rate, measurement, velocity, acceleration, errors, and approximation.

INSTRUCTIONAL STRATEGY

The basic instructional strategy for teaching basic mathematics, the Binomial theorem, trigonometry, and differential equations should be conceptual, with real-world applications from the relevant branches. More numerical and theoretical examples can be used to ensure a clear understanding of the content.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	12	20
2.	12	20
3.	10	12
4.	18	24
5.	18	24
Total	**70**	**100**

1.3 APPLIED PHYSICS-I

L T P

5 - 2

RATIONALE

Applied Physics encompasses the study of various topics related to the world around us. It aims to provide an understanding of the behavior of objects through observation and prediction. This course focuses on concrete knowledge of physical laws, their analysis, and applications in different engineering and technology fields.

Note: Teachers should provide examples of engineering and technology applications for each topic to help students learn and appreciate the concepts and principles. Throughout the course, SI units should be followed.

LEARNING OUTCOMES

After completing this course, students should be able to:

- Identify the use of the S.I. system of measurement with accuracy and its applications in engineering.
- Apply physical laws and concepts of linear and circular motion to represent physical quantities as scalars and vectors in everyday life.
- Solve complex problems related to various motion scenarios (e.g., walking of a man, horse and cart problem, flying of birds/aircraft, etc.).
- Analyze and design banking of roads/railway tracks and apply the principle of conservation of momentum to explain rocket propulsion, recoil of guns, etc.
- Derive and apply the relationships between work, power, and energy to solve problems.
- Define work, energy, and power and their respective units.
- Describe the concept of conservation of energy and its applications.
- Understand the concept of rotational motion of a rigid body and its applications.
- Apply the physical laws and concepts of gravity, including its variation with longitude and latitude, and its applications in space satellites, etc.
- Understand the concept of elasticity, surface tension, pressure, and the laws governing the movement of fluids.
- Relate physical work to heat and temperature and measure temperature using different scales (Celsius, Kelvin, Fahrenheit, etc.).
- Distinguish between conduction, convection, and radiation, and identify different methods to reduce heat losses.
- Understand the laws of thermodynamics, including the Carnot cycle, and their applications.

DETAILED CONTENTS

1. Units and Dimensions (10 Periods)

1.1. Need for measurement in engineering and science
1.2. Units of physical quantities (fundamental and derived units)
1.3. Systems of units (FPS, CGS, and SI units)
1.4. Dimensions and dimensional formulae of physical quantities

1.5. Principle of homogeneity of dimensions
1.6. Dimensional equations and their applications
1.7. Conversion of numerical values between different systems of units
1.8. Checking the correctness of physical equations and deriving relations among physical quantities
1.9. Limitations of dimensional analysis
1.10. Error in measurement, accuracy, and precision of instruments
1.11. Estimation of probable errors in measurement results
1.12. Application of units and dimensions in measuring length, diameter, circumference, volume, surface area, etc., of metallic and non-metallic blocks, wires, pipes, etc.

2. Force and Motion (10 periods)

2.1. Scalar and vector quantities, their representation, and examples
2.2. Addition and subtraction of vectors using the triangle and parallelogram laws
2.3. Scalar and vector products
2.4. Resolution of vectors and its application to a lawn roller
2.5. Force, momentum, conservation of linear momentum, and its applications (e.g., recoil of guns)
2.6. Impulse and its applications
2.7. Circular motion (uniform and non-uniform), angular displacement, velocity, acceleration, frequency, and time period
2.8. Relation between linear and angular velocity, linear and angular acceleration
2.9. Central force, centripetal and centrifugal forces and their applications (e.g., banking of roads, bending of cyclists)
2.10. Application of various forces in lifts, cranes, large steam engines, and turbines

3. Work, Power, and Energy (10 periods)
3.1. Work and its units, examples of zero, positive, and negative work
3.2. Conservative and non-conservative forces
3.3. Friction: modern concept, types, laws of limiting friction, coefficient of friction, and its engineering applications
3.4. Work done in moving objects on horizontal and inclined planes with rough and smooth surfaces
3.5. Energy and its units: kinetic energy, potential energy, work-energy theorem
3.6. Principle of conservation of mechanical energy, transformation of energy
3.7. Power and its units, calculation of power
3.8. Application of friction in the brake system of vehicles, bicycles, scooters, cars, trains, etc.

4. Rotational Motion (10 periods)

4.1. Concept of translatory and rotational motion with examples
4.2. Definition of torque, angular momentum, conservation of angular momentum, and examples
4.3. Moment of inertia, its physical significance, radius of gyration, theorems of parallel and perpendicular axes
4.4. Moment of inertia of rod, disc, ring, hollow and solid sphere
4.5. Concept of flywheel
4.6. Rotational kinetic energy
4.7. Comparison of linear motion and rotational motion
4.8. Application of rotational motion in transport vehicles and machines

5. Motion of Planets and Satellites (08 periods)

5.1. Gravitational force, Kepler's laws of planetary motion
5.2. Acceleration due to gravity and its variation
5.3. Gravitational potential, potential energy
5.4. Motion of satellites, orbital velocity, time period
5.5. Total energy, binding energy, escape energy, escape velocity
5.6. Types of satellites (geo-stationary, semi-synchronous, polar) and their uses in science and technology
5.7. Concept of black holes

6. Properties of Matter (12 periods)

6.1. Elasticity: stress, strain, types of elasticity, Hooke's law, stress-strain curve
6.2. Pressure: definition, units, atmospheric pressure, gauge pressure, absolute pressure, Fortin's Barometer, and its applications
6.3. Surface tension: concept, units, angle of contact, capillary action, determination of surface tension
6.4. Viscosity and coefficient of viscosity: terminal velocity, Stoke's law, effect of temperature on viscosity
6.5. Fluid motion, streamline and turbulent flow, Reynolds number
6.6. Equation of continuity, Bernoulli's theorem, and their applications

7. Heat and Thermodynamics (10 periods)

7.1. Difference between heat and temperature
7.2. Modes of heat transfer: conduction, convection, and radiation
7.3. Different temperature scales and their relationship
7.4. Expansion of solids, liquids, and gases, coefficient of linear, surface, and cubical expansions
7.5. Heat conduction in a metal rod, temperature gradient, coefficient of thermal conductivity
7.6. Isothermal and adiabatic processes
7.7. Zeroth, First, and Second laws of thermodynamics
7.8. Heat engines, Carnot cycle
7.9. Application of various thermometry systems in refrigeration and air conditioning, etc.

LIST OF PRACTICALS (PERFORM A MINIMUM OF SIX EXPERIMENTS)

1. Determination of the radius of a wire and its volume using vernier calipers and a screw gauge.
2. Finding the value of acceleration due to gravity using a simple pendulum.
3. Determination of the radius of curvature of convex and concave mirrors using a spherometer.
4. Verification of the parallelogram law of forces.
5. Study of the conservation of energy of a rolling ball or cylinder on an inclined plane.
6. Determination of the moment of inertia of a flywheel about its axis of rotation.
7. Determination of atmospheric pressure using Fortin's Barometer.
8. Determination of the viscosity of glycerin using Stoke's method.
9. Determination of the coefficient of linear expansion of a metal rod.

10. Determination of the force constant of a spring using Hooke's law.

INSTRUCTIONAL STRATEGY

The teacher can use various teaching aids such as live models, charts, graphs, and experimental kits to impart effective instruction in the subject. It is recommended to explain field applications before teaching the basics to develop a proper understanding of the physical phenomena. Demonstrations and animations can make the subject interesting and foster scientific temper in students. Planning a tour of a Science Park or planetarium in nearby areas can enhance interest in the course.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mid-Term and End-Term written tests
- Model making
- Laboratory work and practical experiments
- Viva voce

RECOMMENDED BOOKS

1. Textbook of Physics for Class XI (Part-I, Part-II) by N.C.E.R.T., Delhi
2. Concepts of Physics by H.C. Verma, Vol. I & II, Bharti Bhawan Ltd., New Delhi
3. Comprehensive Practical Physics, Vol. I & II by J.N. Jaiswal, Laxmi Publications (P) Ltd., New Delhi
4. B.Sc. Practical Physics by C.L. Arora, S. Chand Publication
5. Engineering Physics by P.V. Naik, Pearson Education Pvt. Ltd., New Delhi
6. Engineering Physics by D.K. Bhhatacharya & Poonam Tandan, Oxford University Press, New Delhi
7. Modern Engineering Physics by S.L. Gupta, Sanjeev Gupta, Dhanpat Rai Publications
8. V. Rajendran, Physics-I, Tata McGraw-Hill Publication, New Delhi
9. Arthur Beiser, Applied Physics, Tata McGraw-Hill Publication, New Delhi
10. Physics Volume 1, 5th edition by Haliday Resnick and Krane, Wiley Publication

TOPIC WISE DISTRIBUTION OF PERIODS AND MARKS

Topic No.	Time Allotted	Marks Allotted
1	10	15
2	10	15
3	10	15
4	10	15
5	08	10
6	12	16
7	10	14
Total	**70**	**100**

1.4 GENERAL MECHANICAL ENGINEERING

L	T	P
6	-	4

RATIONALE

For every practicing engineer, some knowledge of Mechanical Engineering relevant to their discipline is a must. This paper is meant to provide the would-be textile technologists with elements of mechanical engineering relevant to their work.

LEARNING OUTCOMES

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

- Understand the foundations and installation principles.
- Identify different types of pipes and pipe fittings and their applications.
- Explain various kinds of bearings, lubrication methods, and their application in textile machinery.
- Describe power transmission and material handling techniques in textile machinery.
- Identify different types of couplings, clutches, eccentrics, and cams and understand their function and use.
- Understand different types of fuels, combustion processes, and properties of liquid fuels.
- Explain the concepts of thermodynamics and its application in dealing with gases and vapors.
- Describe steam generation, steam generators, and the use of steam in textile industry.
- Understand the working principles of pumps, air compressors, and their application in textile industry.
- Explain the principles of refrigeration and air conditioning, including the properties of refrigerants.
- Demonstrate practical knowledge of key components such as biogas plant, wind mill, solar cooker, and voltaic cell type solar energy converter.
- Identify and understand different types of keys, keyways, splined shafts, pins, and bolts.
- Describe different types of clutches, couplings, bearings, gears, and gear trains.
- Demonstrate knowledge of compressors, tension helical springs, slider crank mechanism, and quick return mechanism.
- Perform practical exercises related to velocity ratio determination of spur gear train, velocity diagram of a four-bar chain mechanism, and performance evaluation of a solar cooker.

DETAILED CONTENTS

1. Foundations And Installations (8 Periods)

1.1. General principles and considerations for machine foundations

1.2. Vibrations in machine foundations

1.3. Layout of foundation bolts

1.4. Alignment of machines

1.5. Care and precautions in machine installation

1.6. Introduction to Indian Standards on machine foundations

1.7. Practice in blueprint reading for installations

2. **Pipe And Pipe Fittings**: **(8 Periods)**

2.1. Classification of pipes according to materials used and field of application

2.2. IS specifications of water, air, and steam pipes

2.3. Various types of pipe fittings and their applications

2.4. Laying of pipes

2.5. Cutting, threading, and jointing of pipes

3. **Bearings And Lubrication** **(8 Periods)**

3.1. Various kinds of bearings

3.2. Bush bearing, ball and roller bearing, thrust bearing, and their application in textile machinery

3.3. Principle of film lubrication

3.4. Various methods of lubrication

3.5. Lubricants and their properties

3.6. Selection of lubricants for various textile machinery

4. **Power Transmission & Material Handling** **(8 Periods)**

4.1. Different types of trolleys used in process house

4.2. Belt and gear drive

4.3. Types of gears: spur gear, bevel gear, helical gear, worm and worm wheel, rack and pinion

4.4. Power transmission by belt, chain, and gears

4.5. Application of various kinds of gears and drives in textile machinery

4.6. Variable speed drives

5. **Couplings, Clutches, Eccentrics and Cams** **(8 Periods)**

5.1. Necessity of coupling

5.2. Types of couplings: rigid and flexible couplings, universal coupling, fluid coupling

5.3. Introduction to common types of clutches, eccentrics, and cams

5.4. Function and use of clutches, eccentrics, and cams

6. FUELS AND COMBUSTION **(8 Periods)**

6.1. Common solid, liquid, and gas fuels

6.2. Composition, higher and lower calorific values of fuels

6.3. Calculation of air required for complete combustion

6.4. Concept of excess air in boiler furnace combustion

6.5. Heat carried away by flue gases

6.6. Flue gas analysis by Orsat apparatus

6.7. Specific properties of liquid fuels such as knock resistance, flash point, flame point, solidification point

7. **Thermodynamics** **(8 Periods)**

7.1. Concept of thermodynamic systems and surroundings

7.2. Work and its relation to heat

7.3. First law of thermodynamics and its application to different processes

7.4. Representation of processes in P-V diagram

7.5. Calculation of work done

7.6. Second law of thermodynamics

7.7. Concept of enthalpy, entropy, and specific volume of thermodynamic systems

7.8. Concept of heat engine, heat pump, and refrigerator

7.9. Carnot cycle efficiency, coefficient of performance

7.10. Steady state flow process and its equation

8. **Steam Generation and Steam Generators** **(10 Periods)**

8.1. Steam generation from water

8.2. Pressure and temperature curve of steam generation

8.3. Wet, dry saturated, and superheated steam

8.4. Saturation pressure, temperature, degree of superheat, enthalpy, entropy, and specific volume of steam

8.5. Use of steam tables for calculations

8.6. Introduction to water tube and fire tube boilers

8.7. Boiler mountings and accessories

8.8. Steam traps, reducers, expansion bends

8.9. Boilers specification

8.10. Equivalent evaporation, boiler efficiency, draught, chimney height, conditions for maximum draught

8.11. Measurement of steam consumption

9. **Pumps & Air Compressors (8 Periods)**

9.1. Working principles of reciprocating, centrifugal, and vacuum pumps

9.2. Blowers and compressors, fans and exhausts

9.3. Difference between reciprocating and rotary compressors

9.4. Types and working of single-stage and multi-stage compressors

9.5. Power required to drive a single-stage compressor

9.6. Volumetric efficiency and its effect on temperature

9.7. Use of compressed air in the textile industry

10. **Refrigeration And Air Conditioning (10 Periods)**

10.1. Meaning and application of refrigeration

10.2. Unit of refrigeration

10.3. Refrigeration methods: Bell Coleman air cycle, air refrigerator, vapor compression refrigeration

10.4. Analysis of simple saturated cycle for vapor compression refrigerator

10.5. Characteristics of good refrigerants

10.6. Properties of common refrigerants: NH3, CO2, SO2, Fe-12

10.7. Meaning and application of air conditioning

10.8. Gas and vapor mixture

10.9. Dry and wet bulb temperature, dew point, depression of wet bulb temperature and dew point

10.10. Saturated air, specific humidity, relative humidity, absolute humidity, humid specific volume, heat enthalpy of moist air

10.11. Use of psychometric charts and tables

10.12. Sensible heating and cooling

10.13. Humidification and dehumidification methods

10.14. Air conditioning for human comfort

10.15. Air conditioning for summer and winter

10.16. Industrial air conditioning

GENERAL MECHANICAL ENGINEERING LAB

Demonstration of the following for study and sketch:

1. Bio Gas Plant
2. Wind Mill
3. Solar Cooker
4. Voltaic Cell Type Solar Energy Converter

Key components:

1. Keys, keyways, and splined shafts (e.g., jib head key, flat key, saddle key, woodruff key, feather key, pin key, splined shaft)
2. Pins (split pin, taper cotter type split pin, cottor pin, cottor bolts)
3. Foundation bolts (Lewis's rag bolt, fish tail bolt, square head bolt)
4. Friction clutch and coupling (cone clutch, plate clutch, muff coupling, flange coupling, universal or Hook's joint coupling, flexible coupling - belt and pin type, coil spring type)
5. Bearings (plane, bush, split step bearings, ball roller bearings, thrust bearings)
6. Gears (spur gear, single and double helical gears, bevel gears)
7. Gear trains (simple spur gear train, compound gear train, epicyclic gear train)
8. Compressor and tension helical springs
9. Slider crank mechanism and quick return mechanism Performance Practical's: 10. Determination of velocity ratio of a spur gear train
11. Velocity diagram of a four-bar chain mechanism
12. Performance evaluation of a solar cooker

NOTE Field visits are recommended for equipment not available in the institution, such as biogas plants, windmills, and boilers. Models of boilers may be procured for study purposes.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	10
2	8	10
3	8	10
4	8	10
5	8	10
6	8	10
7	8	10
8	10	10
9	8	10
10	10	10
Total	**84**	**100**

1.5 ENGINEERING DRAWING

L	T	P
-	-	10

RATIONALE

Drawing is the language of engineers and technicians. Reading and interpreting engineering drawings is their day-to-day responsibility. The subject aims to develop basic graphic skills in students, enabling them to use these skills in the preparation, reading, and interpretation of engineering drawings. The emphasis should be on developing conceptual skills in students following BIS SP 46 - 1988.

Note:

i. First angle projection is to be followed.
ii. A minimum of 25 sheets should be prepared, including at least 2 sheets on AutoCAD.
iii. Instructions relevant to various drawings may be given along with appropriate demonstrations before assigning drawing practice to students.

LEARNING OUTCOMES

After completing the subject, students will be able to:

- Identify and use different grades of pencils and other drafting instruments used in the engineering field.
- Draw freehand sketches of various objects.
- Utilize various types of lines used in engineering drawing.
- Read and apply different dimensioning methods to objects.
- Use different types of scales and apply them in reading and reproducing drawings of objects and maps.
- Draw 2-dimensional views of objects from different angles (orthographic views).
- Draw and interpret complete inner hidden details of objects not visible in normal view.
- Make projections of solids.
- Generate isometric (3D) drawings from different 2D (orthographic) views/sketches.
- Identify conventions for different engineering materials, symbols, sections of regular objects, and general fittings used in civil and electrical household appliances.
- Draw different types of machine drawings.
- Use basic commands of AutoCAD.

DETAILED CONTENTS

1. Introduction to Engineering Drawing (03 sheets)

1.1. Introduction to drawing instruments, materials, and different types of lines in engineering drawings as per BIS specifications.

1.2. Practice of vertical, horizontal, and inclined lines, triangles, rectangles, circles, hexagonal, and pentagon shapes using drawing instruments.

1.3. Freehand and instrumental lettering (Alphabet and numerals) - capital letters, vertical and inclined at 75 degrees.

2. Dimensioning Technique (01 sheet)

2.1. Necessity of dimensioning, methods, and principles of dimensioning (mainly theoretical instructions).

2.2. Dimensioning of overall sizes, circles, threaded holes, chamfered surfaces, angles, tapered surfaces, holes equally spaced on P.C.D., countersunk holes, counterbored holes, cylindrical parts, narrow spaces and gaps, radii, curves, and arches.

3. Scales (02 sheets)

3.1. Scales - their needs and importance (theoretical instructions), types of scales, definition of R.F. (representative fraction), and length of scale.

3.2. Drawing of plain and diagonal scales.

4. Orthographic Projections (06 sheets)

4.1. Theory of orthographic projections (elaborate theoretical instructions).

4.2. Projection of points in different quadrants.

4.3. Projection of straight lines (1st and 3rd angle).

4.4. Line parallel to both the planes.

4.5. Line perpendicular to any one of the reference planes.

4.6. Line inclined to any one of the reference planes.

4.7. Projection of planes - different laminae like square, rectangular, triangular, and circular shapes inclined to one plane, parallel and perpendicular to another plane (in 1st angle only).

4.8. Three views of orthographic projection of different objects (at least one sheet in 3rd angle).

4.9. Identification of surfaces.

5. Projection of Solid (01 sheet)

5.1. Definition and salient features of a solid.

5.2. Making projections - top view, front view, and side view of various types of solids.

6. Sections (02 sheets)

6.1. Importance and salient features of sections.

6.2. Drawing full sections, half sections, partial or broken-out sections, offset sections, revolved sections, and removed sections.

6.3. Conventional sectional representation of various materials, conventional breaks for shafts, pipes, rectangular, square, angle, channel, rolled sections.

6.4. Orthographic sectional views of different objects.

7. Isometric Views (02 sheets)

7.1. Fundamentals of isometric projections and isometric scale.

7.2. Isometric views of combinations of regular solids like cylinders, cones, cubes, and prisms.

8. Common Symbols and Conventions Used in Engineering (02 sheets)

8.1. Civil and electrical fitting symbols.

9. Introduction to Machine Drawing (08 Sheets)

9.1. Drawing the assembly from part details of objects.

9.2. Identifying and drawing different types of screw threads used in various machines and assemblies as per domestic and international standards.

9.3. Drawing different types of nuts, bolts, and washers.

9.4. Drawing various locking devices and foundation bolts.

9.5. Drawing different sections of various types of keys and cotter joints.

9.6. Drawing various riveted joints.

9.7. AutoCAD.

AutoCAD drawings will be evaluated internally by sessional marks and not by the final theory paper.

INSTRUCTIONAL STRATEGY

Teachers should show models of real components/parts for which drawings are to be made. Emphasis should be given to cleanliness, dimensioning, and layout of the sheet. Focus should be on the proper selection and use of drawing instruments. The institute should provide AutoCAD or other engineering graphics software for practice in engineering drawings. Teachers should undergo training in AutoCAD/Engineering Graphics. Separate labs for practice on AutoCAD should be established.

MEANS OF ASSESSMENT

- Sketches
- Drawings
- Use of software

RECOMMENDED BOOKS

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

1.6 TEXTILE FIBRE-I

L	T	P
4	-	4

RATIONALE

Textile fibers are essential components of the textile industry, and any education in textiles would be incomplete without knowledge of textile fibers. This subject aims to provide students with a comprehensive understanding of textile fibers, including their properties, classification, and uses. Whether students become textile technologists or textile chemists, knowledge of textile fibers is crucial in their field.

LEARNING OUTCOMES

Upon completion of the course, students will be able to:

- Understand the essential and desirable properties and classification of textile fibers.
- Comprehend the cultivation of cotton, including different varieties and the morphological structure of cotton fibers.
- Understand the properties of wool fibers, their structure, and their uses.
- Understand and explain the properties of silk fibers, their structure, and their uses.

DETAILED CONTENTS

1. Introduction (10 Periods)

1.1. Definitions related to textile fibers.
1.2. Classification of textile fibers.
1.3. Difference between staple and filament fibers.
1.4. Essential and desirable properties of textile fibers.
1.5. Advantages and disadvantages of natural fibers.

2. Cotton Fibers (12 Periods)

2.1. Cotton cultivation and harvesting.
2.2. Development of cotton fibers in the seed.
2.3. Cotton varieties and grading.
2.4. Morphological structure of cotton fibers.
2.5. Physical and chemical properties of cotton fibers.
2.6. Applications of cotton fibers.

3. Jute and Other Natural Fibers (12 Periods)

3.1. Jute cultivation.
3.2. Retting and extraction process.
3.3. Structure of jute fibers.
3.4. Physical and chemical properties of jute fibers.
3.5. Applications of jute fibers.
3.6. Introduction to other natural bast fibers (flax, hemp, ramie, banana, leaf fibers) and their applications.

4. Wool Fibers and Other Animal Fibers (12 Periods)

4.1. Types of wool and grading.
4.2. Morphological structure of wool fibers.
4.3. Chemical composition of wool fibers.

4.4. Physical and chemical properties of wool fibers.
4.5. Varieties of wool fibers and their applications.
4.6. Introduction to other animal fibers (angora fibers, camel hair fibers, goat fibers) and their applications.

5. Silk Fibers (10 Periods)

5.1. Types of silk and its production.
5.2. Chemical composition and morphological structure of silk.
5.3. Physical and chemical properties of silk fibers.
5.4. Applications of silk fibers.

RECOMMENDED BOOKS

1. "वस्त्र रेशे –उत्पादन विशेषताएँ एवं उपयोग" by DR. D.B. Shakyawar & Dr. M.K. Singh, Abhishek Publication Chandigarh/New Delhi.
2. E. P. G. Gohl and L. D. Vilensky, "Textile Science," 2nd Edition, Longman Cheshire, New Delhi, 1983.
3. "A Textbook of Fibres Science and Technology" by S. P. Mishra, New Age International (P) Ltd, 2000.
4. "Textile Fibres" by H.V.S. Murthy, Textile Association Publication, 1995.
5. "Textile Fibres-I" by Dr. V.A. Shenai.

LIST OF EXPERIMENTS

1. Distinguishing animal fibers from vegetable fibers:
   1.1. Using an alkali
   1.2. Using an acid

2. Distinguishing:
   2.1. Linen from cotton fibers
   2.2. Silk from wool fibers

3. Identifying textile fibers (such as cotton, wool, silk, jute) under a microscope and drawing their longitudinal and cross-sectional views.

4. Checking moisture regain of different natural textile fibers using a Shirley moisture meter and a reputable brand conditioning oven.

5. Determining the maturity ratio of cotton fibers using a 10% caustic soda solution.

6. Identifying natural textile fibers through:
   6.1. Staining test
   6.2. Solubility test
   6.3. Burning test

INSTRUCTIONAL STRATEGY

The subject can be taught through a combination of theoretical and practical approaches. Physical demonstrations of various fibers and yarns used in textiles can help students understand the characteristics and properties of different fibers. Industrial visits to textile factories or labs can provide practical exposure to the subject. Students should also be encouraged to prepare a collection of documents on various textile fibers.

MEANS OF ASSESSMENT

- Assignments and quizzes.
- Mid-term and end-term written tests.
- Mini models or chart preparations.
- Lab work and practical exercises.
- Viva voce (oral examination).

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	10	17
2.	12	22
3.	12	22
4.	12	22
5.	10	17
Total	**56**	**100**

SECOND SEMESTER

2.1 APPLIED MATHEMATICS - II

L	T	P
5	-	-

RATIONALE

The course of Applied Mathematics - II is designed to provide students with the necessary mathematical tools for understanding and solving engineering problems. The topics covered in this course, including integral calculus, differential calculus, numerical methods, and coordinate geometry, will develop the students' analytical and conceptual abilities**.**

LEARNING OUTCOMES

Upon completion of this course, students will be able to:
- Calculate simple integrals using various integration methods.
- Evaluate the area under curves and surfaces using definite integrals.
- Calculate area and volume under curves and solve related engineering problems.
- Apply numerical methods to solve engineering problems.
- Understand geometric shapes used in engineering problems through coordinate geometry.

DETAILED CONTENTS

1. Integral Calculus - I (20 Periods)
   - 1.1. Methods of indefinite integration:
   - 1.2. Integration by substitution.
   - 1.3. Integration by rational functions.
   - 1.4. Integration by partial fractions.
   - 1.5. Integration by parts.
   - 1.6. Integration of special functions.

2. Integral Calculus – II (20 Periods)
   - 2.1. Meaning and properties of definite integrals, evaluation of definite integrals.
   - 2.2. Applications:
   - 2.3. Length of simple curves.
   - 2.4. Finding areas bounded by simple curves.
   - 2.5. Volume of solids of revolution and center of mean of plane areas.
   - 2.6. Simpson's 1/3rd and Simpson's 3/8th rule, Trapezoidal Rule: their application in simple cases.
   - 2.7. Numerical solutions of algebraic equations:
   - 2.8. Bisection method.
   - 2.9. Regula-Falsi method.
   - 2.10. Newton-Raphson's method (without proof).
   - 2.11. Numerical solutions of simultaneous equations:
   - 2.12. Gauss elimination method (without proof).

3. Coordinate Geometry (2 Dimension) (18 Periods)
   3.1. Circle:
   3.2. Equation of a circle in standard form.
   3.3. Centre-radius form, diameter form, two-intercept form.

4. Coordinate Geometry (3 Dimension) (12 Periods)
   4.1. Straight lines and planes in space:
   4.2. Distance between two points in space.
   4.3. Direction cosine and direction ratios.
   4.4. Finding the equation of a straight line (without proof).

INSTRUCTIONAL STRATEGY

The basic elements of differential calculus, integral calculus, and differential equations should be taught conceptually, with real engineering applications that demonstrate the practical use of algorithms and theories. Numerical examples and exercises will aid in the understanding of the subject matter.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

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

2.2 APPLIED PHYSICS – II

L	T	P
5	-	2

RATIONALE

Applied physics encompasses the study of various topics related to the world around us. Its objective is to provide an understanding of our physical environment through observation and prediction of object behaviour. This course content focuses on imparting concrete knowledge of physical laws, their analysis, and their applications in different engineering and technological fields. Teachers are encouraged to provide examples of engineering and technology applications for each topic to help students appreciate and comprehend these concepts and principles. Throughout the course, adherence to SI units is recommended.

LEARNING OUTCOMES

Upon completing this subject, students will be able to:

- Define wave motion, its types (transverse and longitudinal), periodicity, and simple harmonic motion, and solve simple problems related to these concepts.
- Define terms such as frequency, amplitude, wavelength, and velocity of a wave.
- Explain various engineering, medical, and industrial applications of ultrasonics.
- Apply principles of acoustics to optimize sound effects in different types of buildings.
- Explain the concepts of diffraction, interference, and polarization.
- Define capacitance and its unit, and explain the function of capacitors in simple circuits, solving problems using the equation C=Q/V.
- Describe the role of free electrons in insulators, conductors, and semiconductors, as well as the qualitative understanding of potential, potential difference, and electromotive force.
- Explain the concept of electric current, resistance, and their measurement.
- List the effects of electric current and their common applications, state and apply Ohm's law, calculate the equivalent resistance of various resistor combinations, determine the energy consumed by an appliance, and distinguish between AC and DC electricity.
- Explain Biot-Savart's law, Ampere's law, and Lorentz force.
- State the laws of electromagnetic induction and describe the effect on a current-carrying conductor when placed in a magnetic field.
- Explain the operation of a moving coil galvanometer and a simple DC motor.
- Apply knowledge of diodes in rectifiers, adapters, ICs, and various electronic circuits. Apply the concept of light amplification in the design of various laser-based instruments and optical sources.
- Explain total internal reflection and apply this concept to optical fibers and their uses in the medical field and communication.

DETAILED CONTENTS

1. Wave motion and its applications (12 periods)

    1.1. Wave motion: transverse and longitudinal wave motion with examples, sound and light waves, relationship between wave velocity, frequency, and wavelength, and their applications.
    1.2. Wave equation: y = r sin wt, phase, phase difference, principle of superposition of waves.
    1.3. Simple Harmonic Motion (SHM): definition, characteristics, expressions for displacement, velocity, acceleration, time period, and frequency in S.H.M. Also includes energy of a body executing S.H.M., simple pendulum, and the concept of simple harmonic progressive wave.
    1.4. Free, damped, and forced oscillations, resonance with examples, Q-factor.
    1.5. Definition of pitch, loudness, quality, and intensity of sound waves, intensity level, echo, reverberation, Sabine formula for reverberation time (without derivation), coefficient of absorption of sound, methods to control reverberation time, and their applications. Acoustics of building defects and remedies.
    1.6. Ultrasonics: production, detection, properties, and applications in engineering and medical fields.

2. Wave Optics (6 periods)

    2.1. Dual nature of light, wave theory of light, laws of reflection and refraction, Snell's law, power of lens, magnification.
    2.2. Two-source interference, double-slit interference, interference due to thin films, Fresnel's biprism.
    2.3. Use of interference for highly efficient solar panels.
    2.4. Diffraction, single-slit diffraction, intensity calculation, etc.
    2.5. Polarization of electromagnetic waves, polarizing sheets, polarizing by reflection (Brewster's law), Malus' law, use of polaroid’s.

3. Electrostatics (12 periods)
    3.1. Concept of charge, Coulomb's law, electric field of point charges, electric lines of force and their properties, electric flux, electric potential, and potential difference.
    3.2. Gauss's law of electrostatics: Application of Gauss's law to find electric field intensity of straight charged conductors, plane charged sheets, and charged spheres.
    3.3. Capacitor and its working principle, capacitance and its units, capacitance of a parallel plate capacitor, series, and parallel combinations of capacitors (including numerical problems), charging and discharging of a capacitor.
    3.4. Dielectric and its effect on capacitance, dielectric breakdown.
    3.5. Application of electrostatics in electrostatic precipitation of microbes, moisture separation from air and gases in industry for pollution control (brief explanation only).

4. Current Electricity (12 periods)

4.1. Electric current, resistance, specific resistance, conductance, specific conductance, series and parallel combinations of resistances, factors affecting resistance, color coding of carbon resistances, Ohm's law, superconductivity.
4.2. Kirchhoff's laws, Wheatstone bridge, and its applications (meter bridge and slide wire bridge).
4.3. Concept of terminal potential difference and electromotive force (EMF), potentiometer.
4.4. Heating effect of current, electric power, electric energy, and its units (including related numerical problems), advantages of electric energy over other forms of energy.
4.5. Examples of application of DC circuits in various electrical and electronic equipment such as C.R.O., TV, audio-video systems, computers, etc.

5. Magneto Statics and Electromagnetism (12 periods)

5.1. Magnetic poles, force on a moving charge, circulating charges, force on a current-carrying wire, Hall effect, torque on a current loop.
5.2. Magnetic field due to moving charge (Biot-Savart's law), magnetic field due to current (Biot-Savart's law), parallel currents, field of a solenoid, Ampere's law.
5.3. Faraday's law, Lenz's law, motional EMF, induced electric fields.
5.4. Magnetic dipole and force on a magnetic dipole in a non-uniform field, magnetization, Gauss's law for magnetism.
5.5. Types of magnetic materials: diamagnetic, paramagnetic, and ferromagnetic materials with their properties.
5.6. Application of electromagnetism in AC/DC motors and generators.

6. Semiconductor Physics (8 periods)

6.1. Types of materials (insulator, semiconductor, conductor), intrinsic and extrinsic semiconductors, p-n junction diode and its V-I characteristics.
6.2. Diode as rectifier: half-wave and full-wave rectifier (center-tapped).
6.3. Semiconductor transistor: pnp and npn (concepts only).
6.4. Application of semiconductor diodes (Zener, LED) and transistors as amplifiers and oscillators.

7. Modern Physics (8 periods)

7.1. Lasers: concept of energy levels, ionizations and excitation potentials, spontaneous and stimulated emission, laser and its characteristics, population inversion, types of lasers (Ruby and He-Ne lasers), engineering and medical applications of lasers.
7.2. Fiber optics: total internal reflection and its applications, critical angle and conditions for total internal reflection, introduction to optical fibers, light propagation, types, acceptance angle, and numerical aperture, types and applications of optical fiber in communication.
7.3. Introduction to nanotechnology, nanoparticles, and nanomaterials.

LIST OF PRACTICALS (To perform a minimum of six experiments)

1. To determine the velocity of sound with the help of a resonance tube.
2. To find the focal length of a convex lens by the displacement method.
3. To find the refractive index of the material of a given prism using a spectrometer.
4. To find the wavelength of sodium light using Fresnel's biprism.
5. To verify the laws of resistances in series and parallel combinations.
6. To verify Ohm's law by drawing a graph between voltage and current.
7. To measure very low resistance and very high resistances using a slide wire bridge.
8. Conversion of a galvanometer into an ammeter and voltmeter of a given range.
9. To draw the hysteresis curve of a ferromagnetic material.
10. To draw the characteristics of a pn junction diode and determine knee and breakdown voltages.
11. To find the wavelength of the laser beam.
12. To find the numerical aperture of an optical fiber.

INSTRUCTIONAL STRATEGY

Teachers may use various teaching aids like live models, charts, graphs, and experimental kits to impart effective instruction in the subject. The teacher should explain field applications before teaching the basics to develop a proper understanding of the physical phenomenon. The use of demonstrations and animations can make the subject interesting and help develop scientific temper in the students. Teachers should plan a tour of Science Park/planetarium available in nearby areas to enhance students' interest in this course.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mid-term and end-term written tests
- Model making
- Actual lab and practical work
- Viva-Voice

RECOMMENDED BOOKS

5. Textbook of Physics (Part-I, Part-II) by N.C.E.R.T., Delhi
6. Concepts in Physics by HC Verma, Vol. I & II, Bharti Bhawan Ltd., New Delhi
7. A Textbook of Optics by Subramanian and Brij Lal, S Chand & Co., New Delhi
8. Practical Physics by C. L. Arora, S Chand publications
9. Engineering Physics by PV Naik, Pearson Education Pvt. Ltd., New Delhi
10. Modern Engineering Physics by SL Gupta, Sanjeev Gupta, Dhanpat Rai Publications
11. Physics Volume 2, 5th edition by Haliday Resnick and Krane, Wiley publication
12. Fundamentals of Physics by Haliday, Resnick & Walker, 7th edition, Wiley publication

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	12	18
2.	6	8
3.	12	18
4.	12	16
5.	12	16
6.	8	12
7.	8	12
Total	**70**	**100**

2.3 APPLIED CHEMISTRY

L	T	P
5	-	2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. 1. Atomic Structure, Periodic Table and Chemical Bonding (14 periods)

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

1.4. Definition of orbit and orbitals, shapes of s and p orbitals only, quantum numbers and their significance.
1.5. Aufbau's principle, Pauli's exclusion principle, and Hund's rule electronic configuration of elements with atomic number (Z) = 30 only. (Electronic configurations of elements with atomic number greater than 30 are excluded).
1.6. Modern periodic law and periodic table, groups and periods, classification of elements into s, p, d, and f blocks (periodicity in properties - excluded).
1.7. Chemical bonding and cause of bonding and types such as ionic bond in NaCl, sigma (σ) and pi (π) covalent bonds in H2, HCl, Cl2, elementary idea of hybridization in BeCl2, BF3, CH4, NH3, and H2O, VSEPR, Molecular orbital Theory.
1.8. States of Matter: Solid, Liquid & Gas, Metallic bonding - explanation with the help of electron gas (sea) model.

2. Fuels and Lubricants (18 periods)

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

3. Water (14 periods)

3.1. Demonstration of water resources on Earth using a pie chart.
3.2. Classification of water - soft water and hard water, action of soap on hard water, types of hardness, causes of hardness, units of hardness - mg per liter (mgL-1) and part per million (ppm) and simple numerical, pH and buffer solutions and their applications.
3.3. Disadvantages caused by the use of hard water in domestic and boiler feed water. Priming and foaming and caustic embrittlement in boilers.
3.4. Removal of hardness - Permutit process and Ion-exchange process.

4. Physico-Chemical methods for Water Quality Testing: (4 Periods)

4.1. Determination of pH using a pH meter, total dissolved solids (TDS).
4.2. Testing and Estimation of - alkalinity, indicator their types and application total hardness by EDTA method and O'Hener's Method. (chemical reaction of EDTA method are excluded).
4.3. Understanding of Indian Water Quality standards as per WHO.
4.4. Natural water sterilization by chlorine and UV radiation and reverse osmosis.

4.5. Municipality wastewater treatment. Definition of B.O.D and C.O.D.

4.6. Electrochemistry

4.7. Redox Reaction, Electrode Potential, Nernst equation, Electrochemical cell (Galvanic and Electrobytes), Nernst equation.

5. Corrosion and its Control (10 periods)

5.1. Definition of corrosion and factors affecting corrosion rate.

5.2. Theories of

5.3. Dry (chemical) corrosion - Pilling Bedworth rule.

5.4. Wet corrosion in an acidic atmosphere by hydrogen evolution mechanism.

5.5. Definition of passivity and galvanic series.

5.6. Corrosion control:

5.7. Metal coatings - Cathodic protection, Cementation on Base Metal Steel - Application of Metal Zn (Sheradizing), Cr (Chromozing), and Al (Calorizing), Sacrificial protection and impressed current voltage.

5.8. Inorganic coatings - Anodizing and phosphating.

5.9. Organic coatings - use of paints, varnishes, and enamels.

5.10. Internal corrosion preventive measures - alloying (with reference to passivating, neutralizing, and inhibition) and heat treatment (quenching, annealing).

6. Organic compounds, Polymers, and Plastics (10 periods)

6.1. Classification of organic compounds and IUPAC Nomenclature.

6.2. Definition of polymer, monomer, and degree of polymerization.

6.3. Brief introduction to addition and condensation polymers with suitable examples (PE, PS, PVC, Teflon, Nylon-66, and Bakelite).

6.4. Definition of plastics, thermoplastics, and thermosetting plastics with suitable examples, distinctions between thermoplastics and thermosetting plastics.

6.5. Applications of polymers in industry and daily life.

LIST OF PRACTICALS

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

INSTRUCTIONAL STRATEGY

Teachers may take the help of various models and charts while imparting instructions to make the concept clear. More emphasis should be laid on discussing and explaining practical applications of various chemical processes and reactions. In addition, students should be encouraged or motivated to

study those processes in more detail, which may find practical application in their future professional career.

MEANS OF ASSESSMENTS

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

RECOMMENDED BOOKS

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

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	14	20
2.	18	25
3.	14	20
4.	4	5
5.	10	15
6.	10	15
TOTAL	**70**	**100**

2.4 TEXTILE FIBRES-II

L	T	P
4	0	4

RATIONALE

Textile fibres are the primary input in the textile industry, and any education in the field of textiles remains incomplete without knowledge of textile fibres. Whether one is a textile technologist or a textile chemist, understanding textile fibres is essential. This course aims to provide a comprehensive understanding of textile fibres to the readers.

LEARNING OUTCOMES

- Upon completing the course, students will be able to:
- Explain the classification of synthetic fibres, including the role of degree of polymerization, molecular weight, and other properties required for fibre-forming polymers.
- Explain the manufacturing process of viscose fibres and their properties.
- Understand and explain different fibre spinning systems, such as melt spinning, solution spinning, dry spinning, etc.
- Explain the manufacturing process and properties of fibres like polyester, polyamide, polypropylene, and other high-performance fibres.
- Explain the manufacturing process of PAN (Polyacrylonitrile) and other high-performance fibres.

DETAILED CONTENTS

1. Classification of man-made fibres (12 Periods)
   1.1. Definition of regenerated and synthetic fibres.
   1.2. Concepts of molecular weight, degree of polymerization, orientation, and crystallinity.
   1.3. Characteristics of fibre-forming polymers.

2. Introduction to methods of fibre formation (12 Periods)
   2.1. Melt spinning.
   2.2. Manufacturing process of polyester fibres.
   2.3. Physical and chemical properties of polyester fibres.
   2.4. Applications of polyester fibres.

3. Polyamide Fibres (12 Periods)
   3.1. History of development.
   3.2. Different types of polyamide fibres.
   3.3. Manufacturing process of Nylon-6 and Nylon-66.
   3.4. Physical and chemical properties of Nylon-6 and Nylon-66.
   3.5. Applications of polyamide fibres.

4. Polyacrylonitrile (PAN) Fibres (10 Periods)
   4.1. Dry spinning
   4.2. Manufacturing process of acrylic fibre.
   4.3. Physical and chemical properties of acrylic fibres.
   4.4. Applications of acrylic fibres.

5. Introduction to regenerated fibres (10 Periods)
   5.1. Wet Spinning
   5.2. Raw materials for viscose rayon.
   5.3. Manufacturing sequence of viscose fibres.
   5.4. Introduction to Acetate and Cuprammonium rayons.

RECOMMENDED BOOKS

1. "वस्त्रेरेशे –उत्पादन विशेषताएँ एवं उपयोग" by DR. D.B. Shakyawar & Dr. M.K. Singh, Abhishek Publication Chandigarh/New Delhi.
2. "Textile Fibre" by Ghol and Valanslk.
3. "A Textbook of Fibres Science and Technology" by S. P. Mishra, New Age International (p) Ltd, 2000.
4. "Textile Fibres" by H. V. S. Murthy, Textile Association Publication, 1995.
5. "Textile Fibres-I" by Dr. V.A. Shenai.

LIST OF EXPERIMENTS

1. To distinguish:
   1.1. Nylon from other fibres
   1.2. Polyesters from other fibres
   1.3. Viscose rayon, Cuprammonium rayon, and Acetate rayon from other fibres
   1.4. Orlon Acrylic fibres from other fibres

2. To identify fibres:
   2.1. Viscose rayon, Polyester, Nylon, and Acrylic fibres under a microscope and draw their longitudinal and cross-sectional views

3. Checking moisture regain of different man-made textile fibres by Shirley moisture meter and by a good brand conditioning oven

4. To identify the man-made fibres by:
   4.1. Staining test
   4.2. Solubility test
   4.3. Burning test

5. To do quantitative estimation of fibres in a blend.

INSTRUCTIONAL STRATEGY

- Conduct physical demonstrations of various fibres and yarns used in textiles.
- Organize industrial visits for students.
- Assign students to prepare a document collection of various textile fibres.

MEANS OF ASSESSMENT

- Assignments and quizzes.
- Mid-term and end-term written tests.
- Preparation of mini models or charts.

- Actual lab work and practical assignments.
- Viva-voce examinations.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	12	22
2	12	22
3	12	22
4	10	17
5	10	17
Total	**56**	**100**

2.5 INTRODUCTION TO CARPET

L	T	P
6	-	-

RATIONALE

The fabrics prepared go under a variety of chemical processing before they reach the hands of the consumer. The processes have different objectives, but they are important for the quality and aesthetic sense added to the fabric, so is this paper here.

LEARNING OUTCOMES

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

- Understand basic terminologies related to carpets
- Classify types of carpets based on manufacturing technique
- Classify types of carpets based on design
- Understand various sectors related to handmade carpets in India
- Understand major fibers and yarns used in carpets

DETAILED CONTENTS

1. Basic definitions and terminologies used in carpet manufacture, functional and aesthetic requirements of a carpet. **(16 Periods)**

2. Classification of carpets based on manufacturing techniques: Handmade carpets (Knotted, tufted, and flat-woven) and Machine-made carpets (Tufted, woven, knitted, and non-woven) **(16 Periods).**

3. Classification of carpets based on design - Afghan carpets, Indian carpets, Persian carpets, Scandinavian carpets, Turkish carpets, Turkmen (Bukhara) carpets, Azerbaijani rug, Oriental carpets in Europe, Spanish carpets, Bulgarian carpets, French carpets, English carpets, Modern carpets. **(18 Periods)**

4. Brief introduction to the handmade carpet sector in India (domestic and exports). **(16 Periods)**

5. Major fibers and yarns used in carpets: Nylon, Polypropylene, Wool and wool-blends, Polyester, Acrylic, etc. **(18 Periods)**

INSTRUCTIONAL STRATEGY

Physical demonstration of various fibers and yarns used in carpets. Physical demonstration of various types of carpets. Industrial visits may be conducted for students. Students should prepare a document collection of various carpet designs.

MEANS OF ASSESSMENT

1. Assignments and quizzes
2. Mid-term and End-term written tests
3. Mini Model or chart preparation
4. Actual lab and practical work
5. Viva-voce

RECOMMENDED BOOK S

1. Journals and magazines carpet –c- world
2. वस्त्रेरेशे –उत्पादन विशेषताएँ एवं उपयोग – DR. D.B. Shakyawar & Dr. M.K. Singh, Abhishek Publication Chandigarh/ New Delhi.
3. Advances in Carpet Manufacture by K. K. Goswami, Woodhead Publishing
4. Journals & Magazines related to carpets
5. Carpet-e-World
6. Carpet Manufacture by Crawshaw
7. Tufted Carpet by Von Moody

SUGGESTED DISTRIBUTION OF MARKS

Topics	Time Allotted (hrs)	Marks Allotted (%)
1.	16	20
2.	16	20
3.	18	20
4.	16	20
5.	18	20
Total	**84**	**100**

2.6 WORKSHOP PRACTICE

L	T	P
-	-	10

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 to provide hands-on experience about the use of different tools and basic manufacturing practices. This subject aims at developing general manual and machining skills in the students. In addition, the development of dignity of labor, safety at the workplace, team working, and the development of the right attitude are the other objectives.

LEARNING OUTCOMES

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

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

DETAILED CONTENTS (Practical Exercises)

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

The following shops are included in the syllabus:

1. Fitting Shop
   - 1.1. Use of personal protective equipment and safety precautions while working.
   - 1.2. Basic deburring processes.
   - 1.3. Introduction to fitting shop tools, marking and measuring devices/equipment.
   - 1.4. Identification of materials. (Iron, Copper, Stainless Steel, Aluminium, etc.)
   - 1.5. Identification of various steel sections (flat, angle, channel, bar, etc.).
   - 1.6. Introduction to various fitting shop operations/processes (Hacksawing, Drilling, Chipping, and Filing).
   - 1.7. Job Practice

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

1.7.2. Job II: Filing a rectangular/square piece to maintain dimensions within an accuracy of ±0.25 mm.

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

1.7.4. Job IV: Drilling and tapping practice on MS Flat.

2. Sheet Metal Shop

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

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

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

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

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

2.6. Job Practice

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

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

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

2.7. Welding Shop – I

3. Introduction and importance of welding as compared to other material joining processes. Specifications and type of welding machines, classification and coding of electrodes, welding parameters, welding joints, and welding positions. Materials to be welded, safety precautions.

3.1. Job Practice

3.1.1. Job I: Practice of striking arc (Minimum 4 beads on 100 mm long M.S. flat).

3.1.2. Job II: Practice of depositing beads on a plate at different current levels. (Minimum 4 beads on M.S. plate at four settings of current level).

3.1.3. Job III: Preparation of a lap joint using the arc welding process.

3.1.4. Job IV: Preparation of a T-joint using gas welding or arc welding on 100 mm x 6 mm MS Flat

4. Foundry Shop

4.1. Study of metal and nonmetals

4.2. Study and Sketch of the Foundry tools

4.3. Study and sketch of Cupola and pit furnace

4.4. To prepare green molding sand and to prepare molds (single piece and double piece pattern sweep mold)

4.5. Casting of nonferrous (Lead or Aluminum)

5. Machine Shop

    5.1. Study and sketch of a lathe machine
    5.2. Study and Sketch of grinders, milling machine, drilling machine, and CNC machine.
    5.3. Plain and step turning and knurling practice.
    5.4. Study and sketch of planning/shaping machine and to plane a rectangle of cast iron.

MEANS OF ASSESSMENT

- Workshop jobs
- Report writing, presentation, and viva voce

RECOMMENDED BOOKS

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

THIRD SEMESTER

3.1 INDUSTRIAL SAFETY

(Common To Textile Chemistry, Textile Technology, Textile Design)

L	T	P
4	-	-

RATIONALE

Textile industry is one of the major industries of the country. Its safety problems are much more different than those of others. So it is vital to give youngsters willing to enter into this field, knowledge of general principles of industrial safety focusing on problems in the textile industry.

LEARNING OUTCOMES

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

- Interpret and apply legislative requirements, standards, and best practices in a variety of workplaces.
- Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards.
- Collect, manage, and interpret information and data to identify trends and issues of occupational safety and health at the workplace.
- Design, support, and evaluate health & safety programs and implement procedures using management principles and processes appropriate to the task.

DETAILED CONTENTS

1. Introduction (12 Periods)

1.1. Need for Industrial Safety - Legal Humanitarian, Economic and Social considerations.
1.2. Safe working conditions and productivity.
1.3. Unsafe conditions and hazards.
1.4. Cost of accidents: Direct or Indirect social cost, financial cost.
1.5. Role of management and workers' participation in Industrial Safety.
1.6. Safety management principles and practices.

2. Principles Of Accident Prevention (10 Periods)

2.1. Definitions: Accident, Injury, Dangerous occurrences, Unsafe acts, Unsafe conditions, and hazards.
2.2. Theories of accident prevention.
2.3. Principles and methods of accident prevention.

3. Safety Engineering (13 Periods)

3.1. Safeguarding of machines: Statutory provisions related to safeguarding machinery and working near unguarded machines.
3.2. Principle of machine guarding.
3.3. Ergonomics of machine guarding.
3.4. Types of guards and guarding machines in the textile industry.
3.5. Incidental safety devices.

3.6. Accidents and hazards.
3.7. Guarding of machines and safety precautions in Opening, Cleaning, Carding, Drawing, Combing, Fly frame, Ring frames, Rotors (spinning), Winding, Doubling, Warping, Sizing, and Weaving operations.
3.8. Material Handling:
  3.8.1. Ergonomics of material handling.
  3.8.2. Principles of the correct method of lifting objects of different sizes, shapes, and weights with safe use of accessories for manual handling.
  3.8.3. Safety aspects of design, construction, and use of material handling machinery used in the textile industry: Lifts, Forks, Motor Trolleys, Overhead cranes, and Chain Pulleys.
  3.8.4. Principle of good illumination at the workplace and its recommended minimum standard.
  3.8.5. Lighting and Color.
3.9. Danger From Electricity:
  3.9.1. Safe limits of amperage and voltages.
  3.9.2. Means for cutting overloads and short circuit protection.
  3.9.3. Earth fault protection.
  3.9.4. Protection of joints and conductors.
  3.9.5. Fire explosion: Common causes for industrial fire detection and alarm.
  3.9.6. Knowledge of water system, Carbon Dioxide System, Foam Extinguishers system, and Dry Chemical Extinguishing Systems for extinguishing fire.
  3.9.7. Sprinklers.

4. **Safety Precaution in Chemical Processes (13 Periods)**

4.1. Bleaching, Dyeing, Printing, Finishing, and Accidental hazards.
4.2. Chemical hazards in wet processing.
4.3. Effluent in textile processing.
4.4. Health and Welfare:
4.5. Health hazards in the Textile industry.
4.6. Dust and Fly.
4.7. Noise generated and control measures.
4.8. Occupational hazards, Occupational diseases.
4.9. Personal protective equipment.
4.10. Health and welfare measures: First Aid Facilities and other welfare measures like Hospital, Clinics.
4.11. Special precautions for specific work environments.

5. Safety Status (8 Periods)

5.1. Employees' welfare and legislation.
5.2. Indian Boiler Act and Regulation.
5.3. The Water (Control of Pollution) Act and Rules.
5.4. The Air (Pollution) Act and Rules.

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion, and literature review.

MEANS OF ASSESSMENT

As per BTE, UP guidelines.

RECOMMENDED BOOKS

1. The Chain Tester's Handbook - Chain Tester Association of Great Britain, London.
2. Rigging Manual - Construction Safety Association of Ontario, Canada.
3. Handbook of rigging for Construction and industrial operation - W E ROSSANGEL.
4. Report no 67 (1945) - N C Nelson, Great Britain Medical Research Council Industrial Health Research Board.
6. Illumination Engineering Vol. 54 - H R Blackwoll.
7. Forthlight Roofs - V R. & B.K.S. Ind. J.

SUGGESTED DISTRIBUTION OF MARKS

Topic no.	Time Allotted (Periods)	Marks Allotted (%)
1.	12	20
2.	10	20
3.	13	25
4.	13	25
5.	8	10
Total	**56**	**100**

3.2 ELECTRICAL TECHNOLOGY & ELECTRONICS

L	T	P
5	-	2

RATIONALE

The superiority of electricity as power over other means in use in home or industry cannot be denied. So, it is imperative to introduce the mechanical engineering students to electrical machines and their various uses.

LEARNING OUTCOMES

After completing the course, the students will be able to: • Faraday's Laws of electromagnetic induction. Self and mutual induction. • Relationship of voltage and current for pure resistance, pure inductance, and pure capacitive reactance, impedance. • Production of Three-phase voltage, advantages of three-phase supply. Concept of star and delta connections. • Measurement of power in a single phase and three-phase circuits by wattmeter, Use of digital multimeter for measurement of voltage, current, and testing of devices. • Basic idea of semiconductors P & N type. Semiconductor diodes, Zener diodes, and their applications in rectifiers. • Working principle, Constructional details of D.C. Generators & D.C. Motors. • Working principle and constructional details of a single-phase and 3-phase transformers.

DETAILED CONTENTS

1. Electric Induction (6 Periods)

1.1. Faraday's Laws of electromagnetic induction. Self and mutual induction. Statically and dynamically induced e.m.f., Lenz's law. Fleming's left-hand and right-hand rule.

2. A. C. Theory (6 Periods)

2.1. Production of alternating e.m.f. Definition of cycle, frequency, amplitude, time period, instantaneous, average, R.M.S. maximum values of sinusoidal wave. Form factor, peak factor. Representation of a sinusoidal quantity by a mathematical expression and phasor, phase and phase difference. Relationship of voltage and current for pure resistance, pure inductance, and pure capacitive reactance, impedance. Solution and phasor diagrams of simple R.L.C. series and parallel circuits. Active and reactive power. Significance of P.F.

3. Three Phase Circuits (6 Periods)

3.1. Production of Three-phase voltage, advantages of three-phase supply. Concept of star and delta connections. Relationship between phase and line values of currents and voltages, Power in three-phase circuits, simple numerical problems.

4. Measurement & Measuring Instruments (8 Periods)

4.1. Primary and secondary instruments-Indicating, Recording and Integrated instruments.

4.2. Working principle and construction of the following instruments.

4.3. Ammeter & Voltmeter (Moving coil & Moving Iron). Extension of their ranges.

4.4. Dynamometer type wattmeter.

4.5. Single Phase A. C. Energy Meter.

4.5.1. Measurement of power in a single phase and three-phase circuits by wattmeter, Use of digital multimeter for measurement of voltage, current, and testing of devices.

5. Electronics (6 Periods)

5.1. Basic idea of semiconductors P & N type. Semiconductor diodes, Zener diodes, and their applications in rectifiers. Transistors-PNP and NPN-their characteristics and uses as an amplifier (Brief description only). Principle characteristics and application of SCR. Devices like UJT, FET, DIAC, TRIAC (Brief introduction, Introduction to operational amplifier, Introduction to basic logic gates and microprocessors.

6. D. C. Machines (6 Periods)

6.1. D. C. Generator:

6.2. Working principle, Constructional details, e.m.f. equation, Types of generators and their applications.

6.3. D. C. Motor:

6.4. Working principle, Back e.m.f., Types of D. C. motor and elementary idea of their characteristics. Torque equation, Methods of speed control (Description Only).

7. Transformers (6 Periods)

7.1. Working principle and constructional details of a single-phase and 3-phase transformers, e.m.f. equation, Losses and efficiency, Cooling of transformers, Elementary idea of auto transformers and welding transformers.

8. Synchronous machines (8 Periods)

8.1. Alternators:

8.1.1. Working principle, Types of alternators, Constructional details, E.M.F. equation, Condition for parallel operation.

8.2. Synchronous Motors:

8.2.1. Working principle, Constructional details, Vector diagram, Effect of excitation on armature current and power factor, Synchronous condenser.

9. **Induction Motors (8 Periods)**

9.1. Three Phase Induction Motors:

9.1.1. Working principle and constructional details-Types of induction motors- Slip ring and Squirrel cage. Slip in induction motors. Speed torque characteristic, Starting and speed control. Application of induction motors in industry. General faults and their remedies.

9.2. Single Phase Induction Motors:

9.2.1. Working principle and constructional details and application of single-phase motors (Split phase, Capacitor start and Run Motor). A. C. series motors, General faults and their remedies.

10. **Electro Heating (5 Periods)**

10.1. Types of electro heating. Brief description of resistance ovens and induction furnace and core furnaces.

11. Electroplating (5 Periods)

11.1. Importance of electroplating, Principle of electroplating and equipment used. Processes used in electroplating, Anodizing.

RECOMMENDED BOOKS

1. A Textbook of Electrical Technology Vol - I | Basic Electrical Engineering | By S. Chand'sby B L Theraja and AK Theraja

2. A Textbook of Electrical Technology Volume II : AC And DC Machines Book 1 of 1: A Textbook of Electrical Technology | by B L Theraja and A K Theraja

3. Electrical & Electronics Engineering Materials, Asian Publishers. Ram Prakash Gupta and Pooja Yadav.

LIST OF PRACTICALS

1. To change the speed and direction of rotation of d.c. shunt motor by
   1.1. Armature control method.
   1.2. Field control method.
2. To change the speed and direction of rotation of d.c. compound motor by
   2.1. Armature control method.
   2.2. Field control method.
3. To measure the terminal voltage with variation of load current of
   3.1. D.C. shunt generator.
   3.2. D.C. compound generator.
4. To perform load test on a single-phase transformer and determine its efficiency.
5. To start and run an induction motor by
   5.1. Star Delta Starter.
   5.2. Auto Transformer Starter.
6. To measure slip of an induction motor by direct loading.
7. To start and change the direction of rotation of an induction motor.
8. To measure the transformation ratio of a single-phase transformer.
9. To measure power and P.F. in a single-phase circuit by Ammeter, Voltmeter, and Wattmeter.
10. To measure power and P.F. in a 3 phase/A.C. circuit by two-wattmeter method.
11. To calibrate a single-phase energy meter at different P.F.'s and different loads.
12. To locate the faults in an electrical machine by a megger.
13. To connect a fluorescent tube and note its starting and running current.
14. To draw characteristics of Silicon Controlled Rectifier (SCR).
15. Testing of electrical devices - Zener, Diode, Transistor, FET, UJT, SCR.
16. Use of operational amplifier as an adder, subtractor, comparator, differentiator, and integrators.

INSTRUCTIONAL STRATEGY

Lectures, assignments, tutorial, group discussion, and literature review.

MEANS OF ASSESSMENT

As per BTE, UP guidelines.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	6	8
2.	6	8
3.	6	8
4.	8	12
5.	6	8
6.	6	8
7.	6	8
8.	8	13
9.	8	13
10.	5	7
11.	5	7
Total	**70**	**100**

3.3 YARN MANUFACTURING PROCESS

L	T	P
4	2	-

RATIONALE

Textile design students need to have introductory knowledge and skills related to various fibers, yarns, and fabrics. This subject provides an understanding of different types of yarns, their manufacturing techniques, numbering systems, and characteristics.

LEARNING OUTCOMES

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

- Understand different types of yarns and their uses, along with a brief idea of their manufacturing processes.
- Familiarize themselves with the numbering system and characteristics of yarns.

DETAILED CONTENTS

1. Flow chart of the processes involved in the conversion of fibers into combed and carded yarn and the objectives of different processes. **(10 periods)**

2. Brief study and working principles of the blow room and carding. **(12 periods)**

3. Brief description and working of the draw frame, combing, and speed frame. **(12 periods)**

4. Brief description and working of the ring frame, doubling frame, and reeling. **(14 periods)**

5. Brief introduction to open-end spinning and its properties. **(12 periods)**

6. Types of yarns, yarn faults, and their uses. **(14 periods)**

7. Numbering system of yarns. **(10 periods)**

INSTRUCTIONAL STRATEGY

Students may be exposed to different types of textile manufacturing processes through textile mill visits so that they can understand the subject properly.

MEANS OF ASSESSMENT

- Assignments and quizzes.
- Mid-term and end-term written tests.
- Mini models or chart preparation.
- Actual lab work and practical exercises.
- Viva-voce.

RECOMMENDED BOOKS

8. A.R. Khare (All Books).

9. P. Venkat Subramaniam.

10. W. Klein, The Textile Institute Publication – Manual of Textile Engineering - Short Staple Spinning Series Vol. I to V.

11. 'The Characteristics of Raw Cotton' by P. Lord. The Textile Institute Publication, Manual of Cotton Spinning Vol. II, Part-I.

12. 'Opening and Cleaning' by Shirley. The Textile Institute Publication, Manual of Cotton Spinning Vol. II, Part-II.

13. Carl Lawrence, Fundamentals of Spun Yarn Technology.

14. 'Opening Cleaning and Picking' by Dr. Zoltan S. Szaloki, Institute of Textile Engineering, Virginia.

15. 'Cotton Ginning' Textile Progress, The Textile Institute Publication.

16. Blow-room and Carding - Training Programme conducted by NCUTE, IIT, Delhi.

17. Essential calculations of practical cotton spinning by TK Pattabhiraman.

18. Carding by F. Charanlay. The Textile Institute publication, Manual of cotton spinning series Vol III.

19. Zoltan, S. Szaloky, Drawing, Combing, roving, and speed frame, The Institute of Textile Engineering, Virginia.

20. J.H. Black, draw frame, combing, and speed frame, The Textile Institute publication, Manual of cotton spinning Vol-IV Part II.

21. Cotton spinning by ATIRA.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted
1	10	12
2	12	15
3	12	15
4	14	16
5	12	16
6	14	16
7	10	10
Total	**84**	**100**

3.4 CARPET YARN MANUFACTURING

L	T	P
6	2	8

RATIONALE

Yarn is a fundamental component of carpets, and woolen yarns are most suitable for carpet manufacturing. The manufacturing systems for woolen yarn differ from those of cotton yarn. This course provides necessary knowledge for diploma engineers working in the field of carpet manufacturing.

LEARNING OUTCOMES

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

- Understand the mechanical processing of wool fibers.
- Understand woolen and worsted fiber spinning systems.
- Understand the process steps involved in converting wool fibers into yarn.
- Understand the requirements of carpet yarn for handmade and machine-made carpets.
- Understand the specific requirements of cotton, jute, silk, and other yarns used in carpet manufacturing.
- Understand the limitations of the Ring Spinning system and explore possibilities of new spinning systems for carpet yarn manufacture.
- Understand friction spinning and the properties of these yarns with respect to carpets.

DETAILED CONTENTS

1. Wool-shearing, clipping, and categorization. Impurities present in wool. **(14 Periods)**

2. Wool fiber spinning systems: Woolen, semi-worsted, and worsted systems. Flow chart and brief description of each system. Differences among these systems and their utilities. **(14 Periods)**

3. Various process steps involved in converting wool fibers into yarn: Blending, opening, carding, gilling, combing, roving, and ring spinning. Brief description, principle of operation, and objectives. **(14 Periods)**

4. Requirements of carpet yarn with regards to count, twist, bulk. Faults in carpet yarn and their remedies. Other properties of carpet yarn required in handmade and machine-made carpets. **(14 Periods)**

5. Specific requirements of cotton, jute, silk, and other yarns used in carpet manufacturing. **(14 Periods)**

6. Limitations of the Ring Spinning system, possibilities of new spinning systems for carpet yarn manufacture. Brief idea of friction spinning and properties of these yarns with respect to carpets. **(14 Periods)**

LIST OF PRACTICALS

1. Study the various parts of the willow machine and their function.

2. Study the waste percentage extracted in the willow machine.

3. Study the various parts and settings of a woolen cum semi-worsted card and passage of material.

4. Study the various settings of a woolen card.

5. Study the noil percentage extracted in combing.

6. Determine the production per hour of a woolen cum semi-worsted carding machine.

7. Study the various parts of a mule spinning frame, their function, and the passage of material.

8. Study the twist constant of a woolen ring frame and calculate the twist per inch in yarn.

9. Determine the production per spindle/hour in a mule spinning frame.

10. Study the various parts of a gilling machine and their function and the passage of material.

11. Determine the draft constant, total draft, and distribution of draft in a gilling machine.

12. Determine the production/hour of a gilling machine.

13. Study the various parts of a roving frame and their function.

14. Study the transmission of drive and production/hr. of a roving frame.

15. Study various parts of semi-worsted R/F (with drafting) and their functions.

16. Study the production per spindle hour of a semi-worsted ring frame (with drafting).

INSTRUCTIONAL STRATEGY

Physical demonstrations of various yarns used in carpets. Conduct industrial visits to carpet yarn spinning mills. Students should prepare a document collection of various yarns used in the manufacturing of carpets.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mid-term and end-term written tests
- Mini models or chart preparation
- Actual lab work and practical exercises
- Viva-voce

RECOMMENDED BOOKS

1. Worsted Yarn Technology by Eric Oxtoby
2. Miles Collins, Woollen and Worsted Spinning, Abhishek Publications
3. New Spinning Technology by W. Klein
4. C. Vickerman, Woollen Spinning, Abhishek Publications, Chandigarh-17 (India)
5. W.S. Simpson and G.H. Crawshaw, Wool: Science and Technology, Woodhead Publishing Limited, Cambridge, England

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted
1	14	16
2	14	16
3	14	16
4	14	16
5	14	18
6	14	18
Total	**84**	**100**

3.5 BASICS OF INFORMATION TECHNOLOGY

L	T	P
-	-	6

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

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

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

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

TOPICS TO BE EXPLAINED THROUGH DEMONSTRATION

1. Introduction to Computers and Peripherals.
   1.1. Components of Computer, Types of Computers, CPU, RAM, ROM, Hard disk, USB,

Flash drive, CD, DVD, Blu-ray, Keyboard, Mouse, Monitor, LCD, Printer, Plotter, Scanner, Modem, Sound Cards, Speakers, CMOS battery, Sharing of Printers.

2. Operation System and Application Software
   2.1. System Software, Application Software, Virtualization Software, Utility Software, MS Office/Open Office/LibreOffice, working with window, Desktop components, Menu bars, creating a shortcut of a program. Installation of Application software, Antivirus and Drivers.

3. Word Processing, Spreadsheet, and Presentation
   3.1. Usage and creation of word document, spreadsheets, and presentation, Google Suite (Google Drive, Google Sheet, Google Doc, Google Presentation).

4. Internet
   4.1. Basics of Networking – LAN, WAN, Wi-Fi technologies, Concept of IP Addresses, DNS, Search Engines, email, Browsing, and cyber laws.

LIST OF PRACTICAL EXERCISES

1. Identify various components, peripherals of a computer and list their functions.
2. Installation of various application software and peripheral drivers.
3. Installation of operating system (Windows/Linux/others).
4. Creation and Management (Rename, delete, search of file and folders).
5. Installation of Antivirus and remove viruses.
6. Scanning and printing documents.
7. Browsing, Downloading, Information using Internet.
8. E-Mail ID creation, comparing, sending and receiving e-mail. Attaching a file with an e-mail message.
9. Word Processing (MS Office/Open Office)
   9.1. File Management
      9.1.1. Opening, creating and saving a document, locating files, copying contents in some different file(s), protecting files, giving password protection for a file.
   9.2. Page setup
      9.2.1. Setting margins, tab setting, ruler, indenting.
   9.3. Editing a document
      9.3.1. Entering text, cut, copy, paste using toolbars.
   9.4. Formatting a document
      9.4.1. Using different fonts, changing font size and color, changing the appearance through bold/italic/underlined, highlighting a text, changing case, using subscript and superscript, using different underline methods.
      9.4.2. Aligning text in a document, justification of a document, inserting bullets and numbering.
      9.4.3. Formatting paragraph, inserting page breaks and column breaks, line spacing.

9.4.4. Use of headers, footers: Inserting footnote, endnote, use of comments, autotext.

9.4.5. Inserting date, time, special symbols, importing graphic images, drawing tools.

9.5. Tables and Borders

9.5.1. 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.

9.5.2. Print preview, zoom, page setup, printing options.

9.5.3. Using find, replace options.

9.6. Using Tools like

9.6.1. Spellchecker, help, use of macros, mail merge, thesaurus, word content and statistics, printing envelopes and labels.

9.6.2. Using shapes and drawing toolbar.

9.6.3. Working with more than one window.

10. Spreadsheet Processing (MS Office/Open Office/LibreOffice)

10.1. Starting excel, open worksheet, enter, edit data, formulas to calculate values, format data, save worksheet, switching between different spreadsheets.

10.2. Menu commands:

10.2.1. Create, format charts, organize, manage data, solving problems by analyzing data.

10.2.2. Programming with Excel Worksheet, getting information while working.

10.3. Workbooks:

10.3.1. Managing workbooks (create, open, close, save), working in workbooks, selecting the cells, choosing commands, data entry techniques, formula creation and links, controlling calculations.

10.3.2. Editing a worksheet, copying, moving cells, pasting, inserting, deletion cells, rows, columns, find and replace text, numbers of cells, formatting worksheet, conditional formatting.

10.4. Creating a chart:

10.4.1. Working with chart types, changing data in a chart, formatting a chart, use chart to analyze data.

10.4.2. Using a list to organize data, sorting and filtering data in a list.

10.5. Retrieve data with a query:

10.5.1. Create a pivot table, customizing a pivot table. Statistical analysis of data.

10.6. Exchange data with other applications:

10.6.1. Embedding objects, linking to other applications, import, export document.

11. PowerPoint Presentation (MS Office/Open Office/LibreOffice)

11.1. Introduction to PowerPoint

11.1.1. How to start PowerPoint.

11.1.2. Working environment: concept of toolbars, slide layout & templates.

11.1.3. Opening a new/existing presentation.

11.1.4. Different views for viewing slides in a presentation: normal, slide sorter.

11.2. Addition, deletion, and saving of slides.

11.3. Insertion of multimedia elements
    11.3.1. Adding text boxes.
    11.3.2. Adding/importing pictures.
    11.3.3. Adding movies and sound.
    11.3.4. Adding tables and charts, etc.
    11.3.5. Adding organizational chart.
    11.3.6. Editing objects.
    11.3.7. Working with ClipArt.
11.4. Formatting slides
    11.4.1. Using slide master.
    11.4.2. Text formatting.
    11.4.3. Changing slide layout.
    11.4.4. Changing slide color scheme.
    11.4.5. Changing background.
    11.4.6. Applying design template.

12. Google Suits
    12.1. Using Google Drive, Google Sheet, Google Docs, Google Slides.

INSTRUCTIONAL STRATEGY

1. Since this subject is practice-oriented, the teacher should demonstrate the capabilities of computers to students while doing practical exercises. The students should be made familiar with computer parts, peripherals, connections, and proficient in making use of MS Office/Open Office/Libre

2. Office/Google Suite in addition to working on the internet. The students should be made capable of working on computers independently.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Fundamentals of Computer by V. Rajaraman; Prentice Hall of India Pvt. Ltd., New Delhi.
2. Information Technology for Management by Henery Lucas, Tata McGraw Hills, New Delhi.
3. Computers Fundamentals Architecture and Organization by B. Ram, revised Edition, New Age International Publishers, New Delhi.

4. Computers Today by S.K. Basandara, Galgotia Publication Pvt. Ltd., Daryaganj, New Delhi.
5. Internet for Everyone by Alexis Leon and Mathews Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
6. A First Course in Computer by Sanjay Saxena; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
7. Computer Fundamentals by P.K. Sinha; BPB Publication, New Delhi.
8. Fundamentals of Information Technology by Leon and Leon; Vikas Publishing House Pvt. Ltd., Jungpura, New Delhi.
9. On Your Marks- Net…Set…Go… Surviving in an e-world by Anushka Wirasinha, Prentice Hall of India Pvt. Ltd., New Delhi.
10. Fundamentals of Information Technology by Vipin Arora, Eagle Parkashan, Jalandhar.

REFERENCE WEBSITES

1. www.tutorialspoint.com
2. www.sf.net
3. Gsuite.google.com
4. Spoken-tutorial.org
5. https://swayam.gov.in/

FOURTH SEMESTER

4.1 COMMUNICATION SKILLS – II

L	T	P
4	-	2

RATIONALE

English language skills are crucial for career development. This subject aims to introduce basic concepts of communication and focuses on developing listening, speaking, reading, and writing skills as part of communication skills.

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Functional Grammar (16 periods)

1.1. Prepositions.
1.2. Framing Questions.
1.3. Conjunctions.
1.4. Tenses.

2. Reading (16 periods)

2.1. Unseen Passage for Comprehension: Vocabulary enhancement - Prefixes, Suffixes, one-word substitution, Synonym and Antonym, based upon the passage.

3. **Writing Skill (24 periods)**

3.1. Correspondence:
  3.1.1. Business Letters: Floating Quotations, Placing Orders, Complaint Letters.
  3.1.2. Official Letters: Letters to Government and other Offices.
3.2. Memos, Circular, Office Orders.
3.3. Agenda & Minutes of Meeting.
3.4. Report Writing.

LIST OF PRACTICALS

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

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

SPEAKING AND LISTENING SKILLS

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

INSTRUCTIONAL STRATEGY

Encourage students to participate in role play and other student-cantered activities in the classroom. Engage them in listening exercises.

MEANS OF ASSESSMENT

- Assignments, quizzes, and class tests.
- Mid-semester and end-semester written tests.
- Practical work, exercises, and viva-voce.
- Presentation and viva-voce.

RECOMMENDED BOOKS

1. Communicating Effectively in English, Book-I by Revathi Srinivas; Abhishek Publications, Chandigarh.
2. Communication Techniques and Skills by R. K. Chadha; Dhanpat Rai Publications, New Delhi.
3. High School English Grammar and Composition by Wren & Martin; S. Chand & Company Ltd., Delhi.
4. E-books/e-tools/relevant software as recommended by AICTE/NITTTR, Chandigarh.

WEBSITES FOR REFERENCE

1. http://www.mindtools.com/page8.html
2. http://www.letstalk.com.in
3. http://www.englishlearning.com
4. http://learnenglish.britishcouncil.org/en/
5. http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

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

4.2 CARPET DESIGN - I

L	T	P
6	-	4

RATIONALE

This course aims to introduce students to different varieties of fabric and designs used in carpet manufacturing. It emphasizes the importance of technical terminology and knowledge of these aspects as the foundation of a textile designer's work.

LEARNING OUTCOMES

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

- Understand woven designs used in carpet manufacturing. Understand the technical terms used in woven design construction. • Understand basic weaves and their derivatives.
- Understand the basics of design and drawing.
- Understand basic carpet designs.
- Understand motifs of design and drawing.
- Understand various drawing tools and techniques for the development of carpet designs.
- Understand different aspects of home textile design in relation to carpets.
- Understand the design requirements pertaining to different countries.

DETAILED CONTENTS

1. Introduction to woven designs used in carpet manufacturing, introduction to technical terms used in woven design construction: Warp, weft, ends, picks, weave, design, repeat of design draft, peg plan, and denting plan. **(10 Periods)**

2. Basic weaves and their derivatives: plain, twill, satin/sateen. **(16 Periods)**

3. Basics of design, Introduction to drawing: Study of different geometrical shapes and forms and their impact on visualization and perception. **(10 Periods)**

4. Basic carpet designs: materials and methods used in carpet designing and coloring. **(8 Periods)**

5. Motifs of design and drawing (Historical, Aesthetical), Indian Motif (Indiya collection): Various sources of design inspiration and its development - nature, archaeological structures, historical designs, etc. **(14 Periods)**

6. Various drawing tools and techniques for the development of carpet designs. **(10 Periods)**

7. Aspects of home textile design in relation to carpets. **(8 Periods)**

8. Design requirements pertaining to different countries, color themes, and motifs. Product life cycle. **(8 Periods)**

INSTRUCTIONAL STRATEGY

Conduct physical demonstrations of various carpet designs. Organize industrial visits to different design studios of carpet manufacturing industries. Encourage students to prepare a document collection of various carpet designs and basic design elements.

MEANS OF ASSESSMENT

- Assignments and quizzes.
- Mid-term and end-term written tests.
- Mini model or chart preparation.
- Actual lab work and practical assignments.
- Viva-voce.

LIST OF EXPERIMENTS

1. Fabric analysis – fabrics of different weaves to be analysed. Minimum 4 kinds of fabrics to be analysed by each student
2. Development of various types of motifs by hand sketching.
3. Colouring of the motifs developed earlier.
4. Development of carpet designs by arrangement of these motifs.

RECOMMENDED BOOKS

1. Watson's Textile Design and Colour: Elementary Weaves and Figured Fabrics by Z. Grosicki.
2. Carpet and Textile by Spuhler, Friedrich.
3. Floral Patterns by Roojen P.V.
4. Textile Design by Thames & Hudson.
5. Persian Carpets by Dr. Seyed.
6. Hand Crafted Indian Textile by Roli Books.
7. Heritage by Design Point.
8. Carpet Style by Phillips, Barty.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	10	12
2.	16	18
3.	10	12
4.	8	10
5.	14	16
6.	10	12
7.	8	10
8.	8	10
Total	**84**	**100**

4.3 TEXTILE TESTING

L	T	P
4	1	6

RATIONALE

This course focuses on developing the capability of testing textile products and their components to ensure desired results. Textile testing is essential for assessing the quality and performance of textiles.

LEARNING OUTCOMES

Upon completion of this course, students will be able to: • Understand the importance of textile testing, sampling, and quality control. • Understand and conduct various fiber dimensions used in textile testing. • Understand and conduct various yarn dimensions used in textile testing. • Understand and conduct various fabric dimensions used in textile testing. • Understand and conduct tensile testing of textiles. • Understand and conduct evenness testing of textiles.

DETAILED CONTENTS

1. **Importance of textile testing**
   - 1.1. Introduction to textile testing and the properties of fibers, yarns, and fabrics.
   - 1.2. Relevance of properties in assessing textile performance during and after manufacture.
2. **Sampling And Quality Control**
   - 2.1. Definition of sample, sample size, and sampling techniques.
   - 2.2. Introduction to quality control.
   - 2.3. Standard deviation and coefficient of variation.
3. **Fiber dimensions**
   - 3.1. Fiber length measurement using Baer sorter, Fibrograph, and their principles of operation.
   - 3.2. Fiber fineness measurement using cutting and weighing method, Sheffield micron air, cotton maturity measurement.
   - 3.3. Role of humidity in textile testing: absolute humidity, relative humidity, moisture regain, moisture content.
   - 3.4. Introduction to High Volume Instruments (H.V.I.).
4. **Yarn dimensions**
   - 4.1. Measurement of yarn twist using Rock bank twist tester, continuous twist tester, and twist and untwist methods.
   - 4.2. Yarn count and its measurement.
   - 4.3. Measurement of yarn diameter using a microscope.
5. **Fabric dimensions**
   - 5.1. Measurement of fabric thickness.
   - 5.2. Measurement of fabric crimp using a crimp tester.

5.3. Air permeability testing of fabrics using an air permeability tester.
5.4. Crease recovery testing of fabrics using a crease recovery tester.
5.5. Water repellency tests.
5.6. Abrasion resistance testing on fabric using Martindale Abrasion Tester.

6. Tensile testing of textiles

6.1. Fiber strength testing using Pressley strength tester and stelometer.
6.2. Yarn strength testing using single yarn strength testing and Lea strength testing.
6.3. Fabric strength testing using cut strip, grab strip, and revealed strip methods.
6.4. Fabric tear testing using tongue tear and trapezoid tear tests.
6.5. Bursting strength testing using a hydraulic strength tester.

7. Evenness testing

7.1. Nature of irregularities: short-term, medium-term, and long-term variations, periodic and non-periodic irregularities.
7.2. Evenness testing using Uster evenness tester.
7.3. Classimate faults and classifaults.

LIST OF EXPERIMENTS

1. Determining the count of yarn:
    1.1.1. Using a physical balance
    1.1.2. Using yarn quadrants balance
    1.1.3. Using Bessley yarn balance
    1.1.4. Calculating the Coefficient of Variation (CV)

2. Calculating yarn count by wrap reel and calculating CV.

3. Measuring the twist of yarn per inch/meter in double yarn and its individual components using a continuous twist tester and twist and untwist tester.

4. Finding the hank of sliver and roving with the aid of a wrap block machine.

5. Determining the staple length of fiber using a Bare Sorter.

6. Measuring fiber fineness by flowing air through a sample of fiber using a micron Aire.

7. Finding fiber length using an analytical digital fibro graph.

8. Determining the lea strength of cotton yarn using a lea strength tester (power-driven) and calculating the CSP (Count Strength Product).

9. Determining the breaking strength of cotton yarn using a Ballistic strength testing machine.

10. Testing the breaking strength and elongation of a single thread of cotton using a single thread testing machine (hand-driven or power-driven).

11. Examining the bursting strength of a fabric using a bursting strength tester.

12. Evaluating the relative abrasion properties of fabrics using a Martindale abrasion tester.

13. Measuring the breaking strength of different textile fabrics using a cloth strength tester (power-driven).

14. Measuring crimp using a Shirley crimp meter.

15. Determining the air permeability of fabric using an air permeability tester.

16. Measuring the crease recovery of fabric using a crease recovery tester.

17. Finding fiber strength using a stelometer.

18. Testing the pilling of fabrics using a computerized pilling tester.

19. Estimating the final pH value of finished fabric.

20. Testing the evenness of the yarn using an evenness tester.

These experiments cover various aspects of textile testing, including yarn properties, fabric strength, abrasion resistance, air permeability, crease recovery, and fiber characteristics.

INSTRUCTIONAL STRATEGY

Conduct physical demonstrations of various textile testing instruments. Organize visits for students to different textile testing laboratories. Emphasize practical work and file preparation.

MEANS OF ASSESSMENT

- Assignments and quizzes.
- Mid-term and end-term written tests.
- Mini model or chart preparation.
- Actual lab work and practical assignments.
- Viva-voce.

RECOMMENDED BOOKS

1. "Principles of Textile Testing" by J.E. Booth.
2. "Physical Testing of Textiles" by B.P. Saville.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted
1	8	12
2	8	16
3	8	16
4	8	16
5	8	16
6	8	14
7	8	10
Total	**56**	**100**

4.4 FABRIC MANUFACTURING SYSTEM

L	T	P
4	-	-

RATIONALE

From the title of the paper, it is evident that the knowledge of manufacturing process is a matter of imperative importance to textile designer. So is the importance of the paper.

LEARNING OUTCOMES

After completing this course the student will be able to:

• Understand the sequence of different processes involved in the conversion of yarns into fabrics.
• Understand various primary, secondary, and auxiliary motions of a loom.
• Understand the classification of various types of weaving machines.
• Understand the different types of shedding devices i.e., dobby and jacquard.
• Understand the concept of knitting and various knitted fabrics.

DETAILED CONTENTS

1. Brief introduction to the sequence of different processes involved in the conversion of yarns into fabrics. Brief study and working principles of cheese winding, warp winding, weft winding, warping, and sizing.
2. Introduction to various primary, secondary, and auxiliary motions of a loom.
3. Classification of various types of weaving machines. Brief Study of handloom, power loom, and elementary knowledge of automatic looms and shutterless looms.
4. Brief study of dobby and jacquard.
5. Introduction to knitted fabrics and various types of knitting concepts (Warp knits and weft knits).

INSTRUCTIONAL STRATEGY

Physical Demonstration of various textile weaving looms and knitting machines. Visit may be conducted for students to different weaving and knitted industries.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mid-term and End-term written tests
- Mini Model or chart preparation
- Actual lab and practical work
- Viva-voce

RECOMMENDED BOOKS

1. Principles of weaving by Marks & Robinson
2. Weaving Mechanism by T. Fox
3. Weaving machine and mechanism by Talukdar, Azgaonkar and Sriramulu
4. Woven Fabric Production – I, II NCUTE Publications
5. Knitting Technology: A Comprehensive Handbook and Practical Guide by David J Spencer.

6. Knitting technology by Prof. D.B. Ajgaonkar.
7. Warp Knitting Production S Ray, Melliand.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted(%)
1.	14	20
2.	12	20
3.	10	20
4.	10	20
5.	10	20
Total	**56**	**100**

4.5 CARPET MANUFACTURING

L	T	P
4	1	5

RATIONALE

Carpet manufacturing is an important aspect of carpet making. It can be manufactured by various methods, and studying all these methods is necessary for a diploma engineering student.

LEARNING OUTCOMES

After completion of this course, the student will be able to:

- Understand the fundamental concepts of carpet manufacturing.
- Understand the manufacturing of hand-knotted carpets, processes, and equipment involved.
- Understand the manufacturing of hand-woven carpets, processes, and equipment involved.
- Understand the manufacturing of tufted carpets, processes, and equipment involved.

DETAILED CONTENTS

1. Fundamentals of carpets (14 Periods)

1.1. Classification of carpets, textures, and other relevant features.

1.2. Introduction to various terms used in the carpet industry (domestic and internationally).

2. Hand-knotted carpet (14 Periods)

2.1. Types of knots used.

2.2. Process sequence involved in making hand-knotted carpets – brief description of each process and equipment used in the manufacturing of hand-knotted carpets.

2.3. Defects arising in hand-knotted carpet manufacturing and their remedial measures.

3. Hand-woven carpets (14 Periods)

3.1. Process sequence involved in making hand-woven carpets.

3.2. Brief description of each process and equipment used in the manufacturing of hand-woven carpets.

3.3. Various types of defects arising in hand-woven carpets and their remedial measures.

3.4. Brief description of flat-woven carpets manufacturing.

4. Tufted Carpets (14 Periods)

4.1. Process sequence involved in making hand-tufted carpets.

4.2. Brief description of each process and equipment used in the manufacturing of hand-tufted carpets.

4.3. Construction of various backing cloth used in tufted carpets.

LIST OF PRACTICALS

1. **Hand Knotted Persian Carpets**
   1.1. Preparation of warp.
   1.2. Mounting and setting of warps.
   1.3. Preparation of weft (pile material, lachchi, and tharry).
   1.4. Practice of knots.
   1.5. To study and identify the various types of knots used in hand-knotted carpet and also to determine knots/square inch in a carpet.
   1.6. Preparation of a small sample.
   1.7. Study of various parts of a vertical carpet loom and their functions.

2. **Tibetan Carpets**
   2.1. Preparation of warping.
   2.2. Practice of knots.
   2.3. Preparation of a small sample.

3. **Hand Tufted Carpet**
   3.1. Framing of primary backing, including tracing of design.
   3.2. Practice of tufting using hand and electric gun.
   3.3. Preparation of a small sample.

4. **Loom Made Carpets**
   4.1. Study of the features of the loom.
   4.2. Study of various parts of the handloom and their function.
   4.3. Installation of a handloom for durry and vertical carpet loom.
   4.4. Preparation of a small sample (Broadloom/durry).
   4.5. To study various parts of a vertical carpet loom and its functions.

5. Practical demonstration on handling of equipment used in the manufacturing of a hand-knotted and hand-tufted carpet.

6. Practical demonstration on the handling of equipment used in the manufacturing of Indo-Tibetan and Broad Loom textiles.

INSTRUCTIONAL STRATEGY

Physical Demonstration of various carpet weaving looms. Students can visit local carpet manufacturing industries and conduct practical trials.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mid-term and End-term written tests
- Mini Model or chart preparation
- Actual lab and practical work
- Viva-voce

RECOMMENDED BOOKS

1. "Carpet Manufacturing" by G.H. Crawshaw
2. "Tufted Carpet" by Von Moody
3. "Encyclopedia of Carpet" by B.S. Chauhan
4. "Process Control in Manufacturing Carpet" by KK Goswami (Available in Hindi and English Versions)
5. "Advances in Carpet Manufacture" by KK Goswami

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted(%)
1	14	25
2	14	25
3	14	25
4	14	25
Total	**56**	**100**

4.6 ENERGY CONSERVATION

L	T	P
3	-	2

RATIONALE

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

LEARNING OUTCOMES

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

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

DETAILED CONTENTS

1. Basics of Energy

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

2. Energy Conservation and EC Act 2001

2.1 Introduction to energy management, energy conservation, energy efficiency and its need

2.2 Salient features of Energy Conservation Act 2001 & The Energy Conservation (Amendment) Act, 2010 and its importance. Prominent organizations at centre and state level responsible for its implementation.

2.3 Standards and Labeling: Concept of star rating and its importance, Types of product available for star rating

3. Electrical Supply System and Motors

3.1 Types of electrical supply system

3.2 Single line diagram

3.3 Losses in electrical power distribution system

3.4 Understanding Electricity Bill: Transformers Tariff structure, Components of power (kW, kVA and kVAR) and power factor, improvement of power factor, Concept of sanctioned load, maximum demand, contract demand and monthly minimum charges (MMC)

3.5 Transformers: Introduction, Losses in transformer, transformer Loading, Tips for energy savings in transformers

3.6 Electric Motors

Types of motors, Losses in induction motors Features and characteristics of energy efficient motors, Estimation of motor loading, Variation in efficiency and power factor with loading, Tips for energy savings in motors

4 Energy Efficiency in Electrical Utilities

4.1 Pumps: Introduction to pump and its applications, Efficient pumping system operation, Energy efficiency in agriculture pumps, Tips for energy saving in pumps

4.2 Compressed Air System: Types of air compressor and its applications, Leakage test, Energy saving opportunities in compressors.

4.3 Energy Conservation in HVAC and Refrigeration System: Introduction, Concept of Energy Efficiency Ratio (EER), Energy saving opportunities in Heating, Ventilation and Air Conditioning (HVAC) and Refrigeration Systems.

5 Lighting and DG Systems

5.1 Lighting Systems: Basic definitions- Lux, lumen and efficacy, Types of different lamps and their features, Energy efficient practices in lighting

5.2 DG Systems: Introduction, Energy efficiency opportunities in DG systems, Loading estimation

6 Energy Efficiency in Thermal Utilities

6.1 Thermal Basics: Thermal energy, Energy content in fuels, Energy Units and its conversions in terms of Metric Tonne of Oil Equivalent (MTOE)

6.2 Energy Conservation in boilers and furnaces : Introduction and types of boilers, Energy performance assessment of boilers, Concept of stoichiometric air and excess air for combustion, Energy conservation in boilers and furnaces, Do's and Don'ts for efficient use of boilers and furnaces

6.2 Cooling Towers: Basic concept of cooling towers, Tips for energy savings in cooling towers

6.3 Efficient Steam Utilization

7. Energy Conservation Building Code (ECBC)

7.1 ECBC and its salient features

7.2 Tips for energy savings in buildings: New Buildings, Existing Buildings

8 Waste Heat Recovery and Co-Generation

8.1 Concept, classification and benefits of waste heat recovery

8.2 Concept and types of co-generation system

9 General Energy Saving Tips

Energy saving tips in:

9.1 Lighting

9.2 Room Air Conditioner

9.3 Refrigerator

9.4 Water Heater

9.5 Computer

9.6 Fan, Heater, Blower and Washing Machine

9.7 Colour Television

9.8 Water Pump

9.9 Cooking

9.10 Transport

10 Energy Audit

10.1 Types and methodology

10.2 Energy audit instruments

10.3 Energy auditing reporting format

PRACTICAL EXERCISES

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

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

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

INSTRUCTIONAL STRATEGY

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

RECOMMENDED BOOKS

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

IMPORTANT LINKS:

1. Bureau of Energy Efficiency (BEE), Ministry of Power, Government of India. www.beeindia.gov.in.

2. Ministry of New and Renewable Energy (MNRE), Government of India. www.mnre.gov.in.

3. Uttar Pradesh New and Renewable Energy Agency (UPNEDA), Government of Uttar Pradesh. www.upneda.org.in.

4. **Central Pollution Control Board (CPCB),** Ministry of Environment, Forest and Climate Change, Government of India. www.cpcb.nic.in.

5. Energy Efficiency Sevices Limited (EESL). www.eeslindia.org.

6. Electrical India, Magazine on power and electrical products industry. www.electricalindia.in.

FIFTH SEMESTER

5.1 INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP DEVELOPMENT

L	T	P
5	-	-

RATIONALE

In the present-day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skills helps the student in the job market. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

LEARNING OUTCOMES

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

- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- Explain the principles of management including its functions in an organisation.
- Have insight into different types of organizations and their structures.
- Inculcate leadership qualities to motivate self and others.
- Manage human resources at the shop-floor
- Maintain and be a part of healthy work culture in an organisation.
- Use marketing skills for the benefit of the organization.
- Maintain books of accounts and take financial decisions.
- Undertake store management.
- Use modern concepts like TQM, JIT, and CRM.

DETAILED CONTENTS

SECTION – A

ENTREPRENEURSHIP

1. **Introduction** (04 Periods)

1.1 Concept /Meaning and its need
1.2 Qualities and functions of entrepreneur and barriers in entrepreneurship
1.3 Sole proprietorship and partnership forms and other forms of business organisations
1.4 Schemes of assistance by entrepreneurial support agencies at National, State, District –level, organisation: NSIC, NRDC, DC, MSME, SIDBI, NABARD, NIESBUD, HARDICON Ltd., Commercial Banks, SFC's TCO, KVIB, DIC,

Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. **Market Survey and Opportunity Identification/Ideation** (04 Periods)

2.1 Scanning of the business environment
2.2 Salient features of National and Haryana State industrial policies and resultant business opportunities
2.3 Types and conduct of market survey
2.4 Assessment of demand and supply in potential areas of growth
2.5 Identifying business opportunity
2.6 Considerations in product selection
2.7 Converting an idea into a business opportunity

3. **Project report Preparation** (06 Periods)

3.1 Preliminary project report
3.2 Detailed project report including technical, economic and market feasibility
3.3 Common errors in project report preparations
3.4 Exercises on preparation of project report
3.5 Sample project report

SECTION –B

MANAGEMENT

4. Introduction to Management (06 Periods)

4.1 Definitions and importance of management
4.2 Functions of management: Importance and process of planning, organising, staffing, directing, and controlling
4.3 Principles of management (Henri Fayol, F.W. Taylor)
4.4 Concept and structure of an organisation
4.5 Types of industrial organisations and their advantages
4.6 Line organisation, staff organisation
4.7 Line and staff organisation
4.8 Functional Organisation

5. Leadership and Motivation (08 Periods)

5.1 Leadership: Definition and Need, Qualities and functions of a leader, Manager Vs leader, Types of leadership, Case studies of great leaders

5.2 Motivation: Definition and characteristics, Importance of self-motivation, Factors affecting motivation, Theories of motivation (Maslow, Herzberg, Douglas, McGregor)

6. Management Scope in Different Areas (14 Periods)

6.1 Human Resource Management: Introduction and objective, Introduction to Man power planning, recruitment and selection, Introduction to performance appraisal methods

6.2 Material and Store Management: Introduction functions, and objectives, ABC Analysis and EOQ

6.3 Marketing and sales: Introduction, importance, and its functions, Physical distribution, Introduction to promotion mix, Sales promotion

6.4 Financial Management: Introductions, importance and its functions, knowledge of income tax, sales tax, excise duty, custom duty, VAT, GST

7. Work Culture (08 Periods)

7.1 Introduction and importance of Healthy Work Culture in organization

7.2 Components of Culture

7.3 Importance of attitude, values, and behavior

7.4 Behavioral Science – Individual and group behavior.

7.5 Professional ethics – Concept and need of Professional Ethics and human values.

8. Basic of Accounting and Finance (10 Periods)

8.1 Basic of Accounting: Meaning and definition of accounting, Double entry system of book keeping, Trading account, PLA account and balance sheet of a company

8.2 Objectives of Financial Management: Profit Maximization v/s Wealth Maximization

9. Miscellaneous Topics (10 Periods)

9.1 Total Quality Management (TQM): Statistical process control, Total employees Involvement, just in time (JIT)

9.2 Intellectual Property Right (IPR): Introduction, definition and its importance, Infringement related to patents, copy right, trade mark

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment, seminar or case study method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development and Management by J.S.Narang; Dhanpat Rai & Sons, Delhi.
3. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
4. Handbook of Small Scale Industry by PM Bhandari
5. Entrepreneurship Development and Management by MK Garg
6. E-books/e-tools/relevant software to be used as recommended by AICTE/ NITTTR, Chandigarh.

WEBSITES FOR REFERENCE

http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted(%)
1	04	06
2	04	06
3	06	08
4	06	08
5	08	12
6	14	20
7	08	12
8	10	14
9	10	14
Total	**70**	**100**

5.2 CARPET CHEMICAL PROCESSING

L	T	P
4	2	6

RATIONALE

Chemical processing plays a crucial role in the manufacturing of yarns and carpets. Understanding different dyeing methods, printing techniques, and the removal of impurities is essential for students studying carpet technology. This course provides knowledge about various dyes, their application on different fibers, suitable machinery, and the overall chemical processing involved in carpet manufacturing.

LEARNING OUTCOMES

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

- Understand the different types of dyes used in the carpet industry.
- Comprehend the principles and mechanisms of different types of dyes.
- Apply relevant dyes to relevant fibers using appropriate methods.
- Familiarize themselves with the machinery suitable for the carpet industry.
- Learn how to remove natural and added impurities from carpet materials.
- Understand different types of printing methods and advancements.

DETAILED CONTENTS

1. Preparatory process for different fibres used in carpets (Scouring bleaching). **(6 Periods)**

2. Classification of dyes and various dyes used for dyeing of various fibres (Cotton, wool, acrylic, polyester , Nylon). **(6 Periods)**

3. Introduction to various terms used in chemical processing of carpets- M:L ratio, Shade % age, Mass colouration, Dope dying exhaustion percentage. Introduction to various dyeing machinery - Fibre dyeing machine, Hank dyeing machine, Winch, Jigger, HTHP dyeing machine Direct, reactive. **(8 Periods)**

4. Principle and application of dyes - Acid dyes, Metal complex dyes, Basic dyes, Disperse dyes. **(6 Periods)**

5. Introduction to method and style of printing various ingredients used in printing paste yarn printing, Flock printing and latest developments in carpet printing. **(6 Periods)**

6. Chemical processing related to carpet **(8 Periods)**

   Impurities present in wool like suint, wool grease and surface soiling. Process for the removal emulsion souring process in relation to detergents and wool grease removal. Principles of the tests carried out on grease. Introduction to wool grease recovery. Wool drying, pressing and packing.

7. Acid dyes **(8 Periods)**

Generalized formula and classification of acid dyes. Procedure for (application) of various types of acid dyes to wool and other fibres (e.g. Nylon and Silk), Nylon: Mechanism of acid dyeing and dye fibre bond, effect of different process parameters and role of additives in acid dyeing, Fastness properties of acid dyes.

Chrome dyes :

Concepts of mordants; formation of chromium complexes; Method of application of chrome dyes - Chrome mordant process, After Chrome Process, Meta chrome process. Brief idea on fastness properties of chrome dyes, Chromosol.

Metal complex dyes :

General formula and structure, Classification of metal complex dyes - 1:1 metal complex dye and 1:2 metal complex dyes; Procedure of application of metal complex dyes and mechanism of dyeing fastness; Properties of metal complex dyes.

8. Chemical process on wool **(8 Periods)**

Bleaching, Prevention of dyebath yellowing, Insect resist treatments, shrink proofing, Anti-static properties, plane retardant wool, photo stabilizers, stain blocking, polymer 5r grafting setting. Wool Scour Effluent Treatment- Process control and quality assurance, Energy conservation.

LIST OF EXPERIMENTS

1. Scouring of woolen yarn
2. Bleaching of woolen yarn using peroxide
3. Dyeing of woolen yarn using acid class of dyes
4. Dyeing of woolen yarn using chrome class of dyes
5. Dyeing of woolen yarn using metal complex class of dyes
6. Finishing of woolen yarn for insect resistance
7. Printing of carpet using block printing
8. Printing of carpet using screen printing
9. Washing of carpet using various recipes like – herbal, chemical antique
10. Preparation of latex recipe and its application on tufted carpets

INSTRUCTIONAL STRATEGY

The course may include physical demonstrations of various dyeing and processing methods. Students can also visit local dyeing plants to enhance their understanding of the subject.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mid-term and end-term written tests
- Mini model or chart preparation
- Actual lab work and practical exercises
- Viva-voce (oral examination)

RECOMMENDED BOOKS

1. "Dyeing & Chemical Technology of Textile Fibres" by E.R. Trotman.
2. "Chemical Technology of Fibrous Materials" by F. Sadov.
3. "Chemistry of Dyes and Principles of Dyeing" by Dr. V.A. Shenai.
4. "Technology of Dyeing" by Dr. V.A. Shenai.
5. "Chemical Processing of Synthetic Fibres" by Dr. K.V. Datye & A.A. Vaidya.
6. "The Dyeing of Cellulose Fibres" by Clifford Preston.
7. "Technology of Finishing – Vol. X" by Dr. V.A. Shenai.
8. "Introduction to Textile Finishing" by J.T. Mars.
9. "Technology of Dyeing" by Dr. V.A. Shenai.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	6	5
2	6	5
3	8	20
4	6	10
5	6	10
6	8	20
7	8	20
8	8	10
Total	**56**	**100**

5.3 CARPET DESIGN-II

L	T	P
4	2	6

RATIONALE

Designing is a critical aspect of carpet production, as it enhances the visual appeal and increases the value of the carpet. This course focuses on developing skills in computer-aided design (CAD) tools, understanding design printing methodologies, and utilizing drawing tools, motif scanning, scanning parameters, colors, and attributes.

LEARNING OUTCOMES

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

- Understand the various aspects of CAD tools.
- Comprehend different design printing methodologies.
- Utilize drawing tools and motif scanning techniques.
- Manipulate scanning parameters, colors, and attributes.

DETAILED CONTENTS

1. Introduction to Computer-Aided Designing (CAD) **(8 Periods)**
   - 1.1. Importance and advantages of CAD.
   - 1.2. Features of CAD systems.
   - 1.3. Interface elements.
   - 1.4. Transferring designs from sketches to print paper.

2. CAD Tools and Utilities **(10 Periods)**
   - 2.1. Customizable settings, views, and new design creations.
   - 2.2. Editing scanned photographs.
   - 2.3. File utilities.
   - 2.4. Freehand tools.
   - 2.5. Geometric tool group.
   - 2.6. Selection group.
   - 2.7. Zoom group.
   - 2.8. Selection utilities.
   - 2.9. General group.

3. Creating Motifs in Computer **(9 Periods)**
   - 3.1. Drawing tools.
   - 3.2. Motif scanning parameters.
   - 3.3. Editing images for graph making.
   - 3.4. Scaling, rotating, reversing motifs.
   - 3.5. Conversion to full motifs.
   - 3.6. Methods of creating different styles and forms of designs using a computer.
   - 3.7. Color Application in Motifs

4. Importance of color application in motifs. **(10 Periods)**
   4.1. Color utilities.
   4.2. Color protection and separation.
   4.3. Transparent colors.
   4.4. Changing colors.
   4.5. Color reduction.
   4.6. Tracing a graph/design plate printout.
   4.7. Wool consumption printout.
   4.8. Creating a new color library.
   4.9. DPI calculation.

5. Computerized Graph Design **(10 Periods)**
   5.1. Creating computerized graph designs from edited motifs.
   5.2. Suitable weaves, vector and raster images.
   5.3. X and Y coordinates in designs.
   5.4. Float control and flat checking.
   5.5. Pixel resolution and its relation to thread and thread per inch.
   5.6. Weave creation and saving.
   5.7. Jacquard designing.

6. Printing Designs **(9 Periods)**
   6.1. Usage of CAD in textile printing.
   6.2. Editing scanned images using CAD tools.
   6.3. Creating designs directly on the computer screen.
   6.4. Creating different textures with CAD.
   6.5. Arranging and laying out motifs to form print designs.
   6.6. Design calculations based on parameters.
   6.7. Color separation for screens and blocks.

LIST OF EXPERIMENTS

1. Introduction to CAD Tools.
2. Geometrical structures, Exploration of forms, Shapes & line with in the natural forms or objects. Still Life drawings.
3. Stripes & Checks effect on fabric,
4. Colour & Design Creations: Dhurries- 30ct , 60ct, 80ct And Boxes & Round Compositions,
5. Colour Wheel, Concept of shade tone,
6. Carpet designs: Tufted - Floral & Modern Designs, Tibbetan – Modern geometrical & Floral,
7. Converting Natural form of designs into Abstract, Modern & Contemporary, and
8. Persian/Traditional Designs.
9. Colour Forecasting.

INSTRUCTIONAL STRATEGY

Teachers may use various teaching aids such as presentations and videos to familiarize students with different carpet designing methods. Real-life scenarios can be explained to demonstrate the importance of carpet designing in achieving improved aesthetics.

Organizing industrial visits to nearby carpet manufacturing industries can provide practical exposure to the subject.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mid-term and end-term written tests
- Mini model or chart preparation
- Lab work and practical exercises
- Viva-voce (oral examination)

RECOMMENDED BOOKS

1. "Carpet Style" by Phillips Borty
2. "Watson's Textile Design and Color" by Z. Grosicki
3. "Manual of Software Arahne Weaves/Paint"

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	14
2	10	18
3	9	16
4	10	18
5	10	18
6	9	16
Total	**56**	**100**

5.4 CARPET FINISHING AND MAINTENANCE

L	T	P
4	2	-

RATIONALE

Carpet finishing is a vital step in carpet manufacturing, which provides necessary aesthetic looks to the carpet. Backing is necessary for making a carpet strong, sturdy and improve its performance during use. Students should be well acquainted with finishing of carpets.

LEARNING OUTCOMES:

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

- Understand the importance of latexing in carpets
- Understand preparation of latex compound and its recipe
- Know about the equipment's used for preparation and application of latex
- Know about pre and post washing sequence for carpet washing

DETAILED CONTENTS

1. **Chemical Coating (18 Periods)**

   Various types of latex and synthetic resin used in carpet backing, latex compound recipe for different carpets, role of each ingredient, Equipment's used for preparation and application of latex compound. Objectives of drying and curing process. Problems arising in Latexing and their remedial measures.

2. **Chemical Finishing (19 Periods)**

   Description and functions of various equipment's used in mechanical finishing of carpets e.g. Bhokani, Beroni, various shearing tools, various types of scissors, embossing tools, pile separator, Steel teeth comb etc.

3. **Chemical Washing of Carpets (19 Periods)**

   Traditional systems. Mechanized system including pre and post washing sequence. Detailed idea on various type of washing like antique wash, herbal wash etc. (Chemicals used, process parameters and equipment's), Sheen and glaze characteristics of woolen and silk carpets.

INSTRUCTIONAL STRATEGY

Teachers may use various teaching aids like presentations, videos to make student become acquainted with various carpet finishing methods. Teacher should explain real life scenarios and how the carpet finishing can be helpful in ensuring improved aesthetics, performance and prolonged life. Teachers may arrange an industrial visit to nearby industries manufacturing machine made carpets for better understanding of the subject.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mini project making
- Actual lab and practical work
- Viva-voce

RECOMMENDED BOOKS

1. Textile Finishing and Carpet Industry by Ajay Shrivastava
2. Advance in Carpet Manufacture (II Addition)
3. Finishing of carpet for Value addition , M.D. Teli 2018

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1.	18	32
2.	19	34
3.	19	34
Total	**56**	**100**

5.5 INDUSTRIAL TRAINING (6 WEEKS)

L	T	P
-	-	2

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 as diploma engineers in the world of work and enables them to integrate theory with practice.
Polytechnics have been arranging industrial training of students of various durations to meet the above objectives.

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

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

An external assessment has been provided in the study and evaluation scheme of 6th 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.

INSTRUCTIONAL STRATEGY

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

MEANS OF ASSESSMENT

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

- Punctuality and regularity 15%
- Initiative in learning new things 15%
- Presentation and VIVA 15%
- Industrial training report 55%

5.6 UNIVERSAL HUMAN VALUES

L	T	P
2	0	1

COURSE OBJECTIVES

This introductory course input is intended

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

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

COURSE METHODOLOGY

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

The syllabus for the lectures is given below:

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

UNIT 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education **(8 Periods)**

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and
3. Experiential Validation- as the mechanism for self-exploration
4. Continuous Happiness and Prosperity- A look at basic Human Aspirations
5. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority
6. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
7. Method to fulfill the above human aspirations: understanding and living in harmony at various levels

UNIT 2: Understanding Harmony in the Human Being - Harmony in Myself! **(8 Periods)**

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

UNIT 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship **(8 Periods)**

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

UNIT 4: Understanding Harmony in the Nature and Existence - Whole existence as Co-existence **(8 Periods)**

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

UNIT 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics **(10 Periods)**

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

Practical Session also Includes Different Yogic Exercises and Meditation Session

INSTRUCTONAL STRATEGY

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

MEANS OF ASSESSMENT

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

REFERENCE MATERIAL

The primary resource material for teaching this course consists of

1. The text book (Latest Edition)
   Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.
2. The teacher's manual (Latest Edition)
   Gaur, R Asthana, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi.
3. In addition, the following reference books may be found useful for supplementary reading in connection with different parts of the course:
   B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
   PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
4. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
5. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
6. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
7. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) KrishiTantraShodh, Amravati.
8. A Nagraj, 1998, JeevanVidyaekParichay, Divya Path Sansthan, Amarkantak.
9. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
10. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

RELEVANT WEBSITES, MOVIES AND DOCUMENTARIES

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

SUGGESTED DISTRIBUTION OF MARKS

Unit	Time Allotted (Periods)	Marks Allotted (%)
1	8	20
2	8	20
3	8	20
4	8	20
5	10	20
Total	**42**	**100**

SIXTH SEMESTER

6.1 ENVIRONMENTAL STUDIES

L	T	P
3	-	2

RATIONALE

A diploma holder should possess knowledge of different types of pollution caused by industries and construction activities in order to help balance the ecosystem and control pollution through various measures. They should also be aware of environmental laws related to pollution control and waste management. Energy conservation is crucial, and understanding energy management and conservation is essential.

LEARNING OUTCOMES

Upon completing this subject, students will be able to:

- Understand the importance of ecosystems and sustainability.
- Demonstrate interdisciplinary knowledge of environmental issues.
- Identify different types of environmental pollution and control measures.
- Take corrective measures for pollution abatement.
- Explain environmental legislation acts.
- Define energy management, energy conservation, and energy efficiency.
- Demonstrate a positive attitude towards judicious energy use and environmental protection.
- Apply energy-efficient techniques in daily life and industrial processes.
- Adopt cleaner production technologies.
- Identify the role of non-conventional energy resources in environmental protection.
- Analyze the impact of human activities on the environment.

DETAILED CONTENTS

1. **Introduction** **(04 Periods)**
   1.1 Basics of ecology, ecosystem concepts, and sustainable development.
   1.2 Renewable and non-renewable resources.

2. **Air Pollution** **(04 Periods)**
   2.1 Sources of air pollution.
   2.2 Effects of air pollution on human health, economy, plants, and animals.
   2.3 Air pollution control methods.

3. **Water Pollution** **(08 Periods)**
   3.1 Impurities in water.
   3.2 Causes and sources of water pollution.
   3.3 Effects of water pollution on human health.

3.4 Concept of dissolved O2, BOD, COD.
3.5 Prevention of water pollution: water treatment processes, sewage treatment.
3.6 Water quality standards.

4. Soil Pollution (06 Periods)

4.1 Sources of soil pollution.
4.2 Types of solid waste: household, hospital, agriculture, biomedical, animal and human excreta, sediments, and e-waste.
4.3 Effects of solid waste.
4.4 Disposal of solid waste: solid waste management.

5. Noise Pollution (06 Periods)

5.1 Sources of noise pollution.
5.2 Units of noise.
5.3 Effects of noise pollution.
5.4 Methods to minimize noise pollution.

6. Environmental Legislation (08 Periods)

6.1 Introduction to Water (Prevention and Control of Pollution) Act 1974.
6.2 Introduction to Air (Prevention and Control of Pollution) Act 1981 and Environmental Protection Act 1986.
6.3 Role and function of State Pollution Control Board and National Green Tribunal (NGT).
6.4 Environmental Impact Assessment (EIA).

7. Impact of Energy Usage on Environment (06 Periods)

7.1 Global warming.
7.2 Greenhouse effect.
7.3 Depletion of the ozone layer.
7.4 Acid rain.
7.5 Eco-friendly materials.
7.6 Recycling of materials.
7.7 Concept of green buildings.

LIST OF PRACTICALS

1. Determination of pH of drinking water.
2. Determination of TDS in drinking water.
3. Determination of TSS in drinking water.
4. Determination of hardness in drinking water.
5. Determination of oil & grease in drinking water.
6. Determination of alkalinity in drinking water.
7. Determination of acidity in drinking water.
8. Determination of organic/inorganic solids in drinking water.
9. Determination of pH of soil.
10. Determination of N&P (Nitrogen & Phosphorus) in soil.
11. Measurement of noise level in classrooms and industries.
12. Segregation of various types of solid waste in a locality.
13. Study of waste management plans for different solid waste.
14. Study of the effect of melting floating ice in water due to global warming.

INSTRUCTIONAL STRATEGY

In addition to theoretical instructions, various activities such as expert lectures, seminars, and visits to greenhouses, effluent treatment plants, and rainwater harvesting plants should be organized to enhance understanding of Environmental Studies.

MEANS OF ASSESSMENT

- Assignments and quizzes/class tests
- Mid-term and end-term written tests

RECOMMENDED BOOKS

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

WEBSITES FOR REFERENCE:

- http://swayam.gov.in

SUGGESTED DISTRIBUTION OF MARKS

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

6.2 NON-WOVEN

L	T	P
4	2	-

RATIONALE

Non-woven is another important and advanced manufacturing technology among all manufacturing techniques. It involves various mechanical and thermal processing manufacturing methods for carpets.

LEARNING OUTCOMES

- Know various raw materials required for manufacturing of non-wovens
- Understand classification of non wovens and their production processes
- Understand types of webs forming techniques for making non-wovens
- Understand different types of bonding techniques for making non-wovens
- Understand finishing of non-woven fabrics

DETAILED CONTENTS

1. Introduction to Non-woven (10 Periods)

1.1. Raw materials: Description of fibrous matters used in non-woven production.
1.2. Properties of fabrics made from different fibrous matters.
1.3. Bonding agents used in non-woven.

2. Classification of Non-woven and Production Steps (10 Periods)

2.1. General production steps for manufacturing non-woven fabrics.
2.2. Dry bonded fabric production steps.
2.3. Spun bonded fabric production.

3. Types of Webs and Their Forming Techniques (8 Periods)

3.1. Staple fiber webs.
3.2. Wet-laid webs.
3.3. Dry-laid webs.
3.4. Fiber preparation.

4. Non-woven Fabric Bonding Techniques (10 Periods)

4.1. Mechanical bonding.
4.2. Needle punching technology.
4.3. Stitched bonding technology.
4.4. Hydro entanglement.
4.5. Adhesive bonding or chemical bonding.
  4.5.1. Spray adhesive bonding.
  4.5.2. Foam bonding.
  4.5.3. Thermal bonding.
  4.5.4. Hot calendaring.
  4.5.5. Area bonding.
  4.5.6. Point bonding.

4.5.7. Embossing.
4.5.8. Belt calendaring.
4.5.9. Through-air bonding.

5. Finishing of Non-Woven Fabrics (10 Periods)

5.1. Introduction to finishing processes for non-woven fabrics.
5.2. Classification of finish applied to non-woven fabrics.
5.3. Shrinkage, Wrenching, and Creping.
5.4. Creeping: The Micrex-Microcreepe process.
5.5. Process carbonizing.
5.6. Calendaring: Roller Presses.
5.7. Perforating and Slitting. - Perforating. - Slitting.
5.8. Grading.
5.9. Velouring.

6. Additional Finishing Processes (8 Periods)

6.1. Antistatic Finish.
6.2. Antimicrobials.
6.3. Water repellent finish.
6.4. Lubricants.
6.5. UV absorbers and Polymer stabilizers.
6.6. Flame retardant.
6.7. Soil release.
6.8. Optical brighteners.

INSTRUCTIONAL STRATEGY

Teachers may use various teaching aids like presentations, videos to make student become acquainted with various non-woven manufacturing methods. Teacher should explain real life scenarios and how non-wovens have increased usage in modern life. Teachers may arrange an industrial visit to nearby industries manufacturing non-wovens for better understanding of the subject.

MEANS OF ASSESSMENT

- Assignments and quizes
- Mini project making
- Actual lab and practical work
- Viva-voce

RECOMMENDED BOOKS

1. Manual of Nonwoven R Krcma
2. Nonwoven Fabric Technology M Mc Donald

3. Nonwoven technology by Milin patel & Dhruv kumar bramahat.
4. Non woven by P Madhavanmoorthi

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	10	16
2	10	16
3	8	16
4	10	18
5	10	18
6	8	16
Total	**56**	**100**

6.3 CARPET TESTING

L	T	P
6	2	8

RATIONALE

Evaluation of carpets is necessary to understand the performance of carpets during use. Testing is also used as a basis for process improvement and control. Carpet testing is a necessary step in exports of carpets to various countries, where the statutory norms and standards set by a particular country should be met. Hence, knowledge of carpet testing is of great importance for a diploma student who would eventually serve the industry mostly involved in exports business.

LEARNING OUTCOMES

After completing the course, the student will be able to -

- Understand need and objectives of testing and evaluation of carpets.
- Understand Different aspects of quality testing and performance assessment of carpets.
- Understand relevance of testing of functional properties of carpets
- Know about various carpet testing equipment's and their operating principle
- Know about various norms and standards for carpet testing

DETAILED CONTENTS

1. Need and objectives of testing and evaluation of carpets. Different aspects of quality testing and performance assessment of carpets. **(18 Periods)**
2. Relevance of testing of functional properties of carpets like – **(20 Periods)**
   - 2.1. Appearance retention
   - 2.2. Carpet durability including soil ability, carpet abrasion resistance
   - 2.3. Resilience
   - 2.4. Tendency of pilling and fuzzing
   - 2.5. Other properties like insulation, acoustic, electrostatic properties etc.
3. Brief description and operating principle of following carpet testing equipment's **(22 Periods)**
   - 3.1. Dynamic loading machine
   - 3.2. Tuft Withdrawal tensiometer
   - 3.3. Pilfuz Carpet Tester
   - 3.4. Usometer
   - 3.5. Tetrapod and Hexapod Tumble Tester
   - 3.6. Digital and Portable Thickness Gauge
   - 3.7. Roller Chair Testing Device
   - 3.8. Carpet Static Loading Device
   - 3.9. Carpet Wear and Abrasion Tester
   - 3.10. Various Carpet Flammability Tests.
4. Norms and standards for carpet testing **(24 Periods)**

LIST OF PRACTICALS

1. Determination of carpet thickness using digital thickness tester.
2. Measurement of pile height of carpet using pile height gauge(leaf gauge).
3. Determination of thickness of carpet under a given load vis-a-vis compressibility and % recovery by Digital thickness guage.
4. Determination of thickness of carpet and carpet backing using portable thickness gauge.
5. Determination of abrasion resistance and weight loss in carpet.
6. Determination of degree of appearance retention of a carpet.
7. Determination of knots/sq inch of a hand knotted carpet.
8. Determination of tuft withdrawal force using tuft withdrawal tensometer.

INSTRUCTIONAL STRATEGY

Teachers may use various teaching aids like presentations, videos to make student become acquainted with various carpet testing methods. Teacher should explain real life scenarios and how the performance evaluation can be helpful in ensuring prolonged performance of carpets. Teachers may arrange a industrial visit to nearby industries manufacturing machine made carpets for better understanding of the subject.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mini project making
- Actual lab and practical work
- Viva-voce

RECOMMENDED BOOKS

1. Process Control in Carpet manufacturing by K.K. Goswami , Abhishek Publications ,Chandigarh India
2. Textile Testing by J.E. Booth
3. Physical Testing of Textiles by Saville

SUGGESTED DISTRIBUTIONS OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	18	20
2	20	24
3	22	36
4	24	20
Total	**84**	**100**

6.4 MODERN CARPET TECHNOLOGY

L	T	P
6	-	-

RATIONALE

In modern days, various machine-made carpets are gaining popularity, hence there is a need of an hour for a diploma student to be well acquainted with modern carpet manufacturing techniques. Study of various technologies involved in manufacturing of machine made carpet manufacturing is necessary for enhancing job opportunities in today's scenario.

LEARNING OUTCOMES

After completing this course, the student will be able to -

- Understand machine made carpets and their classification.
- Understand process sequences involved in manufacturing of various machine woven carpets.
- Understand process sequences involved in manufacturing of machine tufted carpets.
- Know about various types of yarns used in manufacturing of machine made carpets.
- Understand various kinds of non-woven carpets, its construction and machinery involved.

DETAILED CONTENTS

1. Introduction to machine made carpets and their classification **(20 Periods)**
2. Machine made woven carpet looms, process sequence and brief description of carpet manufacturing on Wilton, Axminster, Face to Face weaving loom. **(18 Periods)**
3. Machine tufting - process sequence and brief description of carpet manufacturing. **(16 Periods)**
4. Types of yarns used in machine made carpets including BCF yarns. **(12 Periods)**
5. Non-woven carpets : Types of non-woven carpet, their construction and end use. Brief description of process and machinery involved in manufacturing of Needle punched, adhesive bonded and electrostatically flocked carpet. **(18 Periods)**

INSTRUCTIONAL STRATEGY

Teachers may use various teaching aids like presentations, videos to make student become acquainted with various machine-made carpet manufacturing techniques. Teachers may arrange an industrial visit to nearby industries manufacturing machine made carpets for better understanding of the subject.

MEANS OF ASSESSMENT

- Assignments and quizzes
- Mini project making
- Actual lab and practical work
- Viva-voce

RECOMMENDED BOOKS

1. Advance in Carpet Manufactur By K.K Goswami ,Woodhed Publishing
2. Carpet Manufacture by Crawshaw
3. Tufted Carpet by Von Moody

SUGGESTED DISTRIBUTIONS OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	20	24
2	18	20
3	16	20
4	12	16
5	18	20
Total	**84**	**100**

6.5 PROJECT

L	T	P
2	-	8

Two periods per week are allocated for project work in the final year of the course. During these periods, students will be encouraged and assisted in developing new designs in weave/carpet. They will also be given a clear idea of establishing a carpet unit of a given size, starting from the selection of the site to deciding the type of building construction or shed, the units of machinery required, their layout, and the fundamental requirements of carpet mill organization. This will include deciding the number and type of workers, process control in carpet departments, elements of costing and costing procedures in various sections, factors affecting productivity and efficiency of men and machines, as well as sources of finance and the development of resources. In order to enhance general awareness, students will be introduced to organizations involved in the certification, standardization, research, and development of textile products such as BIS, Centre Silk Board, Textile Committee, Textile Commission, Jute Commission, ATIRA, NITRA, BTRA, etc.

The project paper will consist of two parts:

1. **PART-A:**

Part-A will contain problems to evaluate students' learning. These problems will be related to the development of designs in Carpet Yarn / Manufacturing Methods / Chemical Processing / Finishing of Carpet and the preparation of their samples. Alternatively, they can choose problems related to the establishment of a Carpet Industry Unit of a given size. Students will be allowed to choose one type of problem to solve.

2. **PART-B:**

In Part-B, students will survey a village and prepare a report that provides details about the population, means of livelihood, health and hygienic conditions, education facilities, and various programs/projects running for development. The report should also include information about the personnel and agencies involved in this work. Additionally, students should observe and report on environmental pollution and ecological disturbances, along with their causes and suggested remedies. Without completing Part-B, the project will not be considered complete. Moreover, students will also undertake constructive work for pollution control as advised by the guiding teacher.

Students can choose any one problem from Part-A, while Part-B is compulsory for all students. They can form groups of three to work on one problem. The students will be examined for 100 marks by an examiner appointed by B.T.E, U.P.

The project contains 150 marks, the breakup is as follows

Viva-Voce - 80 Marks

Documentation - 20 Marks

Sessional Marks - 50 Marks

10. RESOURCE REQUIRMENT

LIST OF EQUIPMENT

1. Only the equipment essential for conducting the practical's mentioned in the curriculum should be acquired.

2. Instead of purchasing expensive machines/equipment, it is recommended to acquire experimental models/prototypes/lab models.

3. "Machines/Equipment/Instruments from the old BTE list that are not included in the provided list below should be retained in the Lab/Shop for demonstration purposes but should not be purchased fresh."

Sr. No.	Description	Qty	Total Price (Rs)
COMMUNICATION LABORATORY			
1.	Stools	40	10,000
2.	Display Board/Screen	2	6,000
3.	Sound recording and playing system	1	6,000
4.	Audio cassettes	60	2,000
5.	Overhead Projector	1	5,000
6.	Transparencies slides	100	500
7.	TV, VCR and camera for video recording	1 each	20,000
8.	English spoken course	1	2,000
9.	A Quiz room equipped with two way audio system, back projection system and slide projector	1	30,000
10.	Miscellaneous	LS	1,500

APPLIED PHYSICS LABORATORY			
1.	Vernier calipers Working length 160 mm, Internal and external dia with locking arrangement	12	2,000
2.	Screw Gauges Working length 15 mm, pitch 0.5 mm, least count .005 mm	12	2,000
3.	Spherometers Distance between legs 2.5 mm, pitch 0.5 mm, least count .005 mm.	12	2,000
4.	Mirrors (convex, concave)	5 Each	1,500
5.	Pendulum Setup	02	4,000
6.	Gravesand's Apparatus	02	3,000
7.	Inclined Plane Setup	02	2,000

8.	Flywheel Setup	02	4,000
9.	Prism	05	1,500
10.	Spectrometer	02	25,000
11.	DC Ammeters Moving coil weston-type ammeter with ebonite stand	10	3,500
12.	DC Miliammeters	2	1,000
13.	DC Microammeters	2	700
14.	DC voltmeters	10	700
15.	DC Millivoltmeters	10	2,000
16.	Sensitivity Galvanometer	2	800
17	Student Galvanometers	10	4,000
18.	Demonstration type DC Ammeters Range; 0 to 1 Amp.	2	1,000
19.	D type DC Voltmeter Range : 0 to 1 Volt	2	1,000
20.	D type Galvanometers Sensitivity : 20 microamperes per scale division,	8	8,000
21.	Resistance boxes (dial type) assorted	8	8,000
22.	Rheostats	10	4.000
23.	Miscellaneous items (Spring, Pan, Glycerine, Optic fibre, Ferromagnetic material)	LS	2,000
24.	Fortin's Barometer (Wall type)	2	20,000
25.	Stoke's Apparatus	2	10,000
26.	Gumther's Apparatus	2	16,000
27.	Resonance Tube Apparatus with accessories and Tuning fork set	2	14,000
28.	Sodium Lamp setup with Biprism	2	10,000
29.	Ohmic resistance coil	10	5,00
30.	Slide wire bridge	2	8,000
31.	PN Junction diode Apparatus	2	10,000
32.	Laser (as per requirement)	1	1,00,000
33.	Numerical aperture setup	1	25,000
34.	Miscellaneous	LS	3,000

APPLIED CHEMISTRY LABORATORY			
1.	Digital Balance	1	80,000
2.	Burette 50ml	30	3,000
3.	Pipette 25ml	60	4,000
4.	Beakers 100ml	60	4,000
5.	Burette stand	30	30,000
6.	Glazed tile	30	1,000
7.	Conical flask 50ml (Titration flask)	60	4,000
8.	Standard (Measuring) flask (to prepare standard solution) 250ml/100ml	30	6,000
9.	Able's Flash Point apparatus	2	10,000
10.	(1/10)°C thermometer	06	6,000
11.	Candles	20	100
12.	Crucible with lid	06	2,000
13.	Muffle furnace	1	18,000

14.	Decicators	06	8,000
15.	Pair of tongue (small and big)	24 (small) 2 (big)	2,000
16.	Chemicals EDTA-1 kg Eriochrome Black-T(solochrome black T)-200g Buffer solution (NH3 - 2.5 ltr, NH4Cl – 1 kg) Zinc sulphate- 500g H2SO4- 2.5 ltr Phenolphthalein indicator (as per requirement) Methyl orange indicator (as per requirement) Charcoal (as per requirement) Kerosene- 1 ltr	LS	20,000
17.	Miscellaneous	LS	2,000

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

BASICS OF IT LABORATORY/COMPUTER LABORATORY			
1.	Computer System with latest configuration	30	8,00,000
2	Printer (MFP)	1	25,000
3	Printer (Laser)	1	35,000
4.	Plotter	1	75,000
5.	Digitiser	1	50,000
6.	Antivirus Software	LS	10,000
7.	Internet Facility on Computers	LS	2,00,000
8.	AutoCAD/Solid Works/Unigraphics/Pro-C (any one software)	30 user	5,00, 000
9.	LCD Projector	1	35,000
10.	UPS	60	1,20,000
11.	Software (latest windows, latest MS Office)	1	1,00,000
12.	Scanner	1	10,000
13.	Miscellaneous	LS	5,000

WORKSHOP PRACTICE

CARPENTRY SHOP			
1	Work benches fitted with carpenter vices	5	20,000
2.	Circular saw grinder	1	6,000
3.	Wood cutting band saw-vertical	1	10,000
4.	Bench grinder	1	5,000
5.	Drilling machine	1	8,000
6.	Wood turning lathe	1	40,000
7.	Wood Planner	1	20,000
8.	Tool accessories measuring and marking Instruments	25	25,000
9.	Band saw blade brazing unit	1	10,000
10.	Miscellaneous	LS	1,500

SMITHY SHOP

Sr. No.	Description	Qty	Total Price (Rs)
SMITHY SHOP			
1.	Black smithy forge (with open hearths, accessories to match the forge)	20	40,000
2.	Wrought iron anvils	20	20,000
3.	Swage blocks	4	8,000
4.	Blower with accessories, motor switch etc.	1	6,000
5.	Work benches with vices	2	6,000
6.	Power hammer	1	20,000
7.	Tools and accessories – hammers, swages, tongs, pokers, pullers etc.	20	10,000
8.	Miscellaneous	LS	1,500

SHEET METAL, SOLDERING & BRAZING

S.No.	Name of Equipment	No.	Rate (₹)	Amt. in (₹)
1.	Dividers - 15cm.	5	60	300
2.	Trammel 1 m.	1		
3.	Angle protector	5	60	300
4.	Try square 30 cm.	5	40	200
5.	Centre punch	5	20	100
6.	Steel rule 30 cm., 60 cm.	5	25	125
7.	Sheet metal gauge	1	120	120
8.	Straight snips 30 cm.	2	250	500
9.	Curved snips 30 cm.	2	300	600
10.	Bench shear cutter 40 cm.	1	5000	5000
11.	Chisel 10 cm.	5	100	500
12.	Hammer	5	150	750

13.	Bench vice 13 cm.	5	1000	5000
14.	Plier	5	50	250
15.	Nose plier	5	60	300
16.	Sheet metal anvil/stakes	5	2000	10000
17.	Shearing machine 120 cm.	1	2500	2500
18.	Solder electric	2	500	1000
19.	Solder furnace type	2	250	500
20.	Brazing equipment's and accessories	1	5000	5000
21.	Blow lamp	2	250	500
22.	Sheet bending machine	1	10000	10000
23.	Misc.	LS		5000

FITTING AND PLUMBING SHOP			
1.	Work benches with vices (4 vices on each bench)	5	30,000
2.	Marking tables with scribers	4	24,000
3.	Surface plates	5	20,000
4.	Accessories like calipers, V blocks, height, gauges steel rules and scribers	25	50,000
5.	Tool kits – taps, dies, drills	25	40,000
6.	Tool kits – chiesels, hammers, files, hacksaw	25	25,000
7.	Drilling machine	2	12,000
8.	Pipe vice	4	1,000
9.	Chain wrenches	5	1,250
10.	Ring spanner set	5	600
11.	Pipe die set 2"	2 set	1,000
12.	Pipe bending device	1	5,000
13.	Various plumbing fittings	LS	2,000
14.	Miscellaneous	LS	1,500

WELDING SHOP			
1.	Electrical welding transformer set with accessories	3	30,000
2.	Gas Cutting Unit	1	3,000
3.	Work benches with vices	3	5,000
4.	Welding generator set	1	10,000
5.	Oxy acetylene welding set with accessories	1	7,000
6.	Acetylene generating set	1	6,000
7.	Electric welder tool kit	10	10,000
8.	Projection welding machine	1	15,000
9.	Brazing equipment with accessories	1	10,000
10.	Soldering irons	3	1,000
11.	Pedestal grinder	1	10,000
12.	Metal spraying gun	1	10,000
13.	Spot welder	1	25,000
14.	TIG welding set	1	1,00,000
15.	MIG welding set	1	1,00,000

16.	Welding Partition Screen	5	2,500
17.	Miscellaneous	LS	3,000

PAINTING AND POLISHING SHOP			
1.	Spray gun with hose pipe	1	1,000
2.	Paint brushes	20	2,000
3.	Paint/Varnish	LS	2,000
4.	Air Compressor with 2 hp motor	1 set	10,000
5.	Miscellaneous	LS	2,000

FOUNDRY SHOP			
1.	Moulding boxes	40	8,000
2.	Ladles	5	2,000
3.	Tool Kits	10 set	5,000
4.	Quenching tanks	2	5,000
5.	Portable grinder	1	3,000
6.	Pit furnace with blower	1	10,000
7.	Miscellaneous	LS	1,000

MACHINE SHOP

1.	Centre lathes	10	6,00,000
2.	Grinder	1	10,000
3.	Universal milling machine	1	1,25,000
4.	Shaper	2	1,20,000
5.	Plainer	2	1,20,000
6.	Work bench	3	10,000
7.	Precision instruments	1	10,000
8.	Hand tools and accessories	2	8,000
9.	CNC trainer lathe	1	4,00,000
10.	Miscellaneous	LS	5,000

GENERAL MECHANICAL ENGINEERING LAB

S. No.	Name of Equipment	No.	Rate (₹)	Amt. in (₹)
1.	Biogas Plant	1	-	By Outdoor Visit
2.	Windmill	1	-	By Outdoor Visit
3.	Experimental Solar Cooker Box Type - Instrumented to Measure Temperature, Performance, and Temperature at Various Locations	1	500	500
4.	Photo Voltage Solar Cell	1	10000	10000
5.	Throttling & separating Colorimeter (Thermal Engg. Lab)	1	10000	10000
6.	Jib Head Key, Flat Key, Saddle Key, Wood Ruff Key, Feather Key Pinkey & A piece of splined shaft	1	L.S.	500
7.	Pins - Split Pin, Taper Cottor Type Split Pin, Cottor or Cottor Pin, Cottor Bolts; Lewis or Rag Foundation Bolt, Fish Tail & Square Head Foundation Bolts	1	L.S.	500
8.	Friction Clutches & Couplings - Cone Clutch, Single Plate Muff Coupling, Flange Coupling Universal Coupling or Hooks Joint Flexible Coupling - Belt & Pin Type, Coil Spring Type	1	L.S.	2500
9.	Bearings - Plane, Bushed, Split Step, Ball, Roller Bearings Thrust Bearings	1	L.S.	1000
10.	Spur gear Single & Double Helical Gears, Bevel Gears	1	L.S.	1000
11.	Simple Spur Gear Train	1	1500	1500
12.	Compound Gear Train	1	1500	1500
13.	Epicyclic Gear Train	1	2000	2000
14.	Compression & Tension Helical Springs	1	200	200
15.	Four Bar Mechanism Fitted on a board	1	1000	1000
16.	Slider Crank Mechanism	1	1000	1000
17.	Whitworth Quick Return Mechanism Fitted on a board	1	1000	1000

ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY			
1.	Wattmeter	5	10,000
2.	Ammeter	5	10,000
3.	Voltmeter	5	7,500
4.	DC shunt motor	1	5,000
5.	Single phase variac	1	2,500
6.	Single phase transformer	1	5,000
7.	Resistive load	1	4,000
8.	Multimeter	1	4,000
9.	CRO	1	15,000
10.	Regulated supply	1	8,000
11.	Signal generator	1	5,000
12.	3-phase inductor motor	1	5,000
13.	3-phase variac	1	8,000
14.	DC shunt generator coupled with motor and starter	1	25,000
15.	Rheostat	2	2,500
16.	Tachometer	1	5,000

TEXTILE TESTING LAB (COMMON WITH T.T., T.C., T.E.)

S.No.	Name of Equipment	No.	Rate (₹)	Amt. in (₹)
1.	Baer Sorter (For Fibre Length) Acrylic Transparent Sheet 6"X8"X2 pieces, 3"X8"X2 pieces Fibre Mounting Templates 6"X8"X2 pieces, 3"X8"X2 pieces With tweezers, velvet pad, scales, planchass, and all complete accessories or Latest Configuration	2	20000	40000
2.	Microscope Digital Microscope Magnifying Power 5X, 10X, 20X, 40X, 100X lenses Trinocular biological microscope with fiber cross-section kit, high resolution CCD camera, and imaging software with measurement facilities Scope of use section of fiber or yarn analysis of any fiber, yarn, and fiber Range: 5X, 10X, 20X, 450X, 100X / as per requirements Focus: Adjustable Lights: White, Blue, Yellow, Upper & Lower	2	65000	130000

	Supply: 220 V AC supply Single Phase with all complete accessories or Latest Configuration			
3.	Moisture Meter	1	16000	16000
4.	Wrapreel	2	30000	60000
5.	Wrap Block	2	6000	12000
6.	Beesley Balance	4	7000	28000
7.	Quadrant Balance	2	4000	8000
8.	Lea Strength Tester	1	50000	50000
9.	Single Thread Tester (Digital)	1	100000	100000
10.	R. B. Twist Tester	2	25000	50000
11.	One Inch Twist Tester	2	8000	16000

12.	Take Up Twist Tester Yarn test length: 25 mm to 500 mm adjustable (Metric unit) or 1" to 20" Maximum adjustable (Imperial unit) Range: Upto 60 TPL Resolution: 1 TPM or 0.01 TPI Motor Speed: Upto 1500 RPM Clamps: Spring-loaded clamps at motor end for easy clamping of Yarn Averaging: Reading of at least 10 samples can be stored and average TPM/TPI value is calculated and digital display with preset device Supply: 220 V AC, single phase Suitable for S/Z type of twisted yarn with reset device Tension weight upto 100 gm adjustable Yarn spool mounting arrangement at one end of the twist tester with all complete accessories or Latest Configuration	2	28500	57000
13.	Fabric Strength Tester (Tensile Strength)	1	50000	50000
14.	Tearing Strength Tester	1	20000	20000
15.	Bursting Strength Tester	1	35000	35000
16.	Abrasion Resistance Tester (Martindale	1	50000	50000

	Type)			
17.	Laundromat (For washing fastness testing)	1	50000	50000
18.	Crock Meter	1	10000	10000
19.	Digital Fibro graph Measuring Principle: Optical Measuring Range: 12.0 to 45. Measuring Accuracy: +/- 0.1 mm Result Output: 2.5% SL, 50% SL, and UR % Front End Language: English Applicable Standard: ASTM D5332, ISO2648, and IS233 Power Supply: Single Phase 220V AC	1	320000	320000
20.	Uster Evenness Tester	1	2000000	2000000
21.	Trash Analyzer	1	150000	150000
22.	Conditioning Oven 220 V with capability of maintaining temperature up to 100°C and facility for smooth variation of temperature inside 27 liters	1	98500	98500
23.	Stelometer (For Bundle Strength)	2	70000	140000

24.	Crease Recovery Tester Size of the Test Specimen: 40mm X 15mm Crease Load: 1 Kg (Stainless Steel) Angle Measurement: On an Engraved circular scale graduated in 1 deg Scale Measurement: 0-180 with all complete accessories or Latest Configuration	2	15000	30000
25.	Water Repellency Tester	1	80000	80000
26.	Pilling Tester	1	30000	30000
27.	Crimp Rigidity Tester Minor Load: 2 g to 10 g Major Load: 100 g to 500 g Digital display, 220 V with all complete accessories or Latest Configuration	1	20000	20000
28.	Air Permeability Tester	1	35000	35000
29.	Sheffield Micronaire (For Fiber Fineness)	1		
30.	Uster Stapler for Fiber Length (Spectrophotometer)	1		
Total				3811000

CARPET DESIGN LAB

S. No.	Item	Quantity	Rate (₹)	Amount (₹)
1.	Pick glass	15	300.00	3,000.00
2.	Scissors	5	500.00	2,500.00
3.	Crimp tester	1	30,000.00	30,000.00
4.	Computer with latest configuration (i5 or higher), RAM 8 GB or higher, 27 Inch Monitor, integrated or separate graphics card, 512 GB or higher SSD. Pre loaded latest windows and office software.	30	1,00,000.00	30,00,000.00
5.	Graphics tablet and pen	30	15,000.00	4,50,000.00
6.	Plotter colour printer 24 inches	01	1,00,000.00	1,00,000.00
7.	Scanner A3 size 600 dpi or higher	01	40,000.00	40,000.00
8.	Coloured inkjet printer	01	20,000.00	20,000.00
9.	Networking	L.S.	60,000.00	60,000.00
10.	Carpet designing CAD software – Galaincha, Nedgraphics or equivalant – multi user	1	20,00,000.00	20,00,000.00

CARPET TESTING LABORATORY

S. No.	Item	Quantity	Rate (₹)	Amount (₹)
1	Tuft withdrawal tensometer	1	2,00,000.00	2,00,000.00
2	Thickness, static and dyanamic loadin machine	1	50,00,000.00	50,00,000.00
3	Hexapod tumbler tester	1	25,00,000.00	25,00,000.00
4	Carpet Flammibility tester	1	3,00,000.00	3,00,000.00
5	Carpet digital thickness tester	1	2,50,000.00	2,50,000.00
6	Pile height leaf guage	1	20,000.00	20,000.00
7	Carpet wear and abrasion tester	1	20,00,000.00	20,00,000.00
8	Pick glass	10	300.00	3,000.00
9	Electronic weighing balance	1	50,000.00	50,000.00

CARPET MANUFACTURING LABORATORY

S. No.	Item	Quantity	Rate (₹)	Amount (₹)
1	Vertical hand knotting loom with accessories	4	35,000.00	1,40,000.00
2	Horizontal carpet weaving loom with accessories	1	1,00,000.00	1,00,000.00
3	Tibetal carpet weaving loom with accessories	4	35,000.00	1,40,000.00
3	Carpet tufting frame	10	5,000.00	50,000.00
4	Manual tufting gun	20	1,000.00	20,000.00
5	Automatic tufting gun	2	6,000.00	12,000.00
6	Carpet latex mixing machine	1	10,000.00	10,000.00
7	Squeeze for latexing	5	300.00	1,500.00
8	Shearing machine	1	10,000.00	10,000.00
9	Shearing scissors	10	500.00	5,000.00
10	Cutting scissors	10	500.00	5,000.00
11	Sorting scissors	10	500.00	5,000.00
12	Sewing machines	6	12,000.00	72,000.00

CARPET CHEMICAL PROCESSING LAB

S. No.	Item	Quantity	Rate (₹)	Amount (₹)
1.	Water shaker bath – 8 heads	3	80,000.00	2,40,000.00
2.	Blocks for printing	10	500.00	5,000.00
3.	Screens various sizes	20	1,000.00	20,000.00
4.	Screen preparation chemicals	L.S.	10,000.00	10,000.00
5.	Chemicals and dyes as per need	L.S.	50,000.00	50,000.00
6.	LPG gas stove 2 heads	3	3,500.00	10,500.00
7.	LPG cylinder	2	Market rate	Market rate
8.	Printing table 5'x15'	2	35,000.00	70,000.00
9.	Safety equipments – gloves, shoes, goggles etc.	L.S.	50,000.00	50,000.00

TEXTILE FIBRE LAB

S. No.	Item	Quantity	Rate (₹)	Amount (₹)
1.	Projection microscope	1	5,00,000.00	5,00,000.00
2.	Conditioning chamber	1	1,50,000.00	1,50,000.00
3.	Moisture meter	1	40,000.00	40,000.00
4.	Chemistry glassware as per requirements	L.S.	50,000.00	50,000.00q
5.	Spirint lamps	10	800.00	8,000.00
6.	Dessicator	2	10,000.00	20,000.00
7.	Hot air oven	1	80,000.00	80,000.00
8.	Electronic weighing balance	1	50,000.00	50,000.00

CARPET YARN MANUFACTURING LABORATORY

S. No.	Item	Quantity	Rate (₹)	Amount (₹)
1.	Willow machine lab model	1	15,00,000	15,00,000
2.	Wollen cum semi worsted card lab model	1	22,50,000	22,50,000
3.	Gill box/ Gilling machine lab model	1	15,00,000	15,00,000
4.	Worsted comber lab model	1	22,50,000	22,50,000
5.	Woolen spinning frame lab model	1	18,75,000	18,75,000
6.	Rubbing frame lab model	1	15,00,000	15,00,000
7.	Semi worsted/ worsted ring frame	1	22,50,000	22,50,000
8.	Rotor spinning machine lab model	1	18,75,000	18,75,000
9.	Hank reeling machine	1	15,00,000	15,00,000

FABRIC MANUFACTURING LAB

S.No.	Name of Equipment	No.	Rate (₹)	Amt. in (₹)
1.	Warp Winding Machines A. Ordinary Machine with 10 Heads B. Automatic Winding Machine with 10 Heads	 1 1	 50,000 800,000	 50,000 800,000
2.	Pirn Winding Machine with 4 Heads	1	40,000	40,000
3.	Warping Machines A. Beam Warping Machine (High Speed) B. Sectional Warping Machine	1 1	300,000 175,000	300,000 175,000
4.	Drawing and Denting Frames (cap. 200 ends) Stainless Screen Frame, Capacity 3200 ends with all Complete Accessories or Latest Configuration	2	10,000	20,000
5.	Plain Looms A. Plain Loom for Plain Tappet B. Plain Loom for Other Weave Tappets	 1 1	 40,000 45,000	 40,000 45,000
6.	Dobby Looms A. Single (Acting) Dobby Loom B. Double Acting (Double Lift) Dobby Loom	 1 1	 150,000 150,000	 150,000 150,000
7.	Jacquard Looms A. Loom with Single Lift Single Cylinder B. Loom With Single Lift Double Cylinder C. Loom With Double Lift Double Cylinder	1 1 1	 150,000 160,000 175,000	 150,000 160,000 175,000
8.	Automatic Weaving Machines A. Automatic Pirn Changing Loom B. Automatic Shuttle Changing Loom C. Water Jet Weaving Machine	 1 1 1	 200,000 200,000 1,200,000	 200,000 200,000 1,200,000
9.	Other Weaving Machines A. Hand Looms B. Loom With Circular Multiple Box Motion C. Loom With Drop Box Multiple Box Motion D. Loom With Terry Motion E. Loom With Pick At Will Motion	2 1 1 1 1	 15,000 100,000 100,000 150,000 150,000	 30,000 100,000 100,000 150,000 150,000
10.	Card Cutting Machine	1	25,000	25,000
11.	Sewing Machine	6	8,000	40,000

12.	A. Hand Knotting loom B. Carpet Wearing loom C. Carpet Tufting Frame D. Manual Tufting Guns E. Automatic Tufting Guns	4 1 10 20 2	35,000 35,000 5,000 800 10,000	140,000 35,000 50,000 16,000 20,000
13.	Carpet Latex mixing Machine	1	10,000	10,000
14.	Squeegee for latexing	5	200	1,000
15.	Semi-automatic Carpet backing machine	1	2,000,000	2,000,000
16.	Wire Wilton cut and loop pile wearing m/c	1	10,000	10,000
17.	Shearing machine	1	10,000	10,000
18.	Embossing machine	1	10,000	10,000
19.	Edge Binding Machine	1	10,000	10,000
20.	Carpet Embossing Scissors	10	200	2,000

ENERGY CONSERVATION LABORATORY			
1	Clamp meter	02	5000
2	Multimeter	02	2000
3	Power Analyser	01	20000
4	Different types of lamps (LS) 60 W lamp, 230 V , 100 V 200 W lamp 500 W lamp 100 W lamp, 110 V, 150 V	10	500
5	Lux meter	02	5000
6	Centrifugal pump, 1 kW	1	15,000
7	Standard window A.C.	01	20000
8	Anemometer	02	5000
9	Thermometer	03	2000
10	Flow meter	02	10000
11	Pumping set with at least two pumps of different capacity.	1 set	10000
12	Pressure gauge fitted on discharge lines	1 set	2000
13	Variable Frequency Drive	02	50000
14	A small compressor with a small network of pipe line fitted with suitable pipeline, pressure gauge, safety valve and loading / unloading pressure switch.	1	3000
15	Stop watch	2	1000
16	Small blower (1.5 kW motor) with inlet and outlet ducts of approximately one meter length on both sides	1	10000
17	Black Box (for checking lamp efficacy including stand and luxmeter)	1	25000

LEARNING RESOURCE MATERIALS

S.No.	Description	Qty.	Approx. Cost (₹)
1.	LCD Projector with Screen	1	50,000
2.	Handicam	1	30,000
3.	Cutting, Binding & Stitching equipment	1	30,000
4.	Desktop Computer with Internet Core i5/i7-760 Processor, Genuine Windows 7 Professional, 18-inch HD Flat Panel Monitor, Optical Mouse, Keyboard & all related media or latest version	1	40,000
5.	Home Theater Support Disc type CD, CDR/CDRW, DVDR/DVDRW, VCD Supported with USB Port Support-DIVX/JPEG/MP3	1	25,000
6.	Commercial PA System 16W-220W output, AC & 24V DC Operated, 5 Mic & 2 Auxiliary input, Speaker output 4 Ohm, 8 Ohm, 17V & 100V	1	20,000
7.	Interactive Board	1	50,000

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ANNEXURE - I

PROPOSED GUIDE FOR STUDENTS TO PREPARE THEIR INDUSTRIAL VISIT REPORT

1. Name & Address of the unit:

2. Date of:
   i. Joining.
   ii. Leaving.

3. Nature of Industry:
   i. Product & Capacity.
   ii. Services.
   iii. Working Hours.

4. Sections of the unit visited and activities therein.

5. Details of machines/Tools & instruments used in working in the section of the unit visited and its layout.

6. Work procedure in the section visited.

7. Specifications of the product of the section and materials used.

8. Work of repair and maintenance cell

9. Details of the shops (welding, Foundry, Machine shop, etc.) related to repair and maintenance work.

10. Name of checking and inspecting instruments and their details. Quality control measures taken.

11. Details of hydraulics/pneumatic/thermal units or appliances used. Material Handling Equipment.

12. Description of any breakdown and its restoring.

13. Use of computer - if any.

14. Visit of unit's store, Manner of keeping store items, Their receiving & distribution.

15. Safety measures in the workplace and working conditions in general - comfortable, convenient & hygienic.

ANNEXURE - II

TRAINEES ASSESSMENT

The Institute invites the comments on the work and behavior of the student during his stay in the industry from his immediate supervisors on the following points:

1. Name of the trainee:

2. Date of:
   i. Joining.
   ii. Leaving.

3. Assessment Criteria:
   i. Regularity & Punctuality.
   ii. Sense of responsibility.
   iii. Readiness to work/learn.
   iv. Obedience.
   v. Skill acquired.

4. Name of the sections of the unit he attended during his stay:
   a. Activities/worth of being there.

5. Anything specific.

Signature of the Assessor

Date: Designation

ANNEXURE III

For Community Development work, two 15-day camps will be organized during the session in identified villages. The students shall stay in the camps and, under the supervision of concerned faculty members, undertake/execute the assigned works in the following fields:

1. To launch and sustain functional literacy programs.

2. To train the rural youth in different trades/skills.

3. Training by innovating and improving the efficiency of household gadgets.

4. To control and reduce pollution affecting the social fabric of rural life, i.e., construction of Soak Pits and Sanitary Latrines, Tree Plantation, Social Forestry, Installation of Smokeless Chulhas.

5. To disseminate information on sources of non-conventional energy. Installation and maintenance of Solar Street Lights, Solar Photovoltaic Pumps, Wind Mills, Biogas Plants, etc., shall be undertaken.

6. Transfer of appropriate Technology/Demonstration of cheap houses by the use of locally available material, treatment of mud walls, innovation of mud floor, treatment of thatch roofs, etc., shall be taken with provisions for training the villagers.

7. Training and demonstration of new agricultural implements, household gadgets, and appliances of non-conventional energy.

8. To help the rural youth in preparing project reports to set up industrial units and entrepreneurial development.

9. All community polytechnics shall render repair and maintenance of agricultural implements, appliances of non-conventional energy, household gadgets, etc., and train the rural youth in such skills.

STUDENT ACTIVITIES ON ENERGY CONSERVATION/ENERGY EFFICIENCY

1. Presentations of Case Studies
2. Debate competitions
3. Poster competitions
4. Industrial visits
5. Visual Aids

LEARNING OUTCOMES

After studying this course, a student will be able to co-relate and apply fundamental key concepts of energy conservation and energy management in industry, commercial, and residential areas. A student will be able to:

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

INSTRUCTIONAL STRATEGY

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

REFERENCE BOOKS

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

IMPORTANT LINKS

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

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

11. EVALUATION STRATEGY

INTRODUCTION

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

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

FORMATIVE EVALUATION

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

SUMMATIVE EVALUATION

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

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

STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

Theory

Practical Work (Laboratory, Workshop, Field Exercises)

Project Work

Professional Industrial Training

A. THEORY

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

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-1 should be of the order of 20 percent of the total marks, and no choice should be given in this section. The objective type items should be used to evaluate students' performance in knowledge, comprehension, and at the most application domains only.

Section-II

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

Section-III

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

Table: Suggested Weightage to be given to different ability levels

Abilities	Weightage to be assigned
Knowledge	10-30 percent
Comprehension	40-60 percent
Application	20-30 percent
Higher than application i.e., Analysis, Synthesis, and Evaluation	Upto 10 percent

B. PRACTICAL WORK

Evaluation of students' performance in practical work (Laboratory experiments, Workshop practical / field exercises) aims at assessing students' ability to apply or practice

learned concepts, principles, and procedures, manipulative skills, ability to observe and record, ability to interpret and draw conclusions, and work-related attitudes. Formative and summative evaluation may comprise weightages to performance on the task, quality of the product, general behavior, and it should be followed by viva-voce.

C. PROJECT WORK

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

12.RECOMMENDATIONS FOR EFFECTIVE CURRICULUM IMPLEMENTATION

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

The document so prepared is now ready for its implementation. It is the faculty of polytechnics who have to play a vital role in planning instructional experiences for the courses in four different environments viz. classroom, laboratory, library, and field and execute them in the right perspective. It is emphasized that a proper mix of different teaching methods in all these places of instruction only can bring the changes in stipulated student behavior as in the curriculum document. It is important for the teachers to understand the curriculum document holistically and further be aware of the intricacies of teaching-learning process (T-L) for achieving curriculum objectives. Given below are certain suggestions that may help the teachers in planning and designing learning experiences effectively. These are indicative in nature, and teachers using their creativity can further develop/refine them. The designers of the Programme suggest every teacher read them carefully, comprehend and start using them.

(A) BROAD SUGGESTIONS

1. Curriculum implementation takes place at the Programme, course, and classroom level respectively, and synchronization among them is required for its success. The first step towards achieving synchronization is to read the curriculum document holistically and understand its rationale and philosophy.

2. An academic plan needs to be prepared and made available to all polytechnics well in advance. The principals have a great role to play in its dissemination and percolation up to the grassroots level. Polytechnics, in turn, are supposed to prepare an institutional academic plan.

3. HOD of every Programme Department along with HODs and in-charges of other departments are required to prepare an academic plan at the department level referring to the institutional academic plan.

4. All lecturers/Senior lecturers are required to prepare course-level and class-level lesson plans referring to the departmental academic plan.

(B) COURSE LEVEL SUGGESTIONS

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

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

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

1. Teachers are required to prepare a course plan, considering the departmental academic plan, the number of weeks available, and courses to be taught.

2. Teachers are required to prepare a lesson plan for every theory class. This plan may comprise contents to be covered, learning material for the execution of a lesson plan. They may follow steps for preparing the lesson plan e.g., drawing attention, stating instructional objectives, helping in recalling prerequisite knowledge, delivering planned subject content, checking desired learning outcomes, and reinforcing learning, etc.

3. Teachers are required to plan for expert lectures from the field/industry. Necessary steps are to plan, identify field experts, make correspondence to invite them, take necessary budgetary approval, etc.

4. Teachers are required to plan for guided library exercises by identifying course-specific experience requirements, setting time, assessment, etc. The assignments and seminars can be thought of as the terminal outcome of library experiences.

5. Concept and content-based field visits may be planned and executed for such content of the course which is abstract in nature, and no other requisite resources are readily available in the institute to impart them effectively.

6. There is a dire need for planning practical experiences in the right perspective. These slots in a course are the avenues to use problem-based learning/activity learning/ experiential learning approaches effectively. The development of lab instruction sheets for the course is a good beginning to provide lab experiences effectively.

7. Planning of progressive assessment encompasses periodical assessment in a semester, preparation of a proper quality question paper, assessment of answer sheets immediately, and giving constructive feedback to every student.

8. The student-centered activities may be used to develop generic skills like task management, problem-solving, managing self, collaborating with others, etc.

9. Wherever possible, it is essential to use activity-based learning rather than relying on delivery-based conventional teaching all the time.

10. Teachers may take the initiative in establishing liaison with industries and field organizations for imparting field experiences to their students.

11. Students be made aware of issues related to ecology and environment, safety, concern for wastage of energy, and other resources, etc.

12. Students may be given relevant and well-thought-out project assignments, which are purposeful and develop practical skills. This will help students in developing creativity and confidence for their gainful employment.

13. A Project bank may be developed by the concerned department of the polytechnics in consultation with related Industry, research institutes, and other relevant field organizations in the state.

13. LIST OF PARTICIPANTS

(I)

List of experts who contributed in the revision and to develop the curriculum in semester system for The Three Year (Six Semester) Diploma in Carpet Technology as per NSQF in the workshop held on 31-10-2022 and 01-11-2022 at I.R.D.T.,UP.,KANPUR.

Sr. No.	Name of Participants	Organization
1.	Shri B.D. Dixit	Retd. Professor, G.C.T.I., Kanpur
2.	Smt. Alka Ali	Retd. Associate Professor, U.P.T.T.I. Kanpur
3.	Dr. Prashant Bishnoi	Professor, U.P.T.T.I. Kanpur
4.	Shri A.K.S Gangwar	Associate Professor, U.P.T.T.I. Kanpur
5.	Shri Pankaj Yadav	Assistant Director, D.T.E. Kanpur
6.	Shri Nagendra Prasad	H.O.D. Textile Design, GP Farrukhabad
7.	Shri Himanshu Maurya	Lecturer T.D., GGP Prayagraj
8.	Smt. Anubha Gupta	Lecturer T.T., G.P. Kanpur
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10.	Shri Sambhaskar Singh	Assistant Professor, I.R.D.T. Kanpur
11.	Shri Arunabh Agnhotri	Lecturer, T.T., G.P., Farrukhabad
12.	Shri Vishesh Kumar	Lecturer T.T., G.P. Baherhi, Bareily
13.	Shri D K Verma	Professor, I.R.D.T. Kanpur
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(II)

List of experts who contributed in the revision and to develop the curriculum in semester system for The Three Year (Six Semester) Diploma in Carpet Technology as per NSQF in the workshop held on 13-01-2023 and 14-01-2023 at I.R.D.T.,UP.,KANPUR.

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3. **Flora exports -** Huda Sector 29, Panipat - 132103, Near Flora Chowk, **Phone**: 1802669981, 1802669982, 1802669983, 1802669984, 1802669985
4. **Jainson exports -** Bichpari Chowk, Panipat HO, Panipat - 132145, Noorwala, Phone: 1802637573
5. **Mahajan overseas -** B-15, Ludana, Panipat - 132145, Industrial Area, Phone: 1802650843, 1802650844, 1802650845, +919354902222
6. **Kohinoor carpets -** 283 -84, G T Road, Panipat HO, Panipat - 132145, Subash Nagar, Phone: 1802631287, 1802646588, +919812037476
7. **Pan overseas -** 4/25, H.U.D.A., Panipat
8. **Surya Carpet Pvt Ltd** - Ugapur, Aurai, Bhadohi Phone: 9415303922, 05414-268253
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10. **Obeetee -** Gopiganj, Bhadohi, Contact: obtindia@obeetee.com
11. **Ambadi Enterprises Ltd. -** Plot Number- 61, Panipat Ho, Panipat - 132103, Near Huda, Sector 25 Part-1, Phone: +919996231383
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15. **Saraswati Global -** 3 Ganesh Colony, Amer Road, Jaipur-302002, Rajasthan, INDIA info@saraswatiglobal.com, +91-141-2671890, +91-979-909-7956, +91-946-251-0767
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20. **Malti rugs-** RG-42 Gyanpur Road Malti Rugs Bhadohi Sant Ravidas Nagar, Bhadohi-221401, Uttar Pradesh, India, Phone: 05414-224495
21. **Sharda Exports/ The Rug republic -** Rithani Industrial Area, Delhi Road, Meerut – 250103, Uttar Pradesh Phone: +91-121-24416