DEPARTMENT OF TECHNICAL EDUCATION (DIPLOMA SECTOR)
UTTAR PRADESH

CURRICULUM FOR DIPLOMA PROGRAMME
IN
TEXTILE CHEMISTRY
(3rd to 4th Semester)

==========
Semester System
==========

YEAR 2025-2026

Prepared By:

INSTITUTE OF RESEARCH DEVELOPMENT & TRAINING, U.P., KANPUR

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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.

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1. Sh. Narendra Kumar Bhushan, IAS Additional Chief Secretary, Technical Education Govt. of U.P. for his exemplary vision & approach.

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3. All the participants from Polytechnics and other technical institutions for their professional input during curriculum workshops.

4. CDC Officer and others concerning staff of IRDT for their support and assistance in conducting curriculum workshops.

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2. SALIENT FEATURES

1. Name of the Programme	➢ Diploma in Textile Chemistry
2. Duration of the Programme	➢ Three years (Six Semesters)
3. Entry Qualification	➢ Matriculation or equivalent NEP-2020/NSQF Level 5 as Prescribed by State Board of Technical Education, U.P.
4. Pattern of the Programme	➢ Semester System
5. Ratio between theory and Practice	➢ 40% (Theory) / 60% (Practical)

1) <u>Industrial Training/Internship:</u>

Four and six weeks of industrial training is made mandatory after the II and IV semesters during summer vacation. Total marks allotted to industrial training will be respectively 50 & 100.

In the last (6^{th} Semester) we have made the one semester Industrial training/Internship as optional along with usual classroom training.

2) <u>Audit & Pathways</u>:

As per AICTE and NEP-2020 directives, Essence of Indian Knowledge & Tradition, Indian Constitution, Entrepreneurship & Startup, subjects on Environmental Studies have been incorporated in the curriculum.

3) <u>Student Centered Activities</u>:

A provision of 4-8 hrs. per week has been made for organizing Student Centered Activities for overall personality development of students. Such activities will comprise co– curricular activities such as expert lectures, classroom seminars, games, hobby club like photography, painting, singing etc. declamation contests, field visits, NCC, NSS and other cultural activities, etc.

4) <u>Project work:</u>

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

3. EMPLOYMENT OPPORTUNITIES FOR DIPLOMA HOLDERS IN TEXTILE CHEMISTRY

Keeping present scenario in view following employment opportunities are visualized in different sectors of employment for diploma holders in Textile chemistry.

(1) Manufacturing Industry

The Textile Chemistry diploma holder will be able to execute the following activities:

- Supervisor and managerial job in yarn dyeing production Industry.
- Production Supervisor in Cotton fiber dyeing Industry
- Production Supervisor in Quality assurance Department.
- Production Supervisor in Continuous Processing state-of-the-art plant. .
- Quality Assurance/Control in textile Mills
- Machine installation and maintenance in Process house.
- Assistance in Research and Development in the Textile Industry.
- Assistance in Production Planning and Control in Textile Industry.
-Production Supervisor in Carpet Processing Industry.
- Inventory Management
- Marketing and Sales
-New Product Development in different types of fabric.
- Production Supervisor in Dyeing and Finishing Process.
- Textile testing Lab in charge
- Production Supervisor in Knitting Industry
- Garment/Apparel Production Management.
- Technical Textile Industry

(2) Government Departments such as DRDO, Central Silk Board, MSME, National Textile Corporation, Khadi Gramodyog, Ministry of Textiles, Handloom Development Commission, Weaver's Service Centre

- Lab Technician
- Research Assistant
- Cluster Development Officer
- Supervisor
- Handloom Development officer
- Textile Process Service Centre supervisor

(3) Self Employment

- Khadi Yarn and Fabric Processing Unit.
- Trading Textile Accessories for garment .
- Trading machine Spare parts.
- Trading Fabric.
- Start-up of Garment Manufacturing Unit on a small scale.
- Trading of Dyes and Chemical.
-Trading of Dyed Yarn.
-Trading of Dyed Fiber.
-Start -up Yarn, Fiber Dyeing house.
- Start-up Swing Thread manufacturing small industry.
-Start-up of Special Finished fabric like Fire Retardant, Anti crease, Anti-Static, Odur Finish.
-Start Up of Tie-Die, Block, Screen , Bandhani medium scale printing industry

4. (A) Program Outcomes (POS)

PO1: Basics and Discipline specific Knowledge
Assimilate knowledge of basic mathematics, science, engineering fundamentals, and Textile Chemistry.

PO2: Problem's Analysis and solution
Identify, analyse and solve problems using standard methods and established techniques.

PO3: Design and Development
Design solutions for technical problems.
Assist in designing components, systems, or processes to meet specific requirements.

PO4: Engineering Tools, Experimentation, and Testing

Use modern engineering tools and appropriate techniques to conduct experiments as per BIS standard.

PO5: Socio/ Economic /Environmental impact assessment/remedy.

Apply relevant technologies while considering societal needs, environmental impact keeping in view sustainable and ethical responsibilities.

PO6: Project Management and Communication
Apply engineering management principles, work effectively as an individual or in a team, and communicate clearly on activities.

PO7: Lifelong Learning
Recognize the importance of continuous learning and actively pursue self-improvement to keep pace with technological developments.

4. (B) LEARNING OUTCOMES OF THE PROGRAM

Designing a curriculum for a course in Textile Chemistry requires a comprehensive approach that covers both the fundamental principles of chemistry and their application in the textile industry. Here are some key curriculum areas to consider:

1. Chemistry Fundamentals:
    - Inorganic Chemistry: Introduction to elements, compounds, and chemical reactions relevant to textiles.
    - Organic Chemistry: Study of organic compounds and their relevance in textile fiber and dye chemistry.
    - Physical Chemistry: Thermodynamics, kinetics, and equilibria as applied to textile processes.

2. Fiber Chemistry:
    - Fiber Structure and Properties: Understanding the structure and properties of natural and synthetic textile fibers.
    - Fiber Processing: Overview of spinning, extrusion, and other fiber manufacturing processes.

3. Dye Chemistry:
    - Dye Classification: Study of various types of dyes used in textile applications, such as direct, reactive, vat, and disperse dyes.
    - Dyeing Techniques: Practical knowledge of dyeing techniques including exhaust, pad, and continuous dyeing.

4. Chemical Finishing:
    - Fabric Finishing: Chemical treatments to enhance properties like water repellency, flame resistance, and wrinkle resistance.
    - Printing and Coating: Techniques for applying patterns, designs, and coatings to fabrics.

5. Color Science:
    - Color Theory: Understanding the principles of color perception, color mixing, and color matching.
    - Color Measurement: Practical techniques for color assessment and quality control in textiles.

6. Analytical Techniques:
    - Spectroscopy: Introduction to UV-Visible, IR, and other spectroscopic methods used in textile analysis.
    - Chromatography: Principles and applications of chromatographic techniques in textile chemistry.

7. Environmental and Sustainable Practices:
    - Sustainable Textile Chemistry: Methods to reduce the environmental impact of textile processes, such as wastewater treatment and eco-friendly dyeing.
    - Regulations and Compliance: Understanding and adhering to environmental regulations in textile chemistry.

8. Quality Control and Testing:
    - Textile Testing: Techniques for evaluating the physical and chemical properties of textiles.
    - Quality Assurance: Implementing quality control measures in textile production.

9. Polymer Chemistry:
    - Polymer Science: Understanding the role of polymers in textile materials and processing.
    - Polymerization Techniques: Study of polymerization methods used in creating synthetic fibers.

10. Textile Product Development:
    - Product Innovation: Developing new textiles with desired properties and functionalities.
    - Market Trends: Staying updated on current trends and consumer preferences in the textile industry.

11. Safety and Hazard Management:
    - Chemical Safety: Ensuring the safe handling and storage of chemicals used in textile chemistry.
    - Emergency Response: Training for responding to chemical spills and accidents in the workplace.

12. Research and Development:
    - Research Methods: Techniques for conducting research in textile chemistry.
    - Innovation and Problem-Solving: Applying chemistry knowledge to solve real-world textile challenges.

13. Internship/Practical Experience:
    - Hands-on experience in a textile laboratory or manufacturing facility to apply theoretical knowledge.

14. Capstone Project:
    - A research or practical project that integrates the concepts and skills learned throughout the curriculum.
15. Professional Ethics and Communication:
    - Ethical considerations in the textile industry.
    - Effective communication skills for working in interdisciplinary teams.

Tailoring the curriculum to the specific needs and goals of the students and considering advancements in textile chemistry and technology is essential for ensuring the program remains relevant and up-to-date. Moreover, collaboration with industry partners can provide valuable insights and opportunities for practical experience.

5. ABSTRACT OF THE CURRICULUM AREAS

PROGRAM CORE COURSES

Textile Fibre (Theory)
Preparatory Chemical Processing (Theory)
Preparatory Chemical Processing (Lab)
Organic Chemical Technology
Textile Fibre (Lab)
Physical Chemistry
Advance Skill Development (Open Elective-1)
Textile Testing
Technology of Dyeing-I (Theory)
Technology of Dyeing-I (Lab)
Technology of Textile Printing-I (Theory)
Technology of Textile Printing-I (Lab)
Advance Skill Development (Open Elective-2)
Essence of Indian Knowledge and Tradition (Audit course)
Technology of Dyeing-II (Theory)
Technology of Dyeing-II (Lab)
Technology of Textile Printing-II
Textile Processing Chemical & Auxiliaries
Technology of Finishing
Entrepreneurship and Start-Up
In-House Project or Internship or Industrial Training

PROGRAM ELECTIVE COURSES

(Program Elective -1)
1.Principle Of Design & Colour
2.Textile Manufacturing Process

(Program Elective -2)
1.Chemistry Of Intermediates & Dyes
2.Industrial Safety

AUDIT COURSE

Essence of Indian Knowledge and Tradition

6. STUDY AND EVALUATION SCHEME FOR TEXTILE CHEMISTRY (348)

THIRD SEMESTER

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS INEVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
3.1	TEXTILE FIBRE	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
3.2	PREPARATORY CHEMICAL PROCESSING	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
3.3	PREPARATORY CHEMICAL PROCESSING (LAB)	PROGRAM CORE (PRACTICAL)	-	-	06	3	-	60	60	-	-	40	3	40	100
3.4	ORGANIC CHEMICAL TECHNOLOGY	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
3.5	TEXTILE FIBRE (LAB)	PROGRAM CORE (PRACTICAL)	-	-	04	2	-	60	60	-	-	40	3	40	100
3.6	PHYSICAL CHEMISTRY	PROGRAM CORE (PRACTICUM)	01	-	02	2	-	60	60	-	-	40	3	40	100
3.7	ADVANCE SKILL DEVELOPMENT	(Q) OPEN ELECTIVE-1 (THEORY)	02	-	-	2	50	-	-	-	-	-	-	-	N/A
		(Q) OPEN ELECTIVE-1 (Certification Course)					-	-	-	-	-	-	-	-	N/A
3.8	SUMMER INTERNSHIP** (4 WEEKS)		-	-	-	2	-	50	50	-	-	-	-	-	50
#STUDENT CENTERED ACTIVITIES			-	-	12	-	-	50	50	-	-	-	-	-	50
Total			**12**		**24**	**20**	**120**	**280**	**400**	**180**		**120**		**300**	**700**

(Q) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.

Advance skill development mention at the table provides the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agencies of repute of duration not less than 20 Hrs (Offline/Online).

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. Photography etc., Seminars, Declamation Contests, voluntary contribution in physical activities, Educational Field Visits, NCC, NSS, Cultural Activities and Self-Study.

** Students will present a seminar on their summer internship along with certificate, project and report.

FOURTH SEMESTER **TEXTILE CHEMISTRY (348)**

Sr. No.	SUBJECTS	COURSE TYPE & CATEGORY	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME								Total Marks of Internal & External
							INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT					
			L	T	P		Th	Pr	Tot	Th	Hrs	Pr	Hrs	Tot	
4.1	TEXTILE TESTING	PROGRAM CORE (PRACTICUM)	02	-	02	3	40	-	40	60	3	-	-	60	100
4.2	TECHNOLOGY OF DYEING-I	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
4.3	TECHNOLOGY OF DYEING-I (LAB)	PROGRAM CORE (PRACTICAL)	-	-	04	2	-	60	60	-	-	40	3	40	100
4.4	TECHNOLOGY OF TEXTILE PRINTING-I	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	3	-	-	60	100
4.5	TECHNOLOGY OF TEXTILE PRINTING-I (LAB)	PROGRAM CORE (PRACTICAL)	-	-	04	2	-	60	60	-	-	40	3	40	100
4.6	PROGRAM ELECTIVE -1	PROGRAM CORE (THEORY)	03	-	-	3	40	-	40	60	-	-	3	60	100
4.7	PROGRAM ELECTIVE -2	PROGRAM CORE (THEORY)	02	-	-	2	40	-	40	60	-	-	3	60	100
4.8	ADVANCE SKILL DEVELOPMENT	(Q) OPEN ELECTIVE-2 (THEORY)	02	-	-	2	50	-	-	-	-	-	-	-	N/A
		(Q) OPEN ELECTIVE-2 (Certification Course)					-	-	-	-	-	-	-	-	N/A
4.9	(Q)ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	AUDIT COURSE	02	-	-	-	50	-	50	-	-	-	-	-	NA
#STUDENT CENTERED ACTIVITIES			-	-	09	-	-	50	50	-	-	-	-	-	50
Total			**17**	**-**	**19**	**20**	**200**	**170**	**370**	**300**	**-**	**80**	**-**	**380**	**750**

.(Q) It is compulsory to appear and to pass the examination, but marks will not be included for percentage and division of obtained marks.

Advance skill development mention at the table provides the scope of selecting the course as per choice from the elective list provided in the syllabus conducted by various agencies of repute of duration not less than 20 Hrs (Offline/Online).

Student Centered Activities will comprise of co-curricular activities like extension lectures, games, hobby clubs e.g. Photography etc., Seminars, Declamation Contests, voluntary contribution in physical activities, Educational Field Visits, NCC, NSS, Cultural Activities and Self-Study.

OPEN ELECTIVE-1

SR.NO.	(Q) THEORY COURSES NAME
1.	ECONOMIC POLICIES IN INDIA (Course offered by Polytechnic Institute)
2.	PROJECT MANAGEMENT (Course offered by Polytechnic Institute)

SR.NO.	**CERTIFICATE COURSES**
1.	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc)*Annexure-1
2.	NPTEL
3.	MOOCS THROUGH SWAYAM
4.	AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
5.	C-DAC
6.	CERTIFICATIONS CONDUCTED BY THE INSTITUTE OF NATIONAL IMPORTANCE (IIT, NIT, IIIT ETC.)
7.	ISRO E-LEARNING
8.	OTHER RELEVANT GOVERNMENT, INTERNATIONAL/NATIONAL PLATFORMS OF REPUTE NEILIT
9.	DATABASE MANAGEMENT SYSTEM(ERP) BTRA/NITRA/SITRA/ATIRA/TAI/SASMIRA/WIRA CERTIFICATE PROGRAMME

OPEN ELECTIVE -2

SR.NO.	(Q) THEORY COURSES NAME
1.	RENEWABLE ENERGY TECHNOLOGIES (Course offered by Polytechnic Institute)
2.	ENERGY EFFICIENCY AND AUDIT (Course offered by Polytechnic Institute)

SR.NO.	**CERTIFICATE COURSES**
1..	COURSES CONDUCTED BY CENTRE OF EXCELLENCE (ESTABLISHED BY THIRD PARTY AS: - TATA TECHNOLOGIES. etc)*Annexure-1
2.	NPTEL
3.	MOOCS THROUGH SWAYAM
4.	AICTE-ELIS AND CENTRALLY FUNDED TECHNICAL INSTITUTES
5.	C-DAC
6.	CERTIFICATIONS CONDUCTED BY THE INSTITUTE OF NATIONAL IMPORTANCE (IIT, NIT, IIIT ETC.)
7.	ISRO E-LEARNING
8.	OTHER RELEVANT GOVERNMENT, INTERNATIONAL/NATIONAL PLATFORMS OF REPUTE NEILIT
9.	DATABASE MANAGEMENT SYSTEM(ERP) BTRA/NITRA/SITRA/ATIRA/TAI/SASMIRA/WIRA CERTIFICATE PROGRAMME

ANNEXURE-1

LIST OF COURSES CONDUCTED BY TATA TECHNOLOGIES

1. Fundamentals of Innovation and Design Thinking
2. Product Design and Development
3. Product Verification and Analysis
4. Advanced Automobile
5. Electric Vehicle
6. Internet of Things
7. Advanced Manufacturing
8. Advanced Welding & Painting using Simulator
9. Industrial Automation and MES
10. Industrial Robotics
11. Inspection and Quality Control
12. Advanced Plumbing
13. AI and ML

PROGRAME ELECTIVE-1

SR.NO.	SUBJECT NAME
1.	PRINCIPLE OF DESIGN & COLOUR
2.	TEXTILE MANUFACTURING PROCESS

PROGRAME ELECTIVE-2

SR.NO.	SUBJECT NAME
1.	CHEMISTRY OF INTERMEDIATES & DYES
2.	INDUSTRIAL SAFETY

7. DETAIL CONTENTS OF VARIOUS SUBJECTS

THEORY	3.1 TEXTILE FIBRE	L	T	P
		3	-	-

COURSE OBJECTIVES

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 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.
- 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 Acrylic and other high-performance fibres.

COURSE CONTENTS

UNIT-I Introduction of Natural and various Synthetic Fibre (6 Periods)

Definitions related to textile fibers. Classification of textile fibers, Definition of regenerated and synthetic fibres. Difference between staple and filament fibers. Essential and desirable properties of textile fibers. Advantages and disadvantages of natural Fibers. Concepts of molecular weight, Degree of Polymerization, Orientation and Crystallinity. Characteristics of fibre-forming polymers.

UNIT-II Cotton Fibre and Jute Fiber: (10 Periods)

Cotton cultivation and harvesting. Development of cotton fibers in the seed. Cotton varieties and grading, Morphological structure of cotton fibres Physical and chemical properties of cotton fibers, Applications of cotton fibers.

Jute cultivation, Retting and extraction process. Structure of jute fibers. Physical and chemical properties of jute fibers. Applications of jute fibers. Introduction to other natural bast fibers (flax, hemp) and their applications.

UNIT-III Wool Fibreand Silk Fibre (8 Periods)

Types of wool and grading. morphological structure of wool fibers. Chemical composition of wool Fibers. Physical and chemical properties of wool fibers. Varieties of wool fibers and their applications.

Types of silk and its production. Chemical composition and morphological structure of silk. Physical and chemical properties of silk fibers. applications of silk fibers.

UNIT-IV Polyester Fibre and Polyamide Fibre (10 Periods)

Introduction to methods of fibre formation, Melt spinning. Manufacturing process of polyester fibres. Physical and chemical properties of polyester fibres. Applications of polyester fibres.

Manufacturing process of Nylon-6 and Nylon-66. Physical and chemical properties of Nylon-6 and Nylon-66. Applications of Polyamide fibres.

UNIT-V Acrylic Fibre and Regenerated Fibre (08 Periods)

Manufacturing process of acrylic fibre. Dry spinning, Physical and chemical properties of acrylic fibres. Applications of acrylic fibres.

Introduction to regenerated fibres, Wet Spinning, Raw materials for viscose rayon, Manufacturing sequence of viscose fibres.

INSTRUCTIONAL STRATEGY

The instructional strategy for this carpet manufacturing curriculum combines interactive lectures, visual aids, hands-on activities, and discussions to enhance understanding and engagement. Each unit uses specific methods—such as concept mapping for terminology, group classification tasks for design origins, guest lectures or videos for the Indian carpet sector, and fiber identification activities—to align with the learning outcomes. Real-world examples, cultural context, and physical samples are integrated throughout to make learning relevant and practical, while formative assessments like quizzes, worksheets, and reflections help monitor student progress effectively.

MEANS OF ASSESSMENT

Assessment will be carried out through a combination of formative and summative methods. Formative assessments will include quizzes, class discussions, group activities, worksheets, and short reflective writing to evaluate ongoing understanding. Summative assessments will consist of written tests, classification charts, group presentations, and practical evaluations (e.g., fiber identification). These varied assessment tools will help measure students' knowledge, analytical skills, and application of concepts in real-world contexts.

RECOMMENDED BOOKS -

1. वस्त्र रेशे –उत्पादन विशेषताएँ एवं उपयोग –DR. D. B. Shakyawar & Dr. M. K. Singh , abhishek Publication Chandigarh/ New Delhi.
2. Textile Fibre by Ghol and Valanslk`

3. S. P. Mishra, A text book of Fibres Science and technology, New Age International (p) Ltd 2000.
4. H V S Murthy, Textile Fibres- Textile Association Publication 1995.
5. Textile Fibres –I By Dr. V.A. Shenai

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	14
2	10	24
3	08	20
4	10	24
5	8	18
Total	**42**	**100**

THEORY	3.2 PREPARATORY CHEMICAL PROCESSING	L	T	P
		3	-	-

COURSE OBJECTIVES

Bleaching and mercerization are the processes to improve the looks and quality of the textile products. So, they are indispensable, their knowledge to students of textile processing is a must.

LEARNING OUTCOMES

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

- understand the preparatory processes of processing
- evaluate the bleached and mercerized fabric
- learn different types of machineries used in preparatory processes

COURSE CONTENTS

UNIT I. General Processes and Equipment: (01 Periods)

Natural and added impurities in cotton, silk, wool, jute, etc.

UNIT II. Preparatory Process: (08 Periods)

1. Singeing - . Purpose of singeing and detailed working of gas singeing machine with its advantages and disadvantages.
2. Desizing - Purpose, desizing agents and desizing methods. Detail study of Enzymatic desizing with its advantages and disadvantages.
3. Scouring - Scouring cotton.
4. Bleaching - Bleaching of textile fiber with Hypochlorite, Peroxide and Chlorite bleaching with its advantages and disadvantages.

UNIT III. Mercerization: (08 Periods)

Mercerization, Physical and chemical change during mercerization Process parameter, check the efficiency of mercerization by barium activity number.

UNIT IV. Preparatory Process for Wool Silk and Synthetic Textile Material (08 Periods)

1. Different methods of scouring of wool, machines used Scouring of woolen yarn and fabric. Carbonizing processes for raw wool and woolen fabrics.
2. Degumming of silk.
3. Bleaching of woolen and silk fibers and their blends
4. Bleaching of various synthetic fiber and their blends

UNIT V. After Treatment Process: (08 Periods)

1. Washing- Its importance, Washing range machines
2. Drying- Introduction, Thermal Drying-Cylinder drying, Stenter drying and radiation drying

UNIT VI. Preparatory Macheneries/Processing: **(08 Periods)**
Brief description and working principle of J-box, Kier, Jigger, Winch.

UNIT VII. Evaluation: **(01 Periods)**
Evaluation of Bleached and scoured fabric.

INSTRUCTIONAL STRATEGY

Teacher should take theory lecture, demonstration of concepts and prototype

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS:

1. Technology of Bleaching- VOL 3 V.A. SHENAI
2. Bleaching, mercerizing and Dyeing of Cotton Materials – R.S.Prayag
3. Dyeing of wool, silk and manmade fibers- R.S.Prayag

WEBSITES FOR REFERENCE:

www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	1	2
2	8	19
3	8	19
4	8	19
5	8	19
6	8	19
7	1	3
Total	**42**	**100**

PRACTICAL	3.3 PREPARATORY CHEMICAL PROCESSING	L	T	P
		-	-	6

LIST OF PRACTICALS

1. Design of cotton
   (a) Acid Designing
   (b) Enzymatic Designing

2. Scouring of cotton and to estimate scouring loss.

3. Bleaching of cotton with bleaching powder.

4. Bleaching of cotton with sodium hypochloride.

5. Bleaching of cotton with hydrogen peroxide.

6. Mercerization of cotton.

7. Scouring of wool and silk.

8. Carbonizing wool.

9. Bleaching wool and silk with hydrogen peroxide sodium hypochloride.

10. Bleaching of synthetic fiber with sodium chlorite.

11. Bleaching of blends with sodium chlorite.

THEORY	3.4 ORGANIC CHEMICAL TECHNOLOGY	L	T	P
		3	-	-

COURSE OUTCOMES

Use of organic compounds in textile processes is well known. So, the knowledge of organic chemistry with its relevance to textile industry is essential for the personnel's concerned.

LEARNING OUTCOMES

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

- Understand different types of organic compounds.
- Understand unit reaction and polymers.
- Understand the classification and manufacturing of dyes.

COURSE CONTENTS

UNIT I. Organic Compounds: (08 Periods)
Their classification, Systems of nomenclature of

i. Aliphatic Compounds
ii. Aromatic Compounds

UNIT II. Aliphatic Compounds: (09 Periods)
General Method of preparation and properties of alkane, alkene, alkynes, Halogen derivative, amino compounds, Hydroxy compound, Aldehyde, Ketone and acids.

UNIT III. Aromatic Compounds: (09 Periods)

Classification of Aromatic compounds. General methods of preparation. Properties and uses of aromatic hydrocarbons, Halogen derivatives, Hydroxy compounds, Nitro compounds, Sulphuric acid derivatives, Amino compounds, Diazonium compounds, Acids and their important derivatives.

UNIT IV. Unit Reactions: (08 Periods)
Introduction to following reaction and their application in textile chemistry.
i.Nitration
ii. Sulphonation
iii. Halogenation
iv. Diazotization.

UNIT V. Polymers: (08 Periods)
What is monomer and polymers. Different types of monomer and polymer. Definition of repeat unit, degree of polymerization functionality of monomer. Classification of polymer, molecular mass/ weight of polymer. Glass transition temp (Tg) of polymeric materials.

INSTRUCTIONAL STRATEGY

Teacher should take theory lecture, demonstration of concepts and prototype

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. The complete Technology Book on Dyes and dye intermediates-Dr. Himadri Panda
2. Chemistry of intermediates and dyes- V.A. Shenai

WEBSITES FOR REFERENCE:

www.niir.org/book

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	19
2	9	22
3	9	21
4	8	19
5	8	19
Total	**42**	**100**

PRACTICAL	3.5 TEXTILE FIBRE	L	T	P
		-	-	4

LIST OF PRACTICALS

1. Checking moisture regain of different natural textile fibres using a reputable brand conditioning oven.
2. Checking moisture regain of different synthetic textile fibres using a reputable brand conditioning oven.
3. Identifying of cotton fibers under a microscope and drawing their longitudinal and cross- sectional views.
4. Identifying of cotton fibers by chemical, physical test.
5. .Identifying of jute fibers under a microscope and drawing their longitudinal and cross- sectional views.
6. Identifying of jute fibers by chemical, physical test.
7. Identifying of wool fibers under a microscope and drawing their longitudinal and cross- sectional views.
8. Identifying of wool fibers by chemical, physical test.
9. Identifying of silk fibers under a microscope and drawing their longitudinal and cross- sectional views.
10. Identifying of silk fibers by chemical, physical test.
11. Identifying of polyester fibers under a microscope and drawing their longitudinal and cross- sectional views.
12. Identifying of polyester fibers by chemical, Physical test.
13. Identifying of polyamide fibres under a microscope and drawing their longitudinal and cross- sectional views.
14. Identifying of polyamide fibres by chemical, physical test.
15. Identifying of acrylic fibers under a microscope and drawing their longitudinal and cross- sectional views.
16. Identifying of acrylic fibers by chemical, Physical test.
17. Identifying of viscose fibers under a microscope and drawing their longitudinal and cross- sectional views.
18. Identifying of viscose fibers by chemical, physical test.
19. To do quantitative estimation of fibres in a blend

PRACTICUM	3.6 PHYSICAL CHEMISTRY	L	T	P
		1	-	2

COURSE OUTCOMES

Knowledge of principles of physical chemistry is useful for textile processing activities for better control and qualities. The paper deals with such principles relevant to activities in textile processing house.

LEARNING OUTCOMES

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

- Understand the basic concepts of colloids.
- **U**understand the concept of chemical kinetics.

COURSE CONTENTS

UNIT I. Colloidal Chemistry: (02 Periods)

Particle size and colloidal state, Types of colloids, Dispersed phase and dispersion phase. Preparation of colloidal solution by dispersion and condensation methods. Tyndall effect, Brownian movement, cataphoresis, emulsions, Absorption. Application of colloids in industry and in nature.

Practicals:-

1. Identification of colloidal solution , true solution and disperse solution.

UNIT II. PH Value: (02 Periods)

Importance of pH value in textile chemistry, measurement of pH value by observation and by meter.

Practicals:-

1. Simple titrations on pH meter.
2. To check the PH of different solution with the help of PH meter, universal indicator, PH paper etc.
3. Analysis of acid and alkali.

UNIT III. Chemical Kinetics: (04 Periods)

Rate of a reaction, Expressing rate of a reaction, Factors influencing rate of a reaction. Order of a reaction. Reactions of First, Second and Third order. Methods of determining order of a reaction. Molecularity and temperature dependence of reaction rates. Concept of activation. Catalysis, Influence of catalysts on reaction rates and equilibrium. Concept of free energy and its application in dyeing and bleaching.

Practicals:-

1. Determination of nature of emulsion.

UNIT IV. Surface Tension - Its measurement by (02 Periods)

i. Capillary Rise Methods
ii. Stalagmo Meter
iii. Tension Balance Methods.

iv. Roll Surface in washing

Practicals:-

1. Determination of surface tension by drop weight method using stalagmometer.

UNIT V. Viscosity: (02 Periods)

(i) Temperature dependence of viscosity determination of viscosity by viscometer.
(ii) Roll of viscosity in preparing painting paste.

Practicals:-

1. Determination of viscosity using Ostwald's viscometer

UNIT VII. Application Of Physical Chemistry: (02 Periods)

Its application in various textile chemical processes such as bleaching, dyeing and printing

Practicals:-

1. Estimation of the following oxidizing agents –
   i. Bleaching Powder.
   ii. Sodium Hydrosulphite.
   iii. Hydrogen Peroxide.

INSTRUCTIONAL STRATEGY

Teacher should take theory lecture, demonstration of concepts and prototype

MEANS OF ASSESSMENT

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

SUGGESTED DISTRIBUTION OF MARK

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	02	10
2	02	10
3	04	20
4	02	14
5	02	23
6	02	23
Total	**14**	**100**

THEORY	3.7 ECONOMIC POLICIES IN INDIA (OE-1)	L	T	P
		2	-	-

COURSE OBJECTIVE:
The objective of this course is to familiarize the students of different streams with the basic concepts,
structure, problems and issues concerning Indian economy.

LEARNING OUTCOMES:
At the end of the course, the student will be able to:

- Understand Indian economics policy, planning strategies
- It will enable students to comprehend theoretical and empirical development across countries and region for policy purposes
- Development Economics as a discipline encompasses different approaches to the problems of unemployment, poverty, income generation, industrialization from different perspectives
- Able to identify the problems and capable of deciding the application for future development
- Analyze economic issues and find solutions to complex economic problems and take correct
  economic judgment

COURSE CONTENTS

Unit-1: (6 Periods)
Basic features and problems of Indian Economy: Economic History of India; Nature of Indian Economy, demographic features and Human Development Index, Problems of Poverty, Unemployment, Inflation, income inequality, Black money in India.

Unit-2: (5 Periods)
Sectoral composition of Indian Economy: Issues in Agriculture sector in India, land reforms Green Revolution and agriculture policies of India,

Unit-3: (5 Periods)
Industrial development, small scale and cottage industries, industrial Policy, Public sector in India, service sector in India.

Unit-4: (7 Periods)
Economic Policies: Economic Planning in India, Planning commission v/s NITI Aayog, Five Year Plans, monetary policy in India, Fiscal Policy in India, Centre state Finance Relations, Finance commission in India. LPG policy in India

Unit-5: (5 Periods)
External sector in India: - India's foreign trade value composition and direction, India Balance of payment since 1991, FDI in India, Impact of Globalization on Indian Economy, WTO and India.

INSTRUCTIONAL STRATEGY

- Teachers should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Seminar, Presentation, Viva-voce.

RECOMMENDED BOOKS:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy. S Chand & Co. Ltd. New Delhi.
2. Mishra S.K & V.K Puri (2017). Indian Economy and –Its Development Experience. Himalaya
   Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, New Delhi
6. Kaushik Basu (2007): The Oxford Companion to Economics of India, Oxford University Press.

SUGGESTED DISTRIBUTION OF MARK

Topic No.	Time Allotted (periods)	Marks Allotted (%)
1	06	20
2	05	20
3	05	17
4	07	23
5	05	20
Total	**28**	**100**

THEORY	3.7 PROJECT MANAGEMENT (OE-1)	L	T	P
		2	-	-

COURSE OBJECTIVE:
A project plan starts by defining and confirming goals, then identifying tasks to achieve them. It also involves applying key project management skills like planning, organization, and time management to ensure successful execution.

LEARNING OUTCOMES:
At the end of the course, the student will be able to:

- Understand the importance of projects and its phases.
- Analyze projects from marketing, operational and financial perspectives.
- Evaluate projects based on discount and non-discount methods.
- Develop network diagrams for planning and execution of a given project.
- Apply crashing procedures for time and cost optimization.

COURSE CONTENTS

Unit-1: (6 Periods)
Concept of a project: Classification of projects- importance of project management- The project life cycle- establishing project priorities (scope-cost-time)project priority matrix- work break down structure.

Unit-2: (6 Periods)
Capital budgeting process: Planning- Analysis-Selection-Financing-Implementation-Review. Generation and screening of project ideas- market and demand analysis- Demand forecasting techniques. Market planning and marketing research process- Technical analysis

Unit-3: (5 Periods)
Financial estimates and projections: Cost of projects-means of financing-estimates of sales and production-cost of production-working capital requirement and its financing-profitability
projected cash flow statement and balance sheet. Break even analysis.

Unit-4: (5 Periods)
Basic techniques in capital budgeting: Non discounting and discounting methods- payback period- Accounting rate of return-net present value-Benefit cost ratio-internal rate of return. Project risk. Social cost benefit analysis and economic rate of return. Non-financial justification of
projects**.**

Unit-5: (6 Periods)
Project administration: progress payments, expenditure planning, project scheduling and network planning, use of Critical Path Method (CPM), schedule of payments and physical progress,
time-cost trade off.
Concepts and uses of PERT cost as a function of time, Project Evaluation and Review Techniques/cost mechanisms. Determination of least cost duration. Post project evaluation. Introduction to various Project management softwares.

INSTRUCTIONAL STRATEGY

- Teachers should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Seminar, Presentation, Viva-voce.

RECOMMENDED BOOKS:

1. Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill
2. Project Management – the Managerial Process – Clifford F. Gray & Erik W. Larson – McGraw Hill
3. Project management - David I Cleland - Mcgraw Hill International Edition, 1999
4. Project Management – Gopala Krishnan – Mcmillan India Ltd.
5. Project Management- Harry-Maylor-Peason Publication

SUGGESTED DISTRIBUTION OF MARK

Topic No.	Time Allotted (periods)	Marks Allotted (%)
1	06	17
2	06	20
3	05	20
4	05	20
5	06	23
Total	**28**	**100**

PRACTICUM	4.1 TEXTILE TESTING	L	T	P
		2		2

COURSE OUTCOMES

As the name implies this paper aims to develop in the incumbent the capability of testing the products and its components for desired results. Without it a product can never be claimed for any standard.

LEARNING OUTCOMES

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

- To understand the importance of textile testing
- To understand use of statistics in testing
- To understand fiber testing for various parameters
- To understand yarn testing for various parameters
- Learn the basic Textile chemical testing.

COURSE CONTENTS

UNIT-I Importance Of Textile Testing: (06 Periods)

Introduction to textile testing, properties of fibres, yarns and fabrics and their relevance in assessing the performance, of textiles during and after manufacture. Brief introduction of ISO. Definition of sample, sample size, sampling Technique, Introduction to quality control, Accuracy of measurement, presentation and analysis of data, SQC charts analysis of defects, difference between average and correlation. Standard deviation and coefficient of variation.

Practical:

1. To calculate the count /Denier/Tex of the different types of yarn.

UNIT-II Fibre Testing: (06 Periods)

Fibre Length (mean length, effective length and staple length. .Fiber Length Measurement - Use of Baer sorter, Fibrograph, Uster-stapler, their principles of operation., Fibre Fineness Measurement - By cutting and weighing method, Shefield micronaire, Aerlometer, Maturity of cotton by caustic soda method and by airflow methods., Role of Humidity - Absolute Humidity, Relative Humidity, moisture Regain, Moisture content. Introduction to H.V.I. (High Volume Instruments) Fiber strength testing by stelometer.

Practical

1. Find the staple length of fiber by Bare Sorter.
2. Find out fibre length by analytical digital fibrograph.
3. Measure fibre fineness by flowing air through a sample of fibre by micronaire.
4. Fiber Strength Testing by Stelometer

UNIT-III Yarn Testing: (06 Periods)

Concept of count, its measurement by different methods. Concepts of S & Z twist, relation between TPI, twist multiplier and count, Measurement of yarn twist by Rock bank twist tester, continuous twist tester and by twist and untwist methods Measurement of yarn diameter by microscope. Yarn strength testing, types of testing machines, single yarn strength testing and Lea strength testing. Nature of irregularities – short term, medium term and long term variations, periodic and non-periodic irregularities. Analysis of classmate and classifaults.

Practical:

1. To find the count of yarn by any one
   a. by physical balance
   b. by yarn quadrants balance.
   c.by Beasley yarn balance.
2. Determine the twist of yarn per inch/per meter in double yarn and its individual components by continuous twist tester and twist and untwist tester.
3. Find out lea strength of cotton yarn by lea strength tester (Power driven) and CSP.
4. Test evenness of the yarn by evenness tester.

UNIT-IV Fabric Testing: (05 Periods)

1.Fabric strength testing by cut strip, grab strip and revealed strip methods.

2.Fabric tear testing by tongue tear, trapezoid tear test.

3.Bursting strength testing by hydraulic strength tester.

Practical:

1. Examine the bursting strength of a fabric by bursting strength tester.
2. Find out the relative abrasion properties of fabrics by Martindale abrasion tester.
3. Find the breaking strength of different textile fabrics by means of cloth strength tester (power driven).
4. Measure crimp by Shirley crimp meter.
5. Find out air permeability of fabric by air permeability tester.
6. Measure crease recovery of fabric by crease recovery tester.
7. Test of pilling of fabrics by computerized pilling tester.

UNIT-V Textile Chemical Testing: (05 Periods)

1. Estimation of blend composition (Nylon, Polyester, Acrylic, Polyethylene, Cotton, wool, silk).

2. Colour fastness
   i. Colour fastness to light
   ii. Colour fastness to washing
   iii. Colour fastness to rubbing

iv. Colour fastness to perspiration
v. Colour fastness to chlorine
vi. Water absorbency test

Practical:

1. Estimation of final pH value of finished fabric.
2. Light fastness test
3. Washing fastness test
4. Rubbing fastness test
5. Perspiration fastness test
6. Absorbency test

INSTRUCTIONAL STRATEGY

Teacher should take theory lecture, demonstration of concepts and prototype

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Textile Testing- J.E. Booth
2. Physical testing of textile by B P Saville

Websites for Reference:

https://nptel.ac.in/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	06	18
2	06	22
3	06	30
4	05	20
5	05	10
Total	**28**	**100**

THEORY	4.2 TECHNOLOGY OF DYEING-I	L	T	P
		3	-	-

COURSE OUTCOMES

Dyeing is not a new thing to the textile industry but the improvements in the process and developments of techniques together make it an interesting case of study. Knowledge of chemicals and techniques used in the process is important for people concerned.

LEARNING OUTCOMES

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

- Understand basic dyeing concepts.
- Understand different types of dyestuffs.
- Application of different dyes on different fibers.
- Understand fastness properties of dyes.
- Understand different terms of dyeing.

COURSE CONTENTS

UNIT I. History of Dyeing of Textile, Classification of Dyestuffs & Natural Dyes : (05 Periods)

Definitions and brief history of dyeing of textiles, Classification of dyestuffs on the basis of methods of application and Application of Natural Dyes in Different Textile Fiber.

UNIT II. General Term In Technology of Dyeing: (07 Periods)

General terms and definitions used in technology of dyeing, Such as dyeing- assistants, mordants, dyebath, standing bath, levelling agent, liquor ratio, exhaustion, mangle expression.

UNIT III. Dyeing Machinery/Equipments: (08 Periods)

Dyeing of Textiles in different forms, i.e. loose fibre in yarn and fabric and machinery/equipment used such as jigger, tensionless enclosed jigger. Hank dyeing machine, winch dyeing machine, package dyeing machine, molten metal machine, padding mangles.

UNIT IV. Concept And Mechanism of Dyeing (10 Periods)

(i) Various principles of Dyeing, Theory of Dyeing, Dyeing Mechanism- Adsorption, Diffusion, Dye fibre attachment (Fixation), Equilibriums between dye solution and fibre.
(ii) Dyeing System - Different types of bond formation between dyes and fibres.
(iii) Mechanism and method of Dyeing synthetic fibres and fabrics
(iv) Concept of glass transition temperature (Tg), Tg of different Synthetic fibre such as polyester, acrylic, nylon, etc.

UNIT V. Direct, Basic, Acid, Sulphur and Vat Dyestuffs: (10 Periods)
Principles of dyeing and methods of dyeing cellulosic material. After treatments of materials dyed with direct dyestuffs to improve fastness properties, Principle of dyeing and methods of dyeing cotton, wool silk and jute, Principle of dyeing and methods of dyeing wool and silk with acid, Principle of dyeing and methods of dyeing cotton. Defects like Bronziness, Tendering and their Remedies and Principle of dyeing, Classification and methods of dyeing cotton.

UNIT VI. Solubilized Vat Dyestuffs: (2 Periods)
Application to cotton.

INSTRUCTIONAL STRATEGY

Teacher should take theory lecture, demonstration of concepts and prototype

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Bleaching, mercerizing and Dyeing of Cotton Materials – R.S. Prayag
2. Dyeing of wool, silk and manmade fibers- R.S .Prayag
3. Technology of Dyeing- V.A. Shenai

Websites for Reference:

https://nptel.ac.in/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	05	10
2	07	15
3	08	20
4	10	25
5	10	25
6	02	05
Total	**42**	**100**

PRACTICAL	4.3 TECHNOLOGY OF DYEING-I	L	T	P
		-	-	4

LIST OF PRACTICALS

1. Demonstration on prescribed machinery, preparation of line diagrams.
2. Dyeing of cotton with direct dyes.
3. After treatments of material dyed with direct dyes.
4. Dyeing wool and jute with basic dyes.
5. Dyeing wool and silk with acid dyes.
6. Dyeing of wool and silk with metal complex dyes.
7. Dyeing wool and silk with acid mordant dyes.
8. Dyeing cotton with sulfur black dye .
9. Dyeing of cotton with vat dyestuffs .
10. Dyeing of cotton with solubilized vat dyes.

THEORY	4.4 TECHNOLOGY OF TEXTILE PRINTING-I	L	T	P
		3	-	-

COURSE OUTCOMES

Printing is not a new thing to the textile industry but the improvements in the process and developments of techniques together make it an interesting case of study. Knowledge of chemicals and techniques used in the process is important for people concerned

LEARNING OUTCOMES

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

- Learn the concepts of textile printing
- Learn the preparatory processes of printing
- Learn the application techniques of different types printing
- Learn after treatment of textile printing

DETAILED CONTENTS

UNIT I: Introduction: (5 Periods)

Introduction to printing, methods and styles of printing, classification of printing thickeners and methods of thickeners paste preparation.

UNIT II: Cloth Preparation: (8 Periods)

Preparation of cloth for print paste preparation, wetting agents, hygroscopic chemicals dispersing agents, oxidative and reducing agents etc., precautions.

UNIT III: Methods Of Printing: (16 Periods)

Block printing, block preparation, roller printing, roller engraving, Screen printing- preparation of screens, Manual and automatic flat-bed screen printing, rotary screen printing, rotary screen preparation-manual and photosensitive, its method of application, merits and demerits. Faults and prevention in printing methods.

UNIT IV: After Treatment: (5 Periods)

General methods of print fixation, and machines used for after treatment of printing goods-steaming, ageing, curing etc. Pigment printing of cotton, binder emulsion, print paste recipe and steps involved.

UNIT V: Various Style of Printing: (8 Periods)

Direct, Resist & Discharge style of printing of cotton using direct, reactive and vat colours.

INSTRUCTIONAL STRATEGY

Teacher should take theory lecture, demonstration of concepts and prototype

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Technology of Printing - V.A. Shenai

2. Printing - D.G. Kale

3. Technology of textile printing – R.S. Prayag

4. Textile Printing- L W C Miles (Dyers Company Publication Trust, Bradford, England)

Websites for Reference:

https://nptel.ac.in/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	5	12
2	8	20
3	16	36
4	5	12
5	8	20
Total	**42**	**100**

THEORY	4.5 TECHNOLOGY OF TEXTILE PRINTING-I LAB	L	T	P
		-	-	4

LIST OF PRACTICALS

1. Printing of cotton with blocks.
2. Printing cotton with screens.
3. Printing of cotton by direct style using Direct dye.
4. Printing of cotton by direct style using Vat dye.
5. Print cotton by direct style using Reactive dye.
6. Printing cotton by direct style using Azoic dye.
7. Printing of cotton by direct style using Pigments.
8. Coloured discharge and coloured resist under Direct dye.
9. Coloured discharge and coloured resist under Vat dye.
10. Coloured discharge and coloured resist under Reactive dye.

THEORY	4.6.1 PRINCIPLE OF DESIGN & COLOUR	L	T	P
		3	-	-

COURSE OUTCOMES

Adding aesthetic sense to fabric by using color and development of designs to make it attractive to the consumer is most essential activity in textile manufacturing. This paper aims to equip the incumbent with principles and practices relevant to achieving this goal.

LEARNING OUTCOMES

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

- Draw and sketch flowers, buds and other figures on fabric.
- Understand the light theory and pigment theory.
- Understand primary and secondary colours.
- Understand colour harmony, tints and hues.
- Understand the weave effect.

COURSE CONTENTS

UNIT-I: (8 Periods)

Drawing, tracing, enlarging reducing and transferring of simple and elaborate figures.

UNIT-II: (14 Periods)

Sketching flowers, buds, leaves, geometrical figures and their assembly to obtain an all over effect in fabric. Preparation of sketches for stripped, check, spotted geometric and diaper patterns, suitable for fabrics.

UNIT-III: (8 Periods)

Light and pigment theory of colours. Complementary colours, the chromatic circle. Classification of colours and attributes of the primary and secondary colours according to light and pigment theory. Modification of colours. Colours in combination, general principles of colour contrast, colour harmony, tints, shades and broken hues.

UNIT-IV: (6 Periods)

Application of colour and weave effect.

UNIT-V: (6 Periods)

Development of textile patterns on different basis such as drop, turn over, drop reverse . Transfer of design of motives on graph paper and pilling of weaves according to structure/texture.

INSTRUCTIONAL STRATEGY

Teachers should show different sketches of leaves, flowers and figures. Teachers should show and prepare chart of light and pigment theory also prepare chart of primary and secondary colour.

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Principle of Design- Watson

Websites for Reference:
www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	19
2	14	34
3	8	19
4	6	14
5	6	14
Total	**42**	**100**

THEORY	4.6.2 TEXTILE MANUFACTURING PROCESSES	L	T	P
		3	-	-

COURSE OUTCOMES

The aim of this paper is to give new intrants in the field of textiles first-hand knowledge of principles and processes involved in the manufacture of fabrics beginning from fibre. It is to facilitate their further studies in the coming years of the course.

LEARNING OUTCOMES

- Understand the conversion of fiber to yarn effect.
- Understand the Spinning effect.
- Understand the weave effect.

COURSE CONTENTS

UNIT I. Manufacture Of Yarn: (21 Periods)

Elementary ideas of various processes involved in conversion of Fiber into yarn.

(a) Ginning and Mixing:

Object and different types of Ginning - Suitability of various Ginning machines according to quality of fiber.

(b) Blow Room Line:

Necessity of blow room line, Various machines used in blow room line and general idea of different processes completed in blow room line Viz. Opening, Cleaning and Lap formation

(c) Carding:

Main objects, Line diagram of machines and description of passage of material through Carding machine.

(d) Draw Frame:

Passage of materials through machines and main functions involved in the processes.

(e) Combing:

Definition and need of combing and preparation of material for combing process.

(f) Simplex (Fly Frame):

Object of the process, Passage of material through machines.

(g) Spinning:

(i) Its objects, Passage of material on machine spindle.
(ii) General idea of spinning defects coming in the process.

UNIT II. Manufacture Of Fabric: (21 Periods)

Elementary idea of various processes involved conversion of yarn into fabric. Viz.

(a) Winding:

(i) Its objects , types on basis of machine speed and winding packages . Passage of material through and any high-speed drum winding machine e.g. Rotoconer

(ii) Faults found in the winding package.
(iii)General idea of Pirn winding and its need and advantages.

(b) Warping:
Its main objects, general idea of beam and sectional warping machine.

(c) Sizing:
(i) Its main objects, methods of sizing on the basis of drying system used for drying wet yarn and on the basis of amount of size put on yarn.

(d) Drawing-in & Beaming:
Main objects of drawing in and beaming.

(e) Weaving:
(i) Primary, Secondary and Auxiliary motions in weaving process (Only name and functions of all motions).
(ii) Passage of warp on loom. Showing all its necessary parts.
(iii) Name of some modern weaving techniques.

NOTE:
Numerical problems and detailed description of any machine/mechanism are excluded.

INSTRUCTIONAL STRATEGY
Teacher should take theory lecture, demonstration of concepts and prototype

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. NCUTE
2. Principle of yarn manufacturing by Pattabhiram.
3. Industrial practices in weaving preparatory by Dr. Mukesh Kumar Singh

Websites for Reference:
www.nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	21	50
2	21	50
Total	**42**	**100**

THEORY	4.7.1 CHEMISTRY OF INTERMEDIATES & DYES	L	T	P
		2	-	-

COURSE OUTCOMES

Dyeing is an important activity in the textile industry. So, knowledge of dyes and other intermediate chemicals is essential for people concerned with these activities.

LEARNING OUTCOMES

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

- Learn about the history of dyes and dyestuff industry.
- Learn about different methods of preparing dyes.
- Learn basic chemical constituents of dye.

COURSE CONTENTS

UNIT I. History of Dyestuff Development: (8 Periods)

Historical development of dyestuff industry. Classification of dyes according to their chemical constitution.

UNIT II. Methods Of Preparing Dyes: (12 Periods)

General methods of preparing Nitroso. Nitro, Anthraquinone, Vat, Solubilised Vat with one or two examples of dye preparation (not by name), Preparation of Reactive dyes- Procian and Vinyl Sulphone.

UNIT III. Chemical Constitution of Dyes: (8 Periods)

Basic terms of color chemistry, Relation between chemical constitution of dyes. Concept of light and pigment theory. Chemistry after treatment of direct dye.

INSTRUCTIONAL STRATEGY

Teacher should take theory lecture, demonstration of concepts and prototype

MEANS OF ASSESSMENT

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

RECOMMENDED BOOKS

1. Introduction to the chemistry of dyestuffs- V.A. Shenai
2. Chemistry of Dyes and Principles of Dyeing-V.A.Shenai

Websites for Reference:

https://nptel.ac.in/

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	8	29
2	12	42
3	8	29
Total	**28**	**100**

THEORY	4.7.2 INDUSTRIAL SAFETY	L	T	P
		2	-	-

COURSE OUTCOMES

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 textile industry.

LEARNING OUTCOMES

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

- Understand the importance of safety in industry.
- Prevent the primary level accidents
- Understand the safety related engineering concepts
- Understand industry related acts

DETAILED CONTENTS

UNIT I. Introduction: (5 Periods)

Need for Industrial Safety - Legal Humanitarian, Economic and Social consideration. Safe working conditions and productivity, Unsafe conditions and Hazards. Cost of accidents- Direct or Indirect social cost, financial cost. Safety management principles and practices.

UNIT II. Principles Of Accident Prevention: (3 Periods)

Definitions - Accident, Injury, Dangerous occurrences, Unsafe acts, Unsafe conditions and hazards. Theories of accidents prevention, Principles and methods of accidents preventions.

UNIT III. Safety Precautions in Spinning and Weaving: (5 Periods)

Safeguarding of machines- Statutory provisions related to safeguarding of machinery and working near unguarded machines. Types of guards and guarding machines in textile industry. Incidential safety devices. Guarding machines and safety precautions in Openning, Cleanning, Carding, Drawing, Combing, Fly frame, Ring frames, Rotors (spinning), Winding, Doubling, Warping, Sizing and Weaving operations.

UNIT IV. Safety Precaution in Chemical Process : (5 Periods)

Safety Precautions in Bleaching, Dyeing, Printing, Finishing and Accidental Hazards. Chemical Hazards in Wet Processing. Effluent in textile processing.

UNIT V. Safety Engineering (7 Periods)

Material Handling:

Ergonomics of material handling, Principles of correct method of lifting objects of different size, shape and weight with safe use of accessories for manual handling.

Safety aspects of design and construction and use of material handling machinery use in textile industry- Lifts, Forks, Motor Trolleys, Overhead cranes and Chain Pullies.

Principle of good illumination at workplace and its recommended minimum standard. Lighting and Colour.

Danger From Electricity:
Safe limits of amperage and voltages. Means for cutting overloads and short circuit protection. earth fault protection. Protection of joints and conductors.
Fire explosion, Common cause for industrial fire detection and alarm. Knowledge of water system, Carbon Dioxide System, Foam Extinguishers system and Dry Chemical Extinguishing Systems for extinguishing fire, Sprinklers.

Health and Welfare:
Health hazards in Textile industry, Occupational diseases. Personal production equipments. Special precautions for specific work environment.

UNIT VI. Safety Statutes: (3 Periods)
Employees welfare and legislation. Indian Boiler Act and Regulation. The Water (Control of Pollution) Act and Rules. The Air (Pollution) Act and Rules. The Noise (Pollution) Act and Rules.

INSTRUCTIONAL STRATEGY
Teacher should take theory lecture, demonstration of concepts and prototype

MEANS OF ASSESSMENT
- Assignments and quiz/class tests
- Mid-term and end-term written tests

RECOMMENDED BOOKS
1. Health and Safety for Textile Industry by R Vettriselvan, T Jeya Sudha
2. A Text Book on Industrial Safety by Harsimran Singh Sodhi, Doordarshi Singh

Websites for Reference:
https://nptel.ac.in

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Periods)	Marks Allotted (%)
1	5	18
2	3	11
3	5	18
4	5	18
5	7	24
6	3	11
Total	**28**	**100**

THEORY	4.8 RENEWABLE ENERGY TECHNOLOGIES (OE 2)	L	T	P
		2	-	-

COURSE LEARNING OBJECTIVES:

The objective of this course is to provide a comprehensive understanding of the current and future global energy scenario, with a focus on non-conventional energy sources. It aims to introduce the fundamentals of solar and wind energy systems, explore various forms of bioenergy and their applications, and help students identify and evaluate different alternative energy sources.

LEARNING OUTCOMES:

Upon completion of the course the students will be able to

1. Understand the present and future energy scenario of the world.
2. Understand various methods of solar energy harvesting.
3. Identify various wind energy systems.
4. Evaluate appropriate methods for Bio energy generations from various Bio wastes.
5. Identify suitable energy sources for a location.

COURSE CONTENT

Unit-1: (5 Periods)

Introduction: World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilisation; Renewable Energy Scenario in India and around the World; Potentials; Achievements / Applications; Economics of renewable energy systems.

Unit-2: (8 Periods)

Solar energy: Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrating Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.

Unit-3: (5 Periods)

Wind Energy: Wind Data and Energy Estimation; Types of Wind Energy Systems; Performance. Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.

Unit-4: (5 Periods)

Bioenergy: Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Ethanol production; Bio diesel; Cogeneration; Biomass Applications.

Unit-5: (5 Periods)

Other Renewable Energy Sources: Tidal energy; Wave Energy; Open and Closed OTEC Cycles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.

INSTRUCTIONAL STRATEGY

- Teachers should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Seminar, Presentation, Viva-voce.

REFERENCE BOOKS:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press,U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi,2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, B Natarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey & Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	05	19
2.	08	24
3.	05	19
4.	05	19
5.	05	19
Total	28	100

THEORY	4.8 ENERGY EFFICIENCY AND AUDIT (OE-2)	L	T	P
		2	-	-

COURSE LEARNING OBJECTIVES:

This course aims to develop the competency to undertake energy efficiency measures and conduct energy audits through practical and industry-relevant learning experiences.

LEARNING OUTCOMES:

Upon completion of the course the students will be able to

- Undertake energy efficient activities
- Use energy efficient pumps, compressors and blowers
- Use energy efficient Air Compressors and DG sets
- Use energy efficient Lighting Systems
- Apply energy efficient electrical machines.
- Use Co-generation and relevant tariff for reducing losses in facilities.

COURSE CONTENT

Unit – 1 **(4 Periods)**

Introduction to Energy Efficiency
Energy Scenario: Energy demand and supply, National scenario.
Energy Efficiency and Energy Conservation; concepts
Indian Electricity Act 2001; relevant clauses of energy conservation
BEE and its Roles
Star Labelling: Need and its benefits.

Unit – 2 **(5 Periods)**

Pumping Systems, Fans and Blowers
Factors affecting pump performance
Efficient Pumping system operation
Energy conservation opportunities in Pumping systems
Fan types, flow control strategies
Fan performance Assessment
Energy Conservation opportunities in Pumping systems
Tips for energy saving in fans and blowers

Unit – 3 **(5 Periods)**

Air Compressors and Diesel Power Generator sets
Classification of compressors
Pneumatic System components
Effect of various parameters on efficiency of Compressor
Capacity control of Compressors
Checklist for Energy Efficiency in Compressed air systems
Operating guidelines for diesel generator, operational factors
Effects of improper ventilation of genset
Energy saving measures for DG sets

Unit –4 **(4 Periods)**

Energy Conservation in Lighting System
Replacing Lamp sources
Using energy efficient luminaries
Using light controlled gears

Installation of separate transformers / servo stabilizer for lighting
Periodic survey and adequate maintenance programs
Innovative measures of energy savings in lighting

Unit– 5 **(6 Periods)**

Energy Efficient Electrical Machines
Need for energy conservation induction motor and transformer
Energy conservation techniques in induction motor by:
Energy conservation techniques in Transformer
Energy Conservation Equipment: Soft starters, Automatic star delta converter, Variable Frequency Drives, Automatic p. f. controller (APFC)
Energy efficient motor; significant features, advantages, applications and Limitations
Energy efficient transformers, amorphous transformers; epoxy Resin cast transformers / Dry
type of transformer
Aggregated Technical and commercial losses (ATC), Technical losses; causes and measures to reduce, Commercial losses: pilferage, causes and remedies
Application of tariff system to reduce energy bill
Co-generation and Tariff; concept, significance for energy conservation

Unit– 6 **(4 Periods)**

Energy Audit of Electrical Systems
Energy audit (definition as per Energy Conservation Act)
Energy audit instruments and their use
Questionnaire for energy audit projects
Energy flow diagram (Sankey diagram)
Simple payback period, Energy Audit procedure (walk through audit and detailed audit).
Energy Audit report format.

INSTRUCTIONAL STRATEGY

- Teachers should focus on conceptual clarity.
- An industrial visit can be organized in relevant industries. Audio-visuals aids should be used to teach.

MEANS OF ASSESSMENT

- Assignments and quiz/class tests
- Seminar, Presentation, Viva-voce.

REFERENCE BOOKS:

1. Guidebooks No. 1 and 3 for National Certification Examination for Energy Managers and Energy Auditors, Bureau of Energy Efficiency (BEE), Bureau of Energy Efficiency (Statutory body under Ministry of Power, Government of India) (Fourth Edition 2015).
2. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi, Edition 2018, (ISBN: 978-93-86173-683).
3. Henderson, P. D., India - The Energy Sector, University Press, Delhi, 2016. ISBN: 978-0195606539
4. Turner, W. C., Energy Management Handbook, Fairmount Press, 2012, ISBN 9781304520708
5. Sharma, K. V., Venkataseshaiah; P., Energy Management and Conservation, I K

International Publishing House Pvt. Ltd; 2011 ISBN 9789381141298
6. Mehta,V. K., Principles of Power System, S. Chand andCo.New Delhi, 2016, ISBN 9788121905947
7. Singh, Sanjeev; Rathore, Umesh, Energy Management, S K KatariaandSons, New Delhi ISBN-13: 9789350141014.
8. Desai, B. G.; Rana, J. S.; A. Dinesh, V.; Paraman, R., Efficient Use and Management of Electricity in Industry, Devki Energy Consultancy Pvt. Ltd.
9. Chakrabarti, Aman, Energy Engineering and Management, e-books Kindle Edition

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	04	15
2.	05	17
3.	05	17
4.	04	15
5.	06	21
6.	04	15
Total	28	100

AUDIT COURSE	4.9 ESSENCE OF INDIAN KNOWLEDGE AND TRADITION	L	T	P
		2	-	-

COURSE OBJECTIVES:

Understand the fundamental aspects of the Indian Knowledge System, its integration with modern science, principles of Yoga and holistic healthcare, and practical applications in contemporary contexts.

LEARNING OUTCOMES

Upon completion of the course, the student will be able to demonstrate knowledge of the following topics:

- Overview, importance, and relevance of the Indian Knowledge System, including Vedas, Upvedas, Vedangas, and Upangas.
- Relevance of science and spirituality, and contributions of ancient Indian science and technology.
- Basic principles of Yoga, benefits of holistic healthcare, and integration with modern healthcare.
- Practical applications and case studies of the Indian Knowledge System's relevance today.

COURSE CONTENTS

Unit 1: Introduction to Indian Knowledge System (16 Periods)

Overview of Indian Knowledge System

Importance and relevance

1. Introduction to the Vedas
2. Upavedas
3. Vedangas
4. Upangas

Unit 2: Modern Science and Indian Knowledge System (06 Periods)

1. Relevance of Science and Spirituality,
2. Science and Technology in Ancient India,

Unit 3: Yoga and Holistic Healthcare (04 Periods)

1. Basic principles of Yoga
2. Benefits of holistic healthcare practices
3. Integration with modern healthcare

Unit 4: Case Studies / Assignment (02 Periods)

Practical Applications / Case studies demonstrating the relevance of Indian Knowledge System in modern times.

INSTRUCTIONAL STRATEGY

This being one of the most important subject, teacher should lay emphasis on developing basic understanding of various concepts and principles and procedures involved herein. Teacher should involve students in different practices like meditation, yoga camp etc.

MEANS OF ASSESSMENT

- Viva -Voce Exam

RECOMMENDED BOOKS

1. Cultural Heritage of India-Course Material, V. Sivaramakrishna, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Modern Physics and Vedant, Swami Jitatmanand, Bharatiya Vidya Bhavan
3. Science of Consciousness Psychotherapy and Yoga Practices, R N Jha, Vidyanidhi Prakasham, Delhi, 2016.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Periods)	Marks Allotted (%)
1.	16	50
2.	06	20
3.	04	15
4.	02	15
Total	**28**	**100**

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

It was discussed and decided that the maximum marks for SCA should be 50 as it involves a lot of subjectivity in the evaluation. The marks may be distributed as follows

1. 15 Marks for general behavior and discipline (by HODs in consultation with all the teachers of the department)

2. 10 Marks for attendance as per the following: (by HODs in consultation with all the teachers of the department)
   2.1. 75 - 80% 06 Marks
   2.2. 80 - 85% 08 Marks
   2.3. Above 85% 10 Marks

3. 25 Marks maximum for Sports/NCC/Cultural/Co-curricular/NSS activities as per following: (by In-charge Sports/NCC/Cultural/Co-curricular/NSS)
   3.1. 25 - State/National Level participation
   3.2. 20 - Participation in two of the above activities
   3.3. 15 - Inter-Polytechnic level participation

9. RESOURCE REQUIRMENT

A. PHYSICALRESOURCES

a) Space requirement

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

b) Equipment Requirement:

Following Laboratories are required for a diploma programme in Textile Chemistry (3rd and 4th Semester):

TEXTILE TESTING

S.No	Name of Equipment	No.	@Rs.	Amt.in Rs.
1.	Baer Sorter (For Fibre Length) Acrylic Transparent Sheet - 6"X8"X2 pices, 3"X8"X2 pcs Fibre Mounting Templest 6"X8"X2 pices, 3"X8"X2 pcs with tweezers, velvet pad, scales, planchass with all complete accessories or Latest Configuration	2	20000	40000
2.	MicroscopeDigitalMocroscope - Microscope & Ends Counting Equipments-Magnifying Power 5X,10X,20X,40X,100X lenses Trinocular biological microscope with fibre cross section kit, high resolution CCD camera and imaging software with measurement facilities, Scope of use section of fibre or yarn, analysis of any fibre, yarn and fibre Range : 5X,10X,20X,450X,100X / as per requirements, Focus : Adjustable, Lights - White, Blue,Yellow, Upper & Lower, Supply -220 V AC supply Single Phase with all complete accessories Or Latest Configuration	2	65000	
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), The test lengthis automatically taken into account for calculation and finalreading is displayed directly in TPM/TPL Range :Upto 60TPL 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 pre set 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(Martindle Type)	1	50000	50000
17.	Laundrometer (For washing fastness testing)	1	50000	50000
18.	Crock Meter	1	10000	10000
19.	Digital FibrographMeasuring Principle-Optical Measuring Range-12.0 to 45.0 mm Measuring Accuracy - +/- 0.1 mm Result Output-2.5% SL,50% SL & UR % Front End Language-English Applicable Standard-ASTM D5332,ISO2648 & IS233 Power Supply-Single Phase 220V AC	1	320000	320000
20.	Uster Evenness Tester	1	2000000	2000000
21.	Trash Analyser	1	150000	150000
22.	Conditioning Oven 220 V With capability of maintaining temperature up to 100oC and facility for smoth variation of temperature inside 27 liter.	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 : 1Kg.(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 Repellancy Tester	1	80000	80000
26.	Pilling Tester	1	30000	30000
27.	Crimp Regidity Tester Minor Load - 2 Gr. to 10Gr. in a step of one grams Major Load - 100 Gr. to 500 Gr. in step of 50 Grams Digital display 220 V, with all complete accessories or Latest Configuration	1	20000	20000
28.	Air Permeability Tester	1	35000	35000

29.	Sheffield Micronair (For Fibre Fineness)	1		
30.	Uster Stapler for fibre length	1		
31.	A.N. staplling apparatus for fibre fineness Tester	1		
32.	Miscellaneous Items-Thermameters, L.S. Heating Devices, Thermohydrograph, Whirling Hydrometer, Dry & Wet bulb thermometer, Physical Balance, etc.			
33.	Classimate (Yarn faults finding equipments)	1		900000
33.	H.V.I. (High Volume Instrument) for various parameter of fibre	1		3500000
34.	Sublimation fastness tester	1		15000
35.	Round Sample of GSM with Electronic balance	1	35000	35000
36.	Stiffness Tester	1	15000	15000
37.	Drapemeter	1	25000	25000
38.	Fabric Thickness Tester	1	8000	8000
39.	A.S.T.M. Cards For Threads/Inch	1		

NOTE

1. Indian make working laboratory models for costly equipment be purchased if available.

PROCESS HOUSE

S.No.	Name of Equipment	No.	@ Rs.	Amt.in Rs.
1.	Lab Model of Jigger Machine	1	600000	600000
2.	Electronic weighing scale (min 0.01gm to 300 gm)	1	7000	7000
3.	Dye Bath For Experimental Work	10	10000	100000
4.	Spray, Block and Screen Systems of Printing	10 Set	700	7000
5.	Spray Printing Machine With Compressor	1	150000	150000
6.	Lab Model of High Temperature Beaker Dyeing Machine	1	400000	400000
7.	Lab Model of Padding Mangle Machine.	1	400000	400000
8.	Electrically Operated Lab Stirrers			
	A. Fixed Type	1	7000	7000
9.	Colour Cabinet(Shade matching box)	1	40000	40000
10.	Stenter (Electrically heat setting and Curing Machine)	1	600000	600000
11.	Lab model of Infra Red beaker Dyeing Machine (Beaker -12/18)	1	500000	500000
12.	Wrap reel	1	20000	20000
13.	Lab Model of Winch Dyeing Machine(Open and Closed)	1	250000	75000

14.	HTHP Package Dyeing or Beam Dyeing Machine with compressor	1	600000	600000
15.	Induction Heater	1	4000	4000
16.	Hot Air Oven	1	250000	250000
17.	Vaccum Cleaner For Spray Printing	1	45000	45000
18.	Steam Ager	1	**100000**	**100000**
19	Grey Scale	2set	**50000**	**50000**

B. FURNITURE REQUIREMENT

Norms and standards laid down by AICTE -APH (latest) be followed for working out furniture requirement for diploma courses

C. HUMAN RESOURCES:

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

10. EVALUATION STRATEGY

Evaluation plays an important role in the teaching-learning process. The major objective of any teaching-learning endeavor is to ensure the quality of the product which can be assessed through learner's evaluation. The purpose of student evaluation is to determine the extent to which the general and the specific objectives of curriculum have been achieved. Student evaluation is also important from the point of view of ascertaining the quality of instructional processes and to get feedback for curriculum improvement. It helps the teachers in determining the level of appropriateness of teaching experiences provided to learners to meet their individual and professional needs. Evaluation also helps in diagnosing learning difficulties of the students. Evaluation is of two types: Formative and Summative (Internal and External Evaluation)

Formative Evaluation

It is an on-going evaluation process. Its purpose is to provide continuous and comprehensive feedback to students and teachers concerning 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 topic, subject, semester or year. The main purpose of summative evaluation is to measure achievement for assigning course grades, certification of students and ascertaining accountability of instructional process. The student evaluation has to be done in a comprehensive and systematic manner since any mistake or lacuna is likely to affect the future of students. In the present educational scenario in India, where summative evaluation plays an important role in educational process, there is a need to improve the standard of summative evaluation with a view to bring validity and reliability in the end-term examination system for achieving objectivity and efficiency in evaluation.

STUDENTS' EVALUATION AREAS

The student evaluation is carried out for the following areas:

- Theory
- Practical Work
- Project Work
- Industrial Training

A. Theory

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

Section-I

It should contain objective type items e.g. multiple choice, matching and completion type. Total weightage to Section-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 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 5

Table : Suggested Weightage to be given to different ability levels

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

B. Practical Work

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

C. Internship / In-House Project/ Industrial Training

The purpose of evaluation of project work is to assess students' ability to apply, in an integrated manner, learnt knowledge and skills in solving real life problems, manipulative skills, ability to observe, record, creativity and communication skills. The formative and summative evaluation may comprise of weightage to nature of project, quality of product, quality of report and quality of presentation followed by viva-voce. Evaluation of professional industrial training report and viva-voce/ presentation aims at assessing students' understanding of materials, industrial processes, practices in the industry/field and their ability to engage in activities related to problem-solving in industrial setting as well as understanding of application of learnt knowledge and skills in real life situations. The formative and summative evaluation may comprise of weightages to performance in testing, general behavior, quality of report and presentation during viva-voce.

11. 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.

12. LIST OF EXPERTS

Sr. No.	Name of Participants	Designation	Organization
1.	Sh. Brijesh Mishra	HoD Textile Chemistry	GP Dibai
2.	Smt. Anjali Patel	Lecturer Textile Chemistry	GP Kanpur
3.	Sh. R.K Shrivastav	Ret. Factory Manager	National Textile Corporation Bhopal
4.	Sh. Vijay Pratap Singh	Ret. Senior Executive	Elgin Mill Ltd.
5.	Sh. Rahul Kumar Shringirishi	Guest Lecturer Textile Chemistry	G.P. Kanpur

13. EVALUATION SCHEME GUIDELINES: As Per AICTE ATTACHED (ANNEXURE- 1)

a. For Theory Courses:

(The weightage of Internal assessment is 40% and for End Semester Exam is 60%) The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

b. For Practical Courses:

(The weightage of Internal assessment is 60% and for End Semester Exam is 40%) The student has to obtain at least 40% marks individually both in internal assessment and end semester exams to pass.

c. For Summer Internship / Projects / Seminar etc.

Evaluation is based on work done, quality of report, performance in viva-voce, presentation etc.

Note: The internal assessment is based on the student's performance in mid semester tests (two best out of three), quizzes, assignments, class performance, attendance, viva-voce in practical, lab record etc

ANNEXURE- 1

Evaluation Method For Practicum Based Course Paper (End Exam: PRACTICAL)

Internal Assessment (60 Marks)					**External Assessment (40 Marks)**
Mode	Sessional Exam (02 Best of 03)	Practical Test	Practical Documentation	Attendance and Assignment	Practical Exam
Portion	2 Units	100% Practical	All Practicals	All Units	All Practicals
Duration	1 Hr	3 Hrs	Regularly Monitored by Faculty	Regularly	4Hrs
Exam Marks	20	20	10	10	40
Tentative Schedule	6^{th} Week	12^{th} Week	13^{th} Week	$14^{th} – 15^{th}$ Week	Semester End Exam

NOTE:

1. Complete all exercises/experiments as outlined above and keep them for the practical test. The practical test should be conducted in accordance with the evaluation scheme. The best of the two practical tests will be evaluated internally for a total of 20 marks.

2. Maintain a practical file for each exercise. Submit the document for the practical file with a valid certificate (Progress Card) and Lab/classroom attendance and evaluate it for 10 marks.

3. Submit a micro project report along with the fabrication model/analysis report. The performance of each student in the group will be evaluated by the laboratory supervisor and an internal examiner evaluate it for 10 marks.

Evaluation Method For Practical Based Course Paper (End Exam: PRACTICAL)

Internal Assessment (60 Marks)					**External Assessment (40 Marks)**
Mode	Practical Test	Practical Test	Attendance and Practical Documentation	Micro Project	Practical Exam
Portion	50% Practicals	50% Practicals	All Practicals	All Practicals	All Practicals
Duration	3Hr	3 Hrs	Regularly	Regularly	4 Hrs
Exam Marks	20	20	20	20	40
Tentative Schedule	6^{th} Week	12^{th} Week	13^{th} Week	$14^{th} – 15^{th}$ Week	Semester End Exam

NOTE:

1. Complete all exercises/experiments as outlined above and keep them for the practical test. The practical test should be conducted in accordance with the evaluation scheme. The best of the two practical tests will be evaluated internally for a total of 20 marks.

2. Maintain a practical file for each exercise. Submit the document for the practical file with a valid certificate (Progress Card) and Lab/classroom attendance and evaluate it for 20 marks.

3. Submit a micro project report along with the fabrication model/analysis report. The performance of each student in the group will be evaluated by the laboratory supervisor and an internal examiner evaluate it for 20 marks.

Evaluation Method For THEORY Based Course Paper

Internal Assessment (40 Marks)					**External Assessment**
Mode	Sessional Exam-1	Sessional Exam-2	Sessional Exam-3	Attendance and Assignment	Written Exam
Portion	2 Units	2 Units	All Units	Regularly	All Units
Duration	1 Hr	1 Hr	1 Hr	1 Hr	3 Hrs
Exam Marks	10	10	10	10	60
Tentative Schedule	4th Week	8th Week	12-14th Week	Regularly	Semester End Exam

Evaluation Method For Practicum Based Course Paper (End Exam: THEORY)

Internal Assessment (40 Marks)					**External Assessment (60 Marks)**
Mode	Sessional Exam (02 Best of 03)	Practical Test	Practical Documentation	Attendance and Assignment	Written Exam
Portion	2 Units	100% Practical	All Practicals	All Units	All Units
Duration	1 Hr	3 Hrs	Regularly Monitored by Faculty	Regularly	3 Hrs
Exam Marks	10	10	10	10	60
Tentative Schedule	6th Week	12th Week	13th Week	14th – 15th Week	Semester End Exam