GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma in Engineering

Level: Diploma

Branch: Textile Manufacturing Technology

Course / Subject Code : DI01029011

Course / Subject Name : Textile Fiber Technology

w. e. f. Academic Year:	2024-25
Semester:	1st
Category of the Course:	Professional Core Courses

Prerequisite:	**Basic knowledge of physics, chemistry and textile fiber.**
Rationale:	The textile engineer has to work with various stages of textile product manufacturing department, requiring the sound knowledge of specific material to fulfill all the requirements of clients and customers. In this emerging era of technology, there are multiple ways evolved to produce textile fibres according to the demand of society. To fulfill this demand, student must have the knowledge of various types of textile fibres, their properties and characteristics, types of raw material use and their manufacturing processes and types of finish application on manmade fibre. This course will thus enable student to apply knowledge regarding textile fibre technology by giving overview of all natural and manmade textile fibres along with modern high-performance fibres.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Apply the knowledge of fibre for the product development.	A
02	Analyze the morphological and chemical structure of natural fibres.	A
03	Analyze the structure, properties and process parameters of manmade fibres.	A
04	Select the relevant process of manmade fibre manufacturing for the given raw material.	R,A,E
05	Select various high-performance fibres.	R,A,E

**Revised Bloom's Taxonomy (RBT)*

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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial / Practical		
L	T	PR	C	ESE (E)	PA / CA (M)	PA/CA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	**Introduction of Textile Fibre** 1.1 Meaning of fibre, Staple fibre, Regenerated fibre, Filament, Monomer, Polymer, Degree of polymerization, Crystallinity and Orientation. 1.2 Classification of natural, regenerated and man-made textile fibres. 1.3 Physical and chemical properties of natural and manmade fibres. 1.4 Cross-sectional and Longitudinal view of natural and manmade fibres. 1.5 Identification of textile fibre according to their burning characteristics, chemical group and reaction.	7	14%
2.	**Natural Fibres** 2.1. Cultivation and harvesting, Morphological structure, Properties and applications of Cotton fibre. 2.2. Retting and extraction process of bast fibres, properties and applications of bast fibres such as Jute. 2.3. Manufacturing process, Morphological structure, properties and applications of Wool fibre. 2.4. Types of silk, Stages of manufacturing process, degumming and reeling process, morphological structure, properties and applications Silk fibre. 2.5. Brief study of Cultivation, harvesting and properties of organic fibres such as Leaf fibres (Banana and Sisal) and Fruit fibres (Coir).	10	24%

	2.6. Introduction to mineral origin Basalt fibre.		
3.	**Man-made Fibres** 3.1 Raw material, Manufacturing process, Properties and applications of Viscose Rayon fiber. 3.2 Criteria for fibre forming polymer. 3.3 Give classification of Polymer. 3.4 Definition of Addition and Condensation polymerization. 3.5 Raw material, Polymerization, Manufacturing process, Properties and applications of Nylon 6 fibres 3.6 Raw material, Polymerization, Manufacturing process, Properties and applications of Polyester fibre. 3.7 Raw material, Polymerization, Manufacturing process, Properties and applications of Acrylic fibre. 3.8 Raw material, Polymerization, Manufacturing process, Properties and applications of Polypropylene fibres.	10	24%
4.	**Manmade Fibre Formation Technology** 4.1 Melt spinning process and parts of machine such as Single and Double extruder, Manifold and Quenching system. 4.2 Importance of drawing process. 4.3 Spin draw processes: H4S process and FDY process. 4.4 Dry spinning process, method of Dope (solution) preparation. 4.5 Wet spinning process, method of Dope (solution) preparation, Fibre formation and coagulation variables. 4.6 Dry jet wet spinning process. 4.7 Functions, Desirable properties, Chemical constitute, Method of application (Metered finish system) and affecting factors of spin finish. 4.8 Tow to top conversion stretch breaking method.	10	24%
5.	**High Performance Fibres** 5.1 Raw material, structure, properties and application of Nomex, Kevlar, Carbon and Micro fibre. 5.2 Raw material, structure, properties and application of Glass and Boron fibres. 5.3 Modified polyester fibres: (synthetic fibres) Limitations Of synthetic fibres. Hydrophilic, Hollow and Silk like polyester fibre. 5.4 Introduction to Bi-component and Lycra fiber.	8	14%
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	**30**	**20**	**10**	**5**	**5**

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Introduction to Textile Fibres, Sreenivasamurthy H.V., Woodhead Publishing India in Textiles, New Delhi,2015, ISBN:978-9-38505-957-5
2. Handbook of Textile fibres Volume-1, Gordoncook J., Woodhead Publishing Limited, England, 2006, ISBN-13: 978-1-85573-484-5, ISBN-10: 1-85573-484-2.
3. Production of Synthetic fibres, Vaidya A.A., Prentice-Hall of India Private Limited, New Delhi, 1988, ISBN: 0876925786, 9780876925782
4. Manmade fibres: Production, Processing, structure and applications, Gupta V.B. and Kothari V.K., Indian Institute of Technology, Delhi, 1997, ISBN: 978-94-011-5854-1.
5. Manmade fibres, Moncrieff R. W., Heywood Books, The Butterworth group, England, 1970, ISBN: 0-592-06332-1.
6. Textile terms and definitions, Beech S.R., The Textile Institute, England, 2002, ISBN 10: 1870372441
   ISBN 13: 978-1870372441.
7. Structure and Properties of High-Performance Fibres, BhatGajanan, Wood head Publishing, New Delhi, 2016, ISBN**:** 9780081005507.

(b) Open source software and website:

1. https://www.fibre2fashion.com/
2. http://nptel.ac.in/
3. http://www.textileassociationindia.org/
4. http://www.sitra.org.in/
5. http://textilelearner.blogspot.in/
6. http://www.itamma.org/
7. https://textilestudycenter.com/
8. http://www.fibresource.com/
9. http://www.textileschool.com/
10. https://archive.org/details/manmadefibres0000monc/page/n7/mode/2up
11. https://textilestudycenter.com/textile-books-free-donwload/
12. http://www.cottonsjourney.com/Storyofcotton/page5.asp

Suggested Course Practical List:

1. Identify the longitudinal and cross-sectional fibre structure using microscope.
2. Perform burning and chemical test for identification of Textile fibres.
3. Demonstrate the production process of Jute fibre.
4. Demonstrate the production process of Silk fibre.
5. Demonstrate the production process of Wool fibre.
6. Demonstrate the production of Viscose rayon fibre.
7. Demonstrate the production of Polyester fibre.
8. Demonstrate the production of Nylon 6 fibre.
9. Demonstrate the production of Acrylic fibre.
10. Demonstrate the passage of material through Melt spinning process.
11. Demonstrate the passage of material through Dry spinning process.
12. Demonstrate the passage of material through Wet spinning process.
13. Demonstrate the passage of material through metered finish system of spin finish.
14. Demonstrate structure, properties and application of Aramid and Carbon fibres.

List of Laboratory/Learning Resources Required:

No.	Equipment Name with Broad Specifications
1.	Projection microscope.
2.	Gas burners, test tubes, slides and chemicals.
3.	Melt spinning equipment.
4.	Wet spinning Equipment.
5.	Dry spinning equipment.

Suggested Project List:

a) **Natural fibres**: Collect various sample of natural fibres study the Physical and chemical properties of Textile fibres and prepare compile report.
b) **Organic fibres**: Collect various sample of organic fibres study the Physical and chemical properties of Textile fibres and prepare compile report.
c) **Manmade fibre:** Collect various samples of manmade fibres and prepare the process flow chart of detail of production of manmade fibre.
d) **Melt, Wet and Dry spinning:** Prepare a compile report of Melt, Wet and Dry spinning technology with machine process parameters.
e) **High performance fibres:** Prepare a compile report on raw material, structure, properties and end use application of various high performance fibres.

Suggested Activities for Students:

a) Prepare classification chart of different textile fibres
b) Collect samples of various natural fibres and label them with neat sketches.
c) Collect samples of various Man-made fibres and label them with neat sketches.
d) Present a seminar on any relevant topic of textile fibre technology.
e) Explore library/internet for production technologies being used for production of different fibres and make a report.
f) Prepare showcase portfolios of various textile fibres.

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