GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

Competency-focused Outcome-based Green Curriculum-2021 (COGC-2021)
Semester-II

CourseTitle: Textile Fiber Technology
(Course Code: 4322901)

Diploma programme in which this course is offered	Semester in which offered
Textile Manufacturing Technology	Second

1. 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-performancefibres.

2. COMPETENCY

Thepurposeof this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Useproperties of textile fibre structure and production methods in various textile product manufacturing stages.**

3. COURSE OUTCOMES (COs)

The practical exercises, the underpinning knowledge and the relevant soft skills associated with the identified competency are to be developed in the student for the achievement of the following COs:

a) Apply the knowledge of fibrefor the product development.
b) Analyze the morphological and chemical structure of natural fibres.
c) Analyze the structure, properties and process parameters of manmade fibres.
d) Select the relevant process of manmade fibre manufacturing for the given raw material.
e) Select various high-performancefibres.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
4	-	2	5	30*	70	25	25	150

(*):Out of 30 marks under the theory CA, 10 marks are for assessment of the micro-project to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken

during the semester for the assessing the attainment of the cognitive domain UOs required for the attainment of the COs.

***Legends: L** - Lecture;**T**– Tutorial/Teacher Guided Theory Practice; **P** -Practical; **C** – Credit, **CA** - Continuous Assessment; **ESE** -End Semester Examination.*

5. SUGGESTED PRACTICAL EXERCISES

The following practical outcomes (PrOs) are thesub-components of the COs.*Some of the **PrOs** marked **'*'** (in approx. Hrs column) are compulsory, as they are crucial for that particular CO at the 'Precision Level' of Dave's Taxonomy related to 'Psychomotor Domain'.*

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Identify the longitudinal and cross-sectionalfibre structure using microscope.	I	02*
2	Perform burning test for identification of Textile fibres.	I	02*
3	Perform chemical test for identification of Textile fibres.	I	02*
4	Demonstrate the production process of Banana fibre.	I	02*
5	Demonstrate the production process of Jutefibre.	II	02
6	Demonstrate the production process of Silk fibre.	II	02*
7	Demonstrate the production process of Wool fibre.	II	02
8	Demonstrate the production of Viscose rayon fibre.	III	02*
9	Demonstrate the production of Polyester fibre.	III	02*
10	Demonstrate the production of Nylon 6 fibre.	III	02*
11	Demonstrate the production of Acrylic fibre.	III	02*
12	Demonstrate the passage of material through Melt spinning process.	IV	02*
13	Demonstrate the passage of material through Dry spinning process.	IV	02*
14	Demonstrate the passage of material through Wet spinning process.	IV	02*
15	Demonstrate the passage of material through H4S spinning process.	IV	02
16	Demonstrate the passage of material through metered finish system of spin finish.	IV	02*
17	Demonstrate structure, properties and application of Aramid fibres.	V	02*
18	Demonstrate structure, properties and application of Carbonand Glass fibres.	V	04
	Minimum 14 Practical Exercises		**28 Hrs.**

Note

i. *More **Practical Exercises** can be designed and offered by the respective course teacher to develop the industry relevant skills/outcomes to match the COs. The above table is only a suggestive list.*

ii. *The following are some **sample** 'Process' and 'Product' related skills (more may be added/deleted depending on the course) that occur in the above listed **Practical Exercises** of this course which are embedded in the COs and ultimately the competency.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
1	Identify components.	10
2	Prepare experimental setup.	20
3	Operate the equipment setup or circuit.	20
4	Follow safe practices.	10
5	Record observations correctly.	20
6	Interpret the result and conclude.	20
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTSREQUIRED

Thesemajor equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practical's in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Projection microscope (Specifications aremagnification: total magnification from 125xtill 1000x,observationscreen: 195mm diameter, graduated screen 3600 rotatable, built-in Fresnel Lens,nosepiece: triple/quadruple nosepiece revolves on ball bearing with rubber grip)	1
2	Gas burners, test tubes, slides and chemicals	2,3
3	Melt spinning equipment (Specifications are pilot plant for the production of POY/FDY multifilament yarn, product range: 50 den -2000 denier, polyester, polypropylene, polyamide any other thermoplastic materials)	9,10,12,15
4	Wet spinning Equipment (Specifications arepilot plant operation, variable flow rate 0.5-10 ml/min, single hole and co-axial spinneret, Water circulation bath)	8, 11, 14
5	Dry spinning equipment (Specifications are pilot plant for the production of POY/FDY multifilament yarn, product range: 50 -2000 denier.)	11,13

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample*** Affective Domain Outcomes (ADOs) are embedded in many of the abovementioned COs and PrOs. More could be added to fulfill the development of this competency.

a) Work as a leader/a team member.
b) Follow ethical practices.
c) Follow safety precautions.
d) Practiceenvironmentally friendly methods and processes.

The ADOs are best developed through the laboratory/field based exercises. Moreover, the level of achievement of the ADOs according to Krathwohl's 'Affective Domain Taxonomy' should gradually increase as planned below:

i. 'Valuing Level' in 1st year
ii. 'Organization Level' in 2nd year.

iii. 'Characterization Level' in 3rd year.

8. UNDERPINNING THEORY

The major underpinning theory is given below based on the higher level UOs of *Revised Bloom's taxonomy* that are formulated for development of the COs and competency. If required, more such higher level UOs could be included by the course teacher to focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
Unit – I Introduction of Textile Fibre	1a. Define terminologiesrelated to fibre and filament. 1b. Classifyvarious textilefibres. 1c. Distinguish physical and chemical properties of textile fibres. 1d. Draw the microscopic view of textile fibres. 1e. Identify textilefibre properties using Burning and Chemical Test. 1f. Demonstrate the production method and structure of Organic fibres	1.1 Meaning of fibre, Staple fibre, Regenerated fibre, Filament, Monomer, Polymer, Degree of polymerization, Crystallinityand 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. 1.6 Cultivation, harvesting, structure and properties oforganicfibres such as Leaf fibres (Banana and Sisal), Fruit fibres (Coir).
Unit – II Natural Fibres	2a. Describevegetable origin fibre. 2b. Describe the properties and application of bast fibres. 2c. Draw the morphological structure of animal origin fibre. 2d. Explain specific process for silkfibres. 2e. Describe mineral originfibres.	2.1. Cultivation and harvesting, Development of fibre in seed, 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 and Flax. 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.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
		2.5. Introduction to mineral origin Basaltfibre.
Unit– III Man-made Fibres	3a. Describe various Cellulosic polymer-based manmade fibres. 3b. Sketch the flow chart of different manmade fibre. 3c. Identify the different types of polymers. 3d. Describe the salient features of Polymerization process. 3e. Explainthe production process of polyamide group fibres. 3f. Describe the production process of ester group fibres. 3g. Explain the production process of polyacrylonitrile group fibres. 3h. Describe the production process of polyolefin group fibre.	3.1 Raw material, Manufacturing process, Properties and applications of Viscose Rayon, Lyocell fibres. 3.2 Criteria for fibre forming polymer. 3.3 Give classification of Polymer. 3.4 Addition and Condensation polymerization process. 3.5 Raw material, Polymerization, Manufacturing process, Properties and applications of Nylon 6, Nylon 66 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, Polyethylenefibres.
Unit- IV Manmade FibreFormation Technology	4a. Explain Melt Spinning process. 4b. Describe Drawing processes. 4c. Describe Dry Spinningprocess. 4d. Explain Wet Spinning process. 4e. Differentiate between different manmade fibreformations technologies. 4a. Determine process parameters related to melt, wet and dry spinning. 4f. Explain dry jet wet spinning process. 4g. Describe the salient features Spin finish process.	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 and list the factors affecting the process performance. 4.5 Wet spinning process, method of Dope (solution) preparation,Fibre formation and coagulation variables and list the factors affecting the process performance. 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.
Unit– V	5a. Describe the salient features	5.1 Raw material, structure, properties

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
High Performance Fibres	of high-performancefibres. 5b. State limitations of synthetic fibres. 5c. Describe the salient features of modified polyester fibres. 5d. Distinguish between Bi-component fibre andelastomeric fibre	and application of Nomex, Kevlar, Carbon and Micro fibre 5.2 Raw material, structure, properties and application of Glass, Silicon and Boronfibres. 5.3 Modified polyester fibres: (synthetic fibres) Limitations of synthetic fibres. 5.4 Hydrophilic, Hollow, Low pilling, Flame Retardant, Silk like, Cationic dyeable polyester fibre 5.5 Compare Bi-component fibre and Lycra

9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction of Textile Fibre	08	3	3	2	08
II	Natural Fibres	14	2	4	8	14
III	Manmade Fibres	12	3	5	10	18
IV	Manmade Fibre Forming Technology	12	4	4	10	18
V	High PerformanceFibres	10	2	2	8	12
Total		**56**	**14**	**18**	**38**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*
Note*: This specification table provides general guidelines to assist student for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of theUOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary slightly from above table.*

10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare small reports of above 5 page for each activity,also collect/record physical evidences such as photographs/videos of the activities for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare classificationchart of different textile fibres
b) Collect samples of various naturalfibres 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.

11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a) Massive open online courses (***MOOCs***) may be used to teach various topics/sub topics.
b) Guide student(s) in undertaking micro-projects.
c) ***'L" in section No. 4***means different types of teaching methods that are to be employed by teachers to develop the outcomes.
d) About ***20% of the topics/sub-topics*** which are relatively simpler or descriptive in nature is to be given to the students for ***self-learning***, but to be assessed using different assessment methods.
e) With respect to ***section No.10***, teachers need to ensure to create opportunities and provisions for ***co-curricular activities***.
f) Guide students on how to address issues on environment and sustainability
g) Guide students for using data manuals.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-projects are group-based (group of 3 to 5). However, **in the fifth and sixth semesters**, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The duration of the micro-project should be about **14-16*(fourteen to sixteen) student engagement hours*** during the course. The students ought to submit micro-project by the end of the semester to develop the industry-oriented COs.

A suggestive list of micro-projects is given here. This should relate highly with competency of the course and the COs.Similar micro-projects could be added by the concerned course teacher:

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 ofMelt, 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.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
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	Moncrief 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	Bhat Gajanan	Wood head Publishing,New Delhi, 2016, ISBN: 9780081005507

14. SOFTWARE/LEARNING WEBSITES

a) http://nptel.ac.in/
b) https://www.fibre2fashion.com/
c) http://www.textileassociationindia.org/
d) http://www.sitra.org.in/
e) http://www.itamma.org/
f) https://textilestudycenter.com/
g) http://www.fibresource.com/
h) http://www.textileschool.com/
i) https://archive.org/details/manmadefibres0000monc/page/n7/mode/2up
j) https://textilestudycenter.com/textile-books-free-donwload/
k) http://www.cottonsjourney.com/Storyofcotton/page5.asp
l) http://textilelearner.blogspot.in/
m) https://study.com/academy/topic/textile-fibres-fabrics.html
n) https://www.youtube.com/watch?v=22VC_8xcyrs
o) https://www.youtube.com/watch?v=bILk39zSgqA
p) https://www.youtube.com/watch?v=cn6K1m7yH0I

15. PO-COMPETENCY-CO MAPPING

Semester II	Textile Fibre Technology (Course Code: 4322901)						
	POs						
Competency & Course Outcomes	PO 1 Basic & Discipline specific knowledge	PO 2 Problem Analysis	PO 3 Design/ development of solutions	PO 4 Engineering Tools, Experimentation &Testing	PO 5 Engineering practices for society, sustainability & environment	PO 6 Project Management	PO 7 Life-long learning
Competency	Use properties of textile fibre structure and production methods in various textile product manufacturing stages.						
Course Outcomes CO a) Apply the knowledge of fiber for product development.	3	1	3	1	3	1	3
CO b) Analyze the morphological and chemical structure of natural fibres.	3	1	-	-	3	2	3
CO c) Analyze the structure, properties and process parameters of manmade fibres.	3	2	-	2	2	2	3
CO d) Select the relevant process of manmade fibre manufacturing for the given raw material.	3	1	1	1	2	2	2
CO e) Select various high performance fibres.	2	1	1	-	2	1	2

Legend: '**3'** for high, '**2**' for medium, **'1'** for low or **'-'** for the relevant correlation of eachCOwith PO.

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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