GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: **TECHNOLOGY OF TECHNICAL TEXTILES**
(Course Code: 4362802)

Diploma program in which this course is offered	Semester in which offered
Textile Processing Technology	Sixth

1. RATIONALE

Various kinds of textiles are finding places in various industries as engineering products. The polytechnic students are required to be aware of such Technical Textiles. They should have basic knowledge and skills to understand the technology of various Technical Textiles used in various fields. The course on Technology of Technical Textiles has been designed to provide some idea of non-conventional textiles.

2. COMPETENCY

The course content should be taught and implemented to develop different types of skills leading to the achievement of the following competency,

- Use different technical textiles in various fields.

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:

I. Use knowledge about basic textile materials, structures, and their properties.
II. Identify and classify different types of technical textiles.
III. Classify technical textiles based on their intended applications, materials used, manufacturing processes, and specific functionalities.
IV. Apply various functional finishes to technical textiles as needed.
V. Use of Technical Polymer and composites.

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	
3	2	0	3	30*	70	0	0	100

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

during the semester for 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 the sub-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'.*

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. Require
	NIL		

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 required which are embedded in the Cos and ultimately the competency.*

S. No.	Sample Performance Indicators for the PrOs	Weightage in %
	NIL	

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

This major equipment with broad specifications for the PrOs is a guide to procure them by the administrators to usher in uniformity of practicals in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.

7. AFFECTIVE DOMAIN OUTCOMES

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

a) Work as a leader/a team member.
b) Practice good housekeeping
c) Maintain tools and equipment.
d) Follow ethical practices.

The ADOs are best developed through 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 is formulated for the development of the Cos and competency. If required, more such higher level Uos could be included by the course teacher to focus on the attainment of Cos and competency.

Unit	Unit Outcomes (Uos) (4 to 6 Uos at different levels)	Topics and Sub-topics
Unit – I Introduction to Technical Textiles	1a. Explain Technical Textiles 1b. Explain different forms of Technical Textiles	1.1 Definition and salient features of Technical Textiles. 1.2 Woven, Non-woven, Knitted Technical Textiles 1.3 Share of various fibers in Technical Textiles products. 1.4 Scope of Technical Textiles 1.5 Introduction to smart textiles 1.6 Policies for Technical Textiles
Unit– II Technical Textiles- I	2a. Explain different Technical textiles 2b. Explain the application and end uses of different Technical textiles	2. General properties, Importance, and application of various Technical Textiles 2.1 Hometech 2.2 Agrotech 2.3 Meditech. 2.4 Geotextiles. 2.5 Clothtech. 2.6 Mobitech
Unit– III Technical Textiles- II	3a. Explain different Technical textiles 3b. Explain the application and end uses of different Technical textiles	3. General properties, Importance and application of various Technical Textiles 3.1 Sporttech 3.2 Induteh 3.3 Buildtech 3.4 Pechtech 3.5 Protech 3.6 Oekotech
Unit– IV Functional Finishes	4a. Describe various processing techniques for polymers 4b. Explain various functional finishes for Technical Textiles	4.1 Different processing techniques for Technical polymer • Calendaring • Casting • Thermoforming • Foaming • Lamination • Moulding 4.2 Different technical finishes for Technical textiles • Flame retardant Finish • Water-repellent Finish • UV Protective Finish • Antibacterial Finish

Unit– V Technical Polymer and composites	5a. Describe various individual polymers 5b. Explain the general properties of high-performance textiles 5c. Describe the importance of High-performance textiles	5.1 Various individual polymers • Polyethylene, Polystyrene, Polyvinyl • alcohol & Polyvinyl chloride • Polytetrafluoroethylene (PTFE) • Polyurethane • Silicone polymers • Rubbers (Elastomers) ➢ Natural Rubber (Poly isoprene) ➢ Synthetic Rubber (vulcanized Rubber) 5.2 General Properties, Importance and application of various High performance textiles • Carbon fibres • Poly-Propylene • Aramide fibres • Ceramic fibres • Silicon carbide fibres • Glass Fibre

9. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Introduction to Technical Textiles	06	06	02	04	**12**
II	Technical Textiles- I	10	04	04	06	**14**
III	Technical Textiles- II	10	04	04	06	**14**
IV	Functional Finishes	08	04	04	06	**14**
V	Technical Polymer and composites	08	06	04	06	**16**
Total		**42**	**26**	**18**	**26**	**70**

Legends: *R=Remember, U=Understand, A=Apply and above (Revised Bloom's taxonomy)*

Note*: This specification table provides general guidelines to assist students for their learning and to teachers to teach and question paper designers/setters to formulate test items/questions assess the attainment of the Uos. 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 reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

Material Swatch Creation: Ask students to create a library of material swatches showcasing various technical textiles. This hands-on activity involves sourcing different fabrics, analyzing their properties, and labeling each swatch with its characteristics and potential applications.

Field Research and Surveys: Assign field research tasks where students collect data by conducting surveys or interviews with industry professionals, researchers, or end-users of technical textiles. This activity allows students to understand market demands, challenges, and current trends in the field.

Innovation Challenges: Organize innovation challenges or hackathons focused on technical textile applications. Provide problem statements or scenarios requiring innovative textile solutions and let students brainstorm, prototype, and present their creative solutions within a specified timeframe.

Environmental Impact Assessment: Task students with researching and presenting the environmental impact of various technical textiles. This could involve analyzing the life cycle assessment, sustainability aspects, and eco-friendly alternatives in the production and use of these textiles.

E-Portfolio Development: Encourage students to create e-portfolios showcasing their understanding, projects, research work, and practical experiences related to technical textiles. This portfolio can serve as a comprehensive demonstration of their skills and knowledge to potential employers or further educational institutions.

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) Encourage students to refer different websites for having a deeper understanding of the subject.
g) Assign unit wise assignment to group of 4 to 5 students.
h) Use of video, animations, to explain concepts, facts and application related to printing.

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-project 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 has to match the competency and the Cos. Similar micro-projects could be added by the concerned course teacher:

1. **Fiber Analysis Comparison:** Select different technical textile fibers (like carbon fiber, aramid, etc.), analyze their properties (strength, durability, etc.), and create a comparative study report. Highlight their applications in various industries.
2. **Case Study on Smart Textiles:** Choose a specific application of smart textiles (like healthcare monitoring garments or wearable tech), research its technological advancements, and present a case study showcasing its development, challenges faced, and future prospects.
3. **Fabric Development Experiment:** Conduct an experiment to develop a technical textile fabric with specific properties (like flame resistance, moisture-wicking, etc.) using different materials and manufacturing techniques. Document the process and outcomes.
4. **Life Cycle Analysis of Technical Textiles:** Analyze the environmental impact of technical textiles by conducting a life cycle assessment (LCA). Compare traditional textiles with technical textiles in terms of sustainability, recycling, and disposal.
5. **Market Analysis of Technical Textiles:** Research the current market trends, demands, and challenges in the technical textile industry. Create a comprehensive report highlighting key players, market growth areas, and emerging technologies.
6. **Prototype Development:** Design and create a prototype showcasing the application of technical textiles in a specific industry (e.g., automotive, aerospace, sports). Document the design process, materials used, and potential benefits.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Handbook of Technical Textiles	Edited by A. Richard Horrocks and Subhash C. Anand	Woodhead Publishing, 2000 ISBN: 978-1855732964
2	Technical Textiles: Properties, Applications, and Design	Edited by Roshan Paul	Woodhead Publishing, 2016 ISBN: 978-0081009289
3	High-Performance Apparel: Materials, Development, and Applications	Edited by John McLoughlin and J. Fan	Publication: Woodhead Publishing, 2018 ISBN: 978-0081009289
4	Smart Textiles for Medicine and Healthcare: Materials, Systems, and Applications	Edited by L. Van Langenhove	Publication: Woodhead Publishing, 2007 ISBN: 978-1845692644

14. SOFTWARE/LEARNING WEBSITES

https://onlinecourses.nptel.ac.in

15. PO-COMPETENCY-CO MAPPING

Semester V	Environment Textile Chemistry						
	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 different technical textiles in various fields.						
Course Outcomes CO a)	3	1	-	1	-	1	2
CO b)	1	2	1	2	-	1	1
CO c)	1	2	1	1	2	1	1
CO d)	1	2	1	--	-	1	2
CO e)	1	1	1	--	-	1	1

*Legend: '**3**' for high, '**2**' for medium, '**1**' for low and '**-**' for no correlation of each CO with PO.*

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

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