GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

CourseTitle: Technical Textile & Non Woven Technology
(Course Code: 4352901)

Diploma programme in which this course is offered	Semester in which offered
Textile Manufacturing Technology	5th Semester

1. RATIONALE

Technical Textile is called future of Textile. Technical Textile is one of the most rapidly growing sectors of Textile industries. Technical Textiles (TT) offers new ways, means and opportunities to the Indian textile industry to sustain the present growth and thrive in the near future. It would offer not only an opportunity to augment the growth, but also a new direction for advancement of the industry.Technical textiles are being applied in a wide range of areas like health care, automotive industry, industrial applications, marine industry, electronics, fishing, agriculture, construction and industrial packaging. Keeping in view this wide scope, the curriculum is designed, which will be useful to the students.

2. COMPETENCY

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

- **Apply basic principles of web formation and select appropriate raw material to produce good quality of Technical Textile product.**

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) Choose appropriate Technical Textile product based on the properties.
b) Select relevant Geo textile, Industrial and Automotive textile product.
c) Select relevant Medical textile, Protective textile and Sport textile product.
d) Select relevant method of web formation.
e) Select relevant web bonding method to produce Non-woven.

4. TEACHING AND EXAMINATION SCHEME

			Total Credits (L+T+P/2)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	CA	ESE	CA	ESE	
3	-	2	4	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 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'*.

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Demonstrate the chart of classification of technical textile and its application	I	02*
2	Demonstrate different geo textile product and its applications.	II	02*
3	Demonstrate different Industrial and Automotive textile product and its applications.	II	02*
4	Demonstrate different Medical textile product and its applications.	III	02*
5	Demonstrate different Protective and Sport textile product and its applications.	III	02*
6	Demonstrate production cycle of Non-woven manufacturing process.	IV	02*
7	Demonstrate Air laying, Dry laying process.	IV	02*
8	Demonstrate Wet laying process.	IV	02*
9	Demonstrate Ducan Spun bond process.	IV	02*
10	Demonstrate Melt blown spun bond system.	IV	02*
11	Demonstrate Needle punch bonding method.	V	02*
12	Demonstrate Thermal bonding method.	V	02*
13	Demonstrate Chemical bonding method.	V	02*
14	Demonstrate Mechanical finishing process of Non-woven.	V	02*
	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

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

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Melt Spinning line Screw Diameter : 25 mm. Temperature Controller: up to 450^{o} C L/D ratio : 30:1 Air cooled	9,10
2	Needle Punching machine	11
3	Padding mangle	13, 14

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) Practice environmentally 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 Technical Textile	1a. Describe different sectors of Technical Textiles. 1b. Describe the various applications of Technical Textiles. 1c. Describe different fibres used for Technical Textiles. 1d. Explain the physical properties of various fibres use for Technical Textiles.	1.1 Definition and Classification of Technical Textile 1.2 Application of Technical Textile product in various sectors. 1.3 Raw material use for technical textile 1.4 Characteristics and Physical properties of different fibre used for Technical Textile
Unit – II Geo Textiles Industrial and Automotive Textile	2a. Describe features of Geo textiles. 2b. Differentiate between Geo-textile and Geo synthetics with their applications 2c. Distinguish between natural fibre and synthetic fibre used for Geo Textile	2.1 Functional properties of Geo-textile: Separation, Drainage, Filter, Reinforce 2.2 Characteristics of Geo Textiles: Woven and non-Woven 2.3 Applications: Geo grids, Geo nets, Geo composite, Geo membranes, Geo Cell, Geo mattress 2.4 Natural Fibre: Jute and Coir 2.5 Synthetic Fibre: Polyester, Polypropylene, etc
	2d. Differentiate between industrial and automotive textiles and the type fibres used in them. 2e. Industrial Textile and its application 2f. Automotive Textile and its application	2.6 Different types of Industrial Textile and Automotive Textile Product 2.7 Filter Fabric: - Dry filtration - Wet filtration Tarpaulins and Tent, Conveyor Belt… 2.8 Tyre cord fabrics, Belts and Sheet covers…
Unit – III Medical Textile Protective and Sport Textile	3a. Describe requirement of medical textiles 3b. Describe the Fibre/ filaments used in medical textiles. 3c. Describe the application of medical textiles.	3.1 Function of different Medical textile product. 3.2 Characteristics of fibre/ yarn / fabric used for medical textile. 3.3 Applications: Different application of Medical textile: Clothing, Sutures, Surgical Dressing, Spare parts for human body.
	3d. Describe the use of protective textile with their applications	3.4 Protective Textile: Bullet Proof Fabric, Fire Proof Fabric, Chemical protective fabric, Visual Camouflage

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
	3e. Describe the use of sport textile with their applications	3.5 Sports Textile: Helmets, Hand Gloves, Sport shoes, Balls….
Unit – IV Introduction of Non Woven and Web formation	4a. state the process sequence of non-woven manufacturing process. 4b. Explain the different application of non-woven fabric 4c. State the different fibre and its properties used to produced non-woven fabric 4d. Describe the different web formation methods 4e. Describe Spun bond and Melt Blown Process 4f. State the application of Spun bond non woven and melt blown process of non woven.	4.1 Flow chart of Non woven manufacturing process. 4.2 Non-woven material used in different types of products. 4.3 Different type of fibre and its properties like Denier, Crimp, Tenacity, Elongation….used to produce Non-woven product. 4.4.1 Fibre preparation: opening, cleaning, Blending, Carding, Garneting 4.4.2 Air laying, Dry laying and Wet Laying method 4.4.3 Layering method: Longitudinal Layering (Parallel Laid), Cross Layering (Cross Laid), Vertical Layering (perpendicular) 4.5 Spun bond: Manufacturing process (Ducon , Lutravil, Reicofil system), Polymers used, extruder, materials pump, spinneret, filament separation Melt blown Process: Properties and Application of melt blown web Manufacturing process (Important Parts/element extruder, material pump), Die assembly, Web formation, Process variable affect quality of web, Polymers used. 4.6 End use of Spun bonded and Melt blown web
Unit – V Web Bonding methods and finishing of Non woven	5a. Describe the different bonding methods. 5b. Explain the each bonding methods in details.	5.1 Bonding Methods: Mechanical Bonding (Stitch bonding and Needle Punching), stitch bonding System 5.2.1 Needle Punching System Principle: needle loom, needle punching for different end use 5.2.2 Hydro Entangling /spun lace process 5.2.3 Thermo Bonding: binder for thermo binding process, methods of thermal bonding (hot calendaring , belt calendaring ,air thermal binding,

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
		Ultra Sonic bonding) 5.2.4 Chemical Bonding: methods of application and properties of binder, 5.2.5 Saturation, Foaming, Spraying and Printing, powder binding
	5c. Describe different finishes used for non woven fabric.	5.3 Types of finishes: Dry/ Mechanical
	5d. Explain the dry and wet finishing of nonwoven in details.	5.4 Finishing. Wet/ Chemical finish
	5e. Explain the splitting and winding methods.	5.5 Splitting of Non Woven and winding

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 Technical Textile	4	1	2	5	8
II	Geo Textiles Industrial and Automotive Textile	5	2	3	5	10
III	Medical Textile Protective and Sport Textile	5	2	3	5	10
IV	Introduction of Non Woven and Web formation	13	4	8	8	20
V	Web Bonding methods and finishing of Non woven	15	5	5	12	22
Total		**42**	**14**	**21**	**35**	**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 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 small report of 5 pages for each activity. They should 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 a report on Technical Textile Product of different manufacturers based on your industrial visit.
b) Prepare a report on Geo Textile of different manufacturers based on your industrial visit.

c) Collection of various Medical textile Products and Sport textile product.
d) Visit a nearby Textile unit and prepare a report with suitable machinery sketches.
e) Prepare a presentation on different laying process.
f) Prepare a presentation on Spun bond and Melt blown process.
g) Prepare PPT/ assignment on different Bonding methods.
h) Prepare PPT/ assignment on different finishing process.

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) **Sample collection:** Collect the sample of different Technical Textile product.
b) **Analyze the Sample:** Analyze the Geo textile product.
c) **Sample collection:** Collect sample of Medical Textile and prepare chart of product specification.
d) **Sample collection:** Collect sample of Protective Textile and prepare chart of product specification.
e) **Chart preparation:** Prepare a comparative chart of different web laying process.
f) **Web bonding:** Prepare a report on different Web bonding methods.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Hand book of Technical Textile	A R Harrocks and S C Anand	Wood head publishing limited.
2	The Nonwovens	Giovanni Tanchis	Fondazione ACIMIT
3	Non Woven	Moorthi, P. Madhava and Guruprasad Sunder Shetty	Mahajan Publisher pvt ltd, Ahmedabad ISBN 81-85401-25-X
4	Industrial applications of Textiles: Textile for filtration and coated fabrics	Bajaj, P. and Sengupta, A.G.	Textile progress; 4,1, Textile Inst., 1985
5	Geo textile in Civil Engineering works	Textile Association	The Textile Association 1985
6	Textiles for Protection	Richard, A. Scott	The Textile Institute, CRC Press and Woodhead Publishing Limited
7	Automotive Textiles	Mukhopadhyay, S. K. and Partridge, J. F.	The Textile Institute, Textile Progress, Vol 29, No.1/2

14. SOFTWARE/LEARNING WEBSITES

a) http://nptel.ac.in/
b) http://www.textileassociationindia.org/
c) http://www.sitra.org.in/
d) http://www.itamma.org/
e) https://textilestudycenter.com/
f) http://www.textileschool.com/
g) https://archive.org/details/manmadefibres0000monc/page/n7/mode/2up
h) https://textilestudycenter.com/textile-books-free-donwload/
i) http://www.cottonsjourney.com/Storyofcotton/page5.asp
j) http://textilelearner.blogspot.in/
k) http://www.textileassociationindia.org/
l) http://www.rieter.com

15. PO-COMPETENCY-CO MAPPING

Semester V	Technical Textile and Nonwoven Technology (Course Code: 4352901)
	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	Apply basic principles of web formation and select appropriate raw material to produce good quality of Technical Textile product.						
Course Outcomes CO a) Choose appropriate Technical Textile product based on properties	3	-	2	-	-	-	2
CO b) Select relevant Geo textile, Industrial and Automotive textile product.	3	-	2	-	1	-	2
CO c) Select relevant Medical textile, protective textile and sport textile product	3	-	-	-	-	-	2
CO d) Select relevant method of Web formation	3	-	-	-	-	-	3
CO e) Select relevant Web bonding method to produce Non-woven.	3	-	2	-	-	-	3

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

16. COURSE CURRICULUM DEVELOPMENT COMMITTEE

GTU Resource Persons

S. No.	Name and Designation	Institute	Contact No.	Email
1	Mr. Chetan G. Patel Lecturer in Textile Manufacturing Technology	Dr. S & S S Ghandhy college of Engineering and Technology, Surat	0261-2655799	cgptextile@gmail.com
2	Mr. H N Upadhyaya, Lecturer in Textile Manufacturing Technology	R. C. Technical Institute,Ahmedabad	079-27664785	hnu.1810@gmail.com