GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

CourseTitle: Yarn Texturing and Twisting Technology
(Course Code: 4352904)

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

1. RATIONALE

The texturing of manmade yarns has been one of the most exciting development to utilize the synthetic fibres more advantageously in their continuous filament form to make them bulkier and fuller in appearance without converting them into staple fibre. Also, Texturing is increasingly important in textile production, not only in yarns for weaving and knitting fashion products, but also for carpets, furnishing fabrics and a variety of technical textilesThe course has been designed to provide basic knowledge and skill of different texturing and twisting technology. The course aims to provide the knowledge of need for Twisting, need for texturing, different texturing methods, advantages of texturing and twisting and quality control of textured yarn.

2. COMPETENCY

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

- **Select appropriate texturing methods for producing good quality textured yarn.**

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) Illustrate the importance of texturing and twisting processes.
b)Use false twist texturing and draw texturing process to produce good quality textured yarn.
c) Select appropriate parameters for producing good quality air-jet textured yarn.
d)Select appropriate texturing process to produce different types of textured yarn.
e) Use different process for testing and quality control of textured yarn.

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 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	Obtain important features and need of Texturing process.	I	02*
2	Demonstrate the passage of material through TFO.	I	02*
3	Demonstrate the principle of false twist Texturing.	II	04*
4	Demonstrate the different types of twisting units used in false texturing.	II	04*
5	Demonstrate process of texturing onSequential Draw Texturing machine.	II	04*
6	Demonstrate texturing process on Air jet Texturing machine.	III	04*
7	Test yarn stability of Air jet textured yarn by du-Pont method.	III	02*
8	Demonstrate texturing process on Knit-De-Knit texturing machine.	IV	02*
9	Test denier and its count variations of textured yarn.	V	04*
10	Test tensile properties of textured yarn.	V	04
	Minimum 9 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.	20
2	Prepare experimental setup.	20
3	Operate the equipment setup or circuit.	20
4	Follow safe practices.	20
5	Interpret the result/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 in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO.No.
1	Two for One twister: No. of Spindle- 1 to 12, Spindle gauge-210 to 240mm, Pot dia.- 100-150mm, TPI range-2.5 to 45 TPI, Spindle speed-5000 to 15000 rpm.	2
2	Sequential draw texturing machine: No. of Spindle: 10 (110 mm Pitch length) Delivery Speed: 1000 meters/min.	3,4,5

	Heater Type and Temp. Range: Electrical Heater with 150^{o} C- 260^{o} C	
3	Air Jet Texturing machine: No. of Spindle: 1 to 10 (110 mm Pitch length) Delivery Speed: 1000 meters/min.	6
4	Sample holder with loading arrangement manually or automatically loading or forcing instrument. Loading range-0.01 to 500grams.	7
5	Knit-De-knit texturing machine: Speed – 500 to 1000 rpm, Temp. range 120 ^{o}C -300 ^{o}C, No. of Spindle-01to02	8
6	Weighting balance & Automatic Wrap Reel: No. of Wrap: 01 -10000 (adjustable), periphery of wrap reel-1.5 yard, Speed: 30-280 RPM with preset counter.	9
7	Yarn strength tester: Measurement range- 0-50Kgf, Gauge Length-50cm	10

7. AFFECTIVE DOMAIN OUTCOMES

The following ***sample***Affective Domain Outcomes (ADOs) are embedded in many of the abovementioned COs andPrOs.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 teacherto focus on attainment of COs and competency.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
Unit – I Introduction of Texturing process and Twisting	1a. Describe the need of Texturing. 1b. Give the advantages of textured yarn over filament yarn. 1c. Classify the different types of Textured yarn & different texturing machine 1d. State the object of twist	1.1 Introduction to texturing. 1.2 Classification of Textured yarn. 1.3 Different texturing machine to produce different types of textured yarn 1.4 Twist & object of Twist 1.5 Types of Twist direction 1.6 Types of twisted yarn 1.7 Effect of twisting on yarn properties. 1.8 Types of twisting machines 1.8.1 Ring twister

	1e. Describe types of twisted Yarn and effect of twist. 1f. List & describe different types of twisting machines.	1.8.2 Deck twister 1.8.3 TFO (Two for One Twister)
Unit – II False Twist Texturing & Draw Texturing	2a. Explain principle of false twist Texturing 2b. Passage of material through false twist texturing machine. 2c. Describe factors affecting characteristics of false twist textured yarn. 2d. Differentiate Pin twister and friction twister. 2e. Distinguish the features of Nip and Ring Twister. 2f. Describe different draw texturing process.	2.1 Principle of False twist Texturing. 2.2 False twist texturing machine and function of parts. 2.3 Different factors affecting characteristics of false twist textured yarn. 2.3.1 Material variables 2.3.2 Machine variables 2.3.3 Process variables 2.4 Different Twisting unit: 2.4.1 Pin Twister 2.4.2 Friction Twister 2.4.3 Nip Twister and 2.4.4 Ring Twister 2.5 Draw texturing machine 2.5.1 Importance of Draw texturing 2.5.2 Simultaneous draw texturing 2.5.3 Sequential draw texturing
Unit – III Air jet Texturing and Quality control	3a. Explain the principle of Air-Jet Texturing. 3b. Explain different types of air-textured yarn. 3c. Describe different types of Jets for Air-Texturing. 3d. Explain effect of different variables on Air-jet Textured yarn quality. 3e. Describe modern air-jet Texturing process. 3f. Describe the methods for Testing of air-jet textured yarn stability test.	3.1 Air jet Texturing machine. 3.1.1 Principle of Air-jet texturing 3.1.2 Air-jet texturing process 3.1.3 Application of air-jet textured yarn 3.2 Classification of air-textured yarn 3.2.1 Single end air-textured yarn 3.2.2 Co or parallel end air-textured yarn 3.2.3 Core & effect air textured yarn/Fancy air textured yarn 3.3 Types of jets for Air Texturing. 3.4 Effect of different variables on Air-jet Textured yarn quality. 3.5 Modern air-jet texturing machine 3.6 Methods to test air textured yarn stability 3.6.1 Du-pont method 4.6.2 Heberlain method
Unit – IV Miscellaneous Texturing process &Processing of Microfilaments	4a. Describe the stuffer box texturing process and give its application. 4b. Explain the principle & working of Edge crimping process & give its application. 4c. Describe the Gear crimping process & give its application. 4d. Describe the Knit-De-Knit texturing process & give	4.1 Stuffer box Texturing process. 4.1.1 Single end crimping machine 4.1.2 Simultaneous crimping of multiple ends 4.1.3 Application stuffer-box textured yarn 4.2 Edge crimping machine. 4.2.1 Principle of edge crimping 4.2.2 Edge crimping machine for production of 'Agilon yarn'. 4.2.3 Application of Edge crimped yarn 4.3 Gear crimping machine. 4.3.1 Gear crimping process 4.3.2 Application Gear crimp yarn

	its application. 4e. Describe Processing of microfilament on texturing machine	4.4 Knit-De-Knit Texturing machine. 4.4.1 Knit-De-Knit Texturing process 4.4.2 Application Knit-De-Knit textured yarn 4.5 Processing of Microfilament on Texturing machine.
Unit – V Warping & sizing, Testing & quality control of Textured yarn & Fabric	5a. Explain the testing of different properties of textured yarn. 5b. Describe the warping of textured yarn. 5c. Describe the sizing of textured yarn. 5d. Give the causes and remedies of textured yarn defects. 5e. Give the causes and remedies of textured fabric defects.	5.1 Testing of various textured yarn properties 5.1.1 Denier and its variation 5.1.2 Tensile properties 5.1.3 Spin finish or lubricating oil content by Soxhlet extraction method 5.1.4 Crimp permanency and crimp Contraction: Leesona skein shrinkage test&Heberlain crimp contraction test 5.2 Warping of Textured yarn 5.3 Sizing of Textured yarn 5.4 Textured yarn fault, causes & remedies 5.5 Textured yarn fabric fault, causes & Remedies.

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 Texturing process and Twisting	7	3	4	4	11
II	False Twist Texturing & Draw Texturing	11	4	10	7	21
III	Air jet Texturing and Quality control	8	3	4	7	14
IV	Miscellaneous Texturing process Processing of Microfilaments	6	2	5	5	12
V	Warping & sizing, Testing & quality control of Textured yarn & Fabric	10	2	5	5	12
Total		**42**	**14**	**28**	**28**	**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 report of 5 pagesfor 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 different Texturing process based on your industrial visit.
b) Prepare a report on Microfilament Texturing process based on your industrial visit.
c) Collectionofvarious Textured yarn.

d) Visitanearby Textile unitand prepare a report with suitable machinerysketches.
e) Prepare a presentationon different Texturing process.
f) Plan production of False Twist Texturing machine.
g) Test different properties of Textured yarn.
h) Prepare PPT/ assignment on Air jet Texturing 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) **Twisting:** Prepare the report of different twisting machine with their specifications. Collect &make report for different types of twisted yarn.
b) **False Twist Texturing & Draw Texturing:**Prepare the report of different False twist texturing machine & Draw texturing machine with their specifications.
c) **Air jet Texturing: Prepare the report of Air-jet texturing machine with their specifications.**
d) **Miscellaneous Texturing process:** Prepare the report of different texturing other than False twist texturing and Air-jet texturing machine.
e) **Warping & sizing, Testing & quality control of Textured yarn & Fabric:** Make report for different process & quality control method for textured filament yarn.
f) **Chart preparation:** Prepare a comparative chart of different Texturing process.

g) **Sample collection:** Collect & make report of the sample for different types of textured yarn.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	A Guide to Crimping/Texturing Technology	Rao, M.V.S. and Mr. A.B. Talele	MANTRA Publication, (Year-1992) Nasnal Printers and its associates, Surat, Gujarat
2	Textile Yarns: Technology, Structure and applications	B. C. Goswami, J.G. Martindale and Scardino	John Wiley & Sons INC, Wiley India Pvt Ltd. YEAR:2011 ISBN: 9788126528493
3	Yarn Texturing Technology	J. W. S. Hearle, L. Hollick, D. K. Wilson	Woodhead Publishing Ltd Abington Hall, Abington Cambridge CB1 6AH, England Year-2001 Woodhead Publishing ISBN 1 85573 575 X CRC Press ISBN 0-8493-1310-4
4	False twist textured yarns: Principles, processes and applications	C. Atkinson	Woodhead Publishing series in Textile, 2012 The Textile Institute, ISBN: 978-1-84569-933-8 (Print) SBN 978-0-85709-559-6 (online)
5	Synthetic Filament Yarn Texturing Technology	Demir A., and H.M.	Prentice Hall, 1997 Cornell University ISBN:0134400259, 9780134400259

14. SOFTWARE/LEARNING WEBSITES

a) https://nptel.ac.in/courses/116102053
b) https://archive.org/details/syntheticfilamen0000demi/mode/2up
c) https://www.youtube.com/watch?v=Krhk2JxxwIE
d) https://www.youtube.com/watch?v=VOpLbcVqoW0
e) https://www.youtube.com/watch?v=7DE-_ghu1iU
f) https://www.youtube.com/watch?v=Kozfo47Lj6I
g) https://www.youtube.com/watch?v=uYOWFdNXwBg
h) https://www.youtube.com/watch?v=065Q2BRDqJA
i) https://www.youtube.com/watch?v=-dpS3NVLPJ8
j) https://www.youtube.com/watch?v=Xg6VJievr7o
k) https://www.youtube.com/watch?v=wmucOSL1ms4
l) https://www.youtube.com/watch?v=4Mzn7Ko2C00
m) https://www.youtube.com/watch?v=Kozfo47Lj6I
n) https://www.youtube.com/watch?v=Wp_0iHuEi0U
o) https://www.youtube.com/watch?v=bUk4aM9FHoM
p) https://www.youtube.com/watch?v=J8hU4PZzjFU
q) https://www.dspattextile.com/2022/07/types-of-textured-yarns-and-its-usage.html

r) http://textilelibrary.weebly.com/air-texturizing-process.html
s) https://www.textechno.com/wp-content/uploads/2015/11/TEXTURMAT_ME-.pdf
t) https://www.youtube.com/watch?v=_i7GB3VIe3A

15. PO-COMPETENCY-CO MAPPING

Semester V	Yarn Texturing and Twisting Technology (Course Code: 4352904)						
	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	Select appropriate texturing methods for producing good quality textured yarn.						
Course Outcomes CO a) Illustrate the importance of texturing and twisting processes.	3	-	2	-	-	2	2
CO b) Use false twist texturing and draw texturing process to produce good quality textured yarn.	3	2	2	2	-	2	2
CO c) Select appropriate parameters for producing good quality air-jet textured yarn.	3	2	2	2	-	2	2
CO d) Select appropriate texturing process to produce different types of textured yarn.	3	2	2	2	-	2	2
CO e) Use different process for testing and quality control of textured yarn.	3	2	2	3	-	2	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

S. No.	Name and Designation	Institute	Contact No.	Email
1	Mr. Chetan G. Patel Lecturer in Textile Manufacturing Technology	Dr. S & S SGhandhy college of Engineering and Technology, Surat	0261-2655799	cgptextile@gmail.com

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