GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Modern Spinning Technology
(Course Code: 4362901)

Diploma programme in which this course is offered	Semester in which offered
Textile Manufacturing Technology	6th Semester

1. RATIONALE

Modern spinning technology plays a crucial role in the textile industry by enhancing efficiency, reducing costs, improving product quality and aligning with sustainability goals. As technology continues to evolve, textile manufacturers will likely continue to adopt and adapt modern spinning methods to stay competitive and meet the needs of a changing market.

2. COMPETENCY

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

- Produce yarn by operating modern spinning line effectively and by maintaining process parameters.
- The ability to communicate with team members, supervisors and other stakeholders regarding production issues, quality concerns and process improvements.
- Capability to identify and address technical issues and challenges that may arise during spinning operations and Problem-solving skills to enhance yarn quality, reduce defects and maintain consistent production.

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) Explain limitation of convention spinning process and need of modern spinning process & different modern spinning process.
b) Produce yarn using Rotor spinning and Classify yarn properties
c) Produce yarn using Friction spinning and Air-jet spinning and Classify yarn properties
d) Development in conventional spinning line.
e) Produce yarn using polyester Fibre.

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	-	4	5	30*	70	50	50	200

(*): 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	Find out important features of Open End Spinning assembly.	I	04
2	Draw passage of material through Cover spinning process	I	04
3	Draw passage of material through twist less spinning machines.	I	04
4	Draw passage of material through electrostatic spinning machine	I	04
5	Draw passage of material through air vortex spinning machine	I	04
6	Draw passage of material in Rotor spinning.	II	04
7	Discover important devices in Rotor spinning.	II	04
8	Calculate Production, TPI, and back doubling and Draft of rotor spinning machine	II	04
9	Draw passage of material of Friction spinning. DREF-I, DREF-II, DREF-III, P.S.L.	III	04
10	Produce yarn in Air-jet spinning machine	III	04
11	Compare yarn produced by modern spinning with ring spun yarn		04
12	Discover important features of Modern Blow room machine and chute feeding.	IV	04
13	Discover important features of Modern Carding, Combing, Draw frame, Fly frame and Ring frame process.	IV	04
14	Draw sketch of type of auto levellers and Describe the important features of Auto levellers in card and draw frame.	IV	04
	Minimum 14 Practical Exercises	**56 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.*

iii.

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	Rotor Spinning Machine • Number of Spinning position up to : 220 • Range of yarn linear density: 12 – 125 tex, 8-80 Nm, 5-50 Ne • Draft: 25 to 400 • Opening roller Speed: 6000 to 11000 rpm • Rotor speed: up to 150000 rpm • Rotor Diameter: 32 – 65 mm • Delivery speed: up to 200 mpm • Winding angle: 29º to 45º • Package (Mass): up to 5 kg	
2	DREF Spinning DREF-2 • Number of Spinning position : 6 to 48 • Count Range : 120 – 3300 tex, 0.18 -5 Ne • Raw Material: Wool / bast Fiber / Synthetic fiber • Delivery speed: 280 mpm • Feed stock : Card Sliver • Yarn type : Normal OE yarn DREF-3 • Number of Spinning position : 12 to 96 • Count Range : 33 – 165 tex, 3.5 -18 Ne • Raw Material: Cotton / Synthetic fiber • Delivery speed: 300 mpm • Feed stock : Draw Fame Sliver	

	• Yarn type : Bundle Yarn	

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 **Need of Modern Spinning Systems and modern spinning systems**	1a. Explain limitations of Ring spinning 1b. Explain the principle of open end spinning with its advantages 1c. Describe various modern spinning systems 1d. Describe properties of the yarn spun by other modern spinning machines	1.1 Ring spinning and open end spinning. 1.2 Basic methods of open end spinning Vortex assembly, Axial assembly, Discontinuous assembly, Friction spinning, Rotor spinning 1.3 Modern spinning system cover spinning, Twistless spinning (Bobtex, Twillo, Faciated), Siro-spinning, Self-twisted 1.4 Properties and uses of yarn spun by modern spinning system

Unit – II Rotor Spinning and yarn properties	2a. Describe Rotor Spinning principle and the operations of the Rotor 2b. Explain important functions of Rotor spinning machine. 2c. Describe properties, merits and demerits of rotor spun yarn. 2d. Calculate production, draft and twist of Rotor spinning machine	2.1 Rotor spinning and principles of operation. 2.2 Parts of the Rotor spinning machine. 2.3 Fibre opening, fibre transfer and twist-insertion in rotor spinning. 2.4 Properties of Rotor spun yarn. 2.5 Calculation for production, draft and twist
Unit – III Friction Spinning and Air-Jet spinning and yarn properties	3a. Describe principle of operation of friction spinning 3b. Differentiate the different types of friction spinning machines. 3c. Describe properties of friction spun yarn. 3d. Describe principle of operation of Air-jet spinning. 3e. Describe properties of Air-jet spun yarn	3.1 Friction spinning 3.2 Different types of Friction spinning machines: Dref-I, Dref -II, Dref-III, P.S.L) 3.3 Properties of friction spun yarn. 3.4 Air-jet spinning. 3.5 Properties of Air-jet spun yarn
Unit – IV Modern Development in conventional spinning process	4a. Describe the working of the Chute feed systems 4b. Describe the working of the Auto leveller in Card and Draw frame 4c. Describe modern developments in blow room to Ring frame	4.1 Chute feed systems. 4.2 Auto leveller in Card and Draw frame. 4.3 Developments in blow room, card, draw frame, comber, speed frame and ring frame - Ring cam system.
Unit –V Polyester Fibre Spinning	5a. Describe the requirement of polyester fibre spinning 5b. Describe machine sequences and process parameters of polyester fibre spinning.	5.1 Polyester fibre spinning and its requirement. 5.2 Machine sequences and process parameter used for polyester fibre spinning.

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	Modern Spinning Systems	10	3	8	4	15
II	Rotor Spinning	11	4	10	7	21
III	Friction Spinning and Air-Jet spinning	11	3	10	7	20
IV	Modern Development in conventional spinning process	5	0	4	3	7
V	Polyester Fibre Spinning	5	0	4	3	7
Total		**42**	**10**	**36**	**24**	**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 ***cocurricular*** 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 Modern Spinning machine of different manufacturers based on your industrial visit.
(b) Collection of various machine specifications, and process parameters Moder Spinning machine.
(c) Visit a nearby spinning unit and prepare a report with suitable machinery sketches.
(d) Prepare a presentation on recent technological advancement in spinning Technology.
(e) Present a seminar PPT on any of the following relevant topic.
(f) Internet based assignment topic wise.

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 yarn proceed by modern spinning machine.
b) **Chart preparation:** Prepare a comparative chart of different yarn produced by modern spinning machine.
c) **Comparative study** : compare technoeconomic study between modern spinning machine.
d) **Report preparation and presentation** : prepare a detailed report on any moderns spinning machine, advancement in spinning technology and present it to audience.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	Rieter Manual of Spinning Volume 6 "Alternative spinning system"	Dr Herbert Stalder	Rieter Machine Works Ltd Klosterstresse 20 CH-8406,Wintherthur ISBN 10 3-9523173-6-5, ISBN 13 978-3-9523173-6-5
2	Rieter Manual of Spinning Volume 7 "Processing of Man made fibres"	Prof. Dr. Thomas Weide	Rieter Machine Works Ltd Klosterstresse 20 CH-8406,Wintherthur ISBN 10 3-9523173-7-5, ISBN 13 978-3-9523173-7-2

3	Rotor Spinning	Lawrence C.A. and Chen, K.Z.	The Textile Institute, Textile Progress Vol.13, Textile Institute, 1984 ISBN 10 0-9007396-8-1, ISBN 13 978-0-9007396-8-2
4	Short Staple Spinning - Vol. I-VI	Klein, W.	Rieter Machine Works Ltd Klosterstresse 20 CH-8406,Wintherthur ISBN 10 3-9523173-0-6 ISBN 13 978-3-9523173-0-3
5	Spun Yarn Technology	Eric Oxtoby	Butterworths Publication, Elsevier Ltd.1987 ISBN 10 : 978-0-408-01464-9 ISBN-13 : 978-1483129389
6	Gowda, R. V. Mahendra	New Spinning System	NCUTE

14. SOFTWARE/LEARNING WEBSITES

1 http://www.rieter.com/cz/rikipedia/articles/rotor-spinning/the-importance-of-rotor-spinning/the-principle-of-rotor-spinning/
2 ii. http://nptel.ac.in/courses/116102038/new%20spinning%20systems/rotor%20spinning-1.htm
3 http://textilelearner.blogspot.in/2013/02/an-overview-of-developments-in-yarn.html
4 http://www.indiantextilejournal.com/articles/FAdetails.asp?id=2010
5 http://textiletodaybd.com/magazine/printable.php?id=371
6 http://www.rieter.com/cz/rikipedia/articles/fibre-preparation/the-blowroom/summary-of-the-process/the-blowroom-installation-as-asequence-of-machines/
7 http://www.slideshare.net/nayen/blowroom
8 http://www.rieter.com/cz/rikipedia/articles/alternative-spinning-systems/the-various-spinning-methods/open-end-spinning-processes/friction-spinning/operating-principle/
9 http://www.indiantextilejournal.com/articles/FAdetails.asp?id=4636
10 http://www.slideshare.net/aybalaozcan/aybala-te-550friction-spinning
11 http://textilelearner.blogspot.in/2011/08/high-speed-spun-yarn-production-rotor_5195.html
12 http://nptel.ac.in/courses/116102038/32
13 http://www.rieter.com/en/rikipedia/articles/technology-ofshort-staple-spinning/yarn-formation/assembly-of-fibers-to-make-up-a-yarn/the-positions-of-the-fibers-in-the-yarn-structure/open-end-spun-yarns/
14 http://www.rieter.com/en/rikipedia/articles/ring-spinning/the-ring-spinning-machine/introduction/

15. PO-COMPETENCY-CO MAPPING

Semester VI	Modern Spinning Technology (Course Code: 4362901)						
	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	• Produce yarn by operating modern spinning line effectively and by maintaining process parameters. • The ability to communicate with team members, supervisors and other stakeholders regarding production issues, quality concerns and process improvements. • Capability to identify and address technical issues and challenges that may arise during spinning operations and Problem-solving skills to enhance yarn quality, reduce defects and maintain consistent production.						
Course Outcomes CO a) Explain limitation of convention spinning process and need of modern spinning process & different modern spinning process	3	-	2	1	1	-	3
CO b) Produce yarn using Rotor spinning, and Classify yarn properties .	3	2	2	2	1	2	2
CO c) Produce yarn using Friction spinning and Air-jet spinning and Classify yarn properties	3	2	2	1	-	2	2
CO d) Development in conventional spinning line.	3	-	2	1	-	-	3
CO e) Produce yarn using polyester Fibre	3	2	2	1	-	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

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1	Mr. Sandip P Patel Lecturer in Textile Technology	Sir. Bhavsinhji Polytechnic Institute	+91 8141650106	patelsandiprcti@gmail.com
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