GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

Course Title: Spinning Technology-I
(Course Code: 4322902)

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

1. RATIONALE

Cotton is very important fibre since ancient era. Cotton fibre accounts for almost 50% of the worldwide consumption of textile fibre. Nowadays the worldwide consumption of cotton fibre is reached to 30 million tons per year and India is the second largest country in production of cotton fibre. Spinning technology is a sequence of processes that convert raw cotton fibres into yarn suitable for use in various textile end products- like- woven fabric, knitted fabric, lace making, felting and braiding or plaiting. For manufacturing clean, strong and uniform yarns, series of number of various spinning machines are required. The textile industries are competing with technological upgradation and automation in such way to improve quality and production of yarn with reduction in manufacturing cost. This course is designed to develop knowledge base related to spinning processes of blow room and carding.

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 opening, cleaning and mixing of cotton fibre to produce uniform fault free sliver.**

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) Select relevant machine/process for opening and cleaning of cotton.
b) Select relevant mixing/blending method.
c) Use carding machine to produce uniform fault free sliver.
d) Apply best practices to reduce and reuse fibre wastages.

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	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'*.

S. No.	Practical Outcomes (PrOs)	Unit No.	Approx. Hrs. required
1	Demonstrate working of components of blow room machines.	I	02*
2	Use bale opening machines for tuft opening from cotton bale.	I	02*
3	Demonstrate cleaning of cotton fibres in coarse cleaning machines.	I	02*
4	Demonstrate cleaning of cotton fibres in fine cleaning machines.	I	02*
5	Demonstrate removal of dust from cotton fibres through dust removal machine.	I	02*
6	Demonstrate passage of material on modern blow room line.	I	02*
7	Determine cleaning efficiency of blow room.	I	02*
8	Use mixing machines to mix varieties of cotton fibres.	II	02*
9	Demonstrate the principle of two-piece chute feed system.	III	02*
10	Demonstrate the passage of material on carding machine.	III	02*
11	Set flat and cylinder settings for effective carding action.	III	02
12	Demonstrate difference in wire points of licker in, cylinder and flat.	III	02*
13	Demonstrate grinding of wire points on carding machine.	III	02*
14	Apply different card settings to identify its effects on material.	III	02*
15	Demonstrate doffing mechanism of can on card.	III	02
16	Demonstrate functions of auto-levelers on card.	III	02
17	Calculate production and cleaning efficiency of carding machine.	III	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 required 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/ 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 practical in all institutions across the state.

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	Automatic bale opener: Material: Cotton, man-made fibres up to 65 mm staple length, Production output: Cotton (1000 - 2000 kg/h)	1,2
2	Cleaning machine: Material: Cotton, cotton waste, linen, Production volume: 1000- 1400 kg/h, working width:1600 mm, Clearer roller diameter:750 mm, Speed:480-960 rpm, Length: 2000 mm, Width:1000 mm, Height:2000 mm	3 to 7
3	Mixing machine: Material: fibres up to 65 mm staple length, Production: 800-1000 kg/h, No. of chambers:8, Opening roller speed: 500-600 rpm, Take-off roller speed:660 rpm, Width:1500 mm, Length:8795 mm	8
4	Carding machine: Working width:1500 mm, Licker-in diameter:180 mm, Licker-in speed:1000-2000 rpm, Main cylinder diameter:814 mm, Main cylinder speed:600-900 rpm, Doffer diameter:680 mm, Delivery:300-400 m/min., Flat bars:80, In working position:27, Flat direction: backward, Pressure:6 bar	9 to17

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 course competency.

a) Work as a leader/a team member.
b) Follow safety practices while using blow room and carding machines.
c) Practice environment friendly methods and processes. (Environment related)

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 levels)	Topics and Sub-topics
Unit – I **Blow Room**	1a. Describe the basic operations in blow room. 1b. Justify the need of opening and cleaning of fibres. 1c. Describe the components of blow room machines with neat sketches. 1d. Explain working of machines used for "Opening" of fibres. 1e. Explain working of machines used for "Cleaning" of fibres. 1f. Describe working of dust removal machines with neat sketch. 1g. Describe working principle of damage prevention and fire protection units. 1h. Calculate the cleaning efficiency of blow room.	1.1 Basic operations in the blow room: Opening, Cleaning, Dust removal, Blending, Even feed of material to the card 1.2 Need for opening and cleaning: Type and degree of opening, General considerations regarding opening and cleaning 1.3 Components of blow room machines: Feeding apparatus, opening devices, Endless path devices, Gripping elements, Rotating devices, The grid, Interaction of feed assembly, opening element and grid 1.4 Machines for "Opening": Automatic bale opening machines, UNIfloc, Blendomat, Conventional bale openers 1.5 Machines for "Coarse cleaning":Step cleaner, Dual roller cleaner, Monocylinder cleaner, UNIclean 1.6 Machines for "Intermediate cleaning": RN cleaner 1.7 Machines for "Fine cleaning": UNIflex fine cleaner, CLEANOMAT TFV fine cleaner 1.8 Dust removal: Dust extractor, DUSTEX dedusting machine 1.9 Metal detection: Magnetic metal extractors, Electronic metal extractors, Combo Shield 1.10 Cleaning efficiency of blow room
Unit – II **Mixing and Blending**	2a. Justify the need of mixing and blending of fibres. 2b. Describe working of machines used for "Mixing and Blending" of fibres with neat sketch. 2c. Determine the quality of blending of given fibres. 2d. Explain the different types of blending operations.	2.1. The purpose of blending 2.2. Machines for "Mixing and Blending": Mixing battery, MCM/MPM multiple mixer, UNImix, Metering and blending on one machine 2.3. Evaluation of blending 2.4. Types of blending operations: Bale mixing, Flock blending, Lap blending, Web blending, Sliver blending, Fibre

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different levels)	Topics and Sub-topics
		blending, Roving blending
Unit– III **Carding Machine**	3a. Explain the functions of card. 3b. Explain the operating principle of card. 3c. Describe the operating zones of card with neat labeled sketches. 3d. Describe the types of card clothing with neat sketches. 3e. Explain working principle of autoleveling equipment. 3f. Describe the maintenance procedure of card clothing. 3g. Explain defects of carding machine. 3h. Calculate the output production and cleaning efficiency of carding machine.	3.1 Functions of card: Opening into individual fibres, Elimination of impurities, Elimination of dust, Disentangling of neps, Elimination of short fibres, Fibre blending, Fibre orientation, Sliver formation 3.2 Operating principle 3.3 Operating zones of card: Basic concept of tuft feed, The two-piece chute feed system, Fine cleaning integrated in the card chute, Unidirectional feed, The operation of the licker-in, Carding plates or carding bars, Purpose and effects of carding elements, The cylinder, Function and construction of flats, The doffing operation, The detaching apparatus 3.4 Classification of card clothing: Flexible clothing, Semi-rigid clothing, Metallic clothing 3.5 Classification and principles of autoleveler 3.6 Maintenance of card clothing: Stripping, Burnishing, Grinding, IGS-top integrated grinding system 3.7 Various defects of carding 3.8 Calculation of production and cleaning efficiency
Unit– IV Recycling of Fibre Waste	4a. Explain the objectives of recycling fibre waste. 4b. Apply the recycling process of installation for reusable waste.	4.1 Objectives of recycling fibre waste 4.2 Process of recycling installation for reusable waste

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	Blow room	16	3	10	14	27
II	Mixing and Blending	4	1	2	4	07
III	Carding Machine	18	5	10	15	30
IV	Recycling of Fibre Waste	4	1	1	4	06
Total		**42**	**10**	**23**	**37**	**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 to 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. They also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a) Prepare report on different manufacturers' blow room machines based on their industrial visit.
b) Prepare report on different manufacturers' carding machine based on their industrial visit.
c) Give seminar on recent technological advancement of blow room.
d) Give seminar on recent technological advancement of card.
e) Prepare comparative report from e-brochures of different machineries.

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

a) **Fibre sample collection:** Collect the sample of different types of cotton fibre, prepare property chart and compare properties.
b) **Card sliver analysis**: Calculate number of fibres in cross section, calculate hank of sliver, and analyze weight/unit length.
c) **Sliver defects analysis:** Prepare report on identification of various defective card slivers, reasons for those defects and possible remedies to avoid it.
d) **Blow room and card settings:** Prepare report on various changes in blow room and card machines and its settings while changing in raw material from natural fibre to man-made fibre.
e) **Market survey of wire points and rollers:** Collect different types of wire points and rollers available in market and make a sample book of wire points with their specifications and uses.
f) **Machine specifications:** Prepare a report on machine specifications of blow room and card of different manufacturers with part numbers mentioned.
g) **Fibre waste**: Compile a report onfibre wastes and prepare charts and strategies to re-use.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	The Rieter Manual of Spinning, Volume-I-Technology of Short-staple spinning	Klein Werner	Rieter Machine Works Ltd., Winterthur, Switzerland, 2014, ISBN 10 3-9523173-1-4/ ISBN 13 978-3-9523173-1-0
2	The Rieter Manual of Spinning, Volume-II-Blow room and Carding	Klein Werner	Rieter Machine Works Ltd., Winterthur, Switzerland, 2014, ISBN 10 3-9523173-2-2/ ISBN 13 978-3-9523173-2-7
3	Spun Yarn Technology	Oxtoby Eric	Butterworth's (Publishers) Limited, UK,1983, ISBN: 0-408-01464--4
4	Handbook of Yarn production	Lord Peter R.	Woodhead publishing limited in association with The Textile institute, North America,2003, ISBN 1 85573 696 9
5	Handbook on Cotton Spinning Industry	B. Purushothama	Woodhead Publishing India Pvt. Ltd., New Delhi, 2016, ISBN 13: 978-93-85059-55-1

14. SOFTWARE/LEARNING WEBSITES

a) http://www.textileassociationindia.org/
b) http://www.nitma.org/
c) http://www.sitra.org/
d) http://www.cottonjouney.com/Storyofcotton/page5.asp
e) http://textiletechinfo.com/spinning/BLOWROOM.htm
f) http://textilelearner.blogspot.in

g) https://nptel.ac.in/course.html
h) https://www.youtube.com/watch?v=pYruLp-X2Jw

15. PO-COMPETENCY-CO MAPPING

Semester II	Spinning Technology-I (Course Code: 4322902)						
	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 opening, cleaning and mixing of cotton fibre to produce uniform fault free sliver.						
Course Outcome CO a) Select relevant machine/process for opening and cleaning of cotton.	3	2	1	2	2	1	2
CO b) Select relevant mixing/blending method.	3	2	1	1	2	1	2
CO c) Use carding machine to produce uniform fault free sliver.	3	2	1	2	2	1	2
CO d) Apply best practices to reduce and reuse fibre wastages	3	2	3	2	3	1	3

*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

S. No.	Name and Designation	Institute	Contact No.	Email
1	Sandip P. Patel, Lecturer	RCTI, Ahmedabad	079-27664785	patelsandiprcti@gmail.com
2	Samrat M. Zala, Lecturer	RCTI, Ahmedabad	079-27664785	samrat.zala@gmail.com
3	Dipal H. Panchal, Lecturer	RCTI, Ahmedabad	079-27664785	dipalpanchal23@gmail.com
4	Chetan G. Patel, Lecturer	Dr. S.&S.S. Gandhi College, Surat	0261-2655799	cheki7889@gmail.com

NITTTR Resource Persons

S. No.	Name and Designation	Department	Contact No.	Email
1	Dr. A. S. Rocha, Professor	Coordinator NITTTR Extension Center,	0832-2411326	asrocha@nitttrbpl.ac.in

S. No.	Name and Designation	Department	Contact No.	Email
		Goa		
2	Dr. Hussain Jeevakhan, Assistant Professor	Applied Science and Education	0755-2661600*360	hjeevakhan@nitttrbpl.ac.in