GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

CourseTitle: Spinning Technology-II
(Course Code: 4332902)

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

1. RATIONALE

Technological up gradation in yarn manufacturing has led to design improvement in spinning machines and better process control. Higher productivity and improved yarn quality is achieved with vertical and horizontal integration in spinning process. This course is intended to impart knowledge of recent technological development in Draw frame & Comber. The Draw frame & Comber are important machineries of the spinning operation because it influences yarn quality. Quality of yarn is directly related to the quality of drawn and combed sliver. Draw frame improves the sliver quality through fibre parallelization and ensures uniform sliver formation. Combing improves the fibre length distribution curve of feedstock through removal of noil (short fibres), enabling spinning of uniform finer yarn. This course also provides knowledge of modern development in creel region, drafting system, incorporation of auto leveler and different machine elements ensuring better fibre control and minimizes fibre loss with improved sliver quality and maintaining machine efficiency.

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 drafting, doubling and combing to produce even and fault free sliver with high production efficiency.**

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) Use Draw frame to produce uniform fault free sliver.

b) Select relevant machine/process for Combing preparatory to produce even lap sheet.

c) Use Comber to produce good quality of sliver by reducing and reusing fibre wastages.

d) Calculate the production of Draw frame, Lap former, and Comber.

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 passage of material through Draw frame with a neat labelled sketch.	I	02*
2	Determine the important drafting parameters in Draw frame.	I	02*
3	Demonstrate the drafting elements in Draw frame.	I	02*
4	Identify and differentiate various types of top roller weighting systems in Draw frame.	I	02*
5	Draw labelled sketches of different drafting systems in Draw frame.	I	02*
6	Observe the working of electrical stop motion on Draw frame and write its working principle.	I	02*
7	Demonstrate working principle of auto leveler used for Draw frame with a labelled figure.	I	02*
8	Demonstrate the passage of material through Super lap former with a neat labelled sketch.	II	02*
9	Describe the passage of material through Comber with a neat labelled sketch.	III	02*
10	Demonstrate Combing cycle with neat labelled sketches.	III	02*
11	Demonstrate nipper motion on Comber.	III	02*
12	Demonstrate detaching roller drive in Comber.	III	02*
13	Demonstrate noil extraction with forward and backward feed in Comber.	III	02*
14	Calculate the production of Draw frame and Comber from the provided data.	IV	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

These 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	Miniature Draw frame Delivery: Single, Delivery speed: 100-150 m/min, No. of sliver fed:6-8, Drafting system with pressure bar, Draft range: 8-12	1 to 7,14
2	Super lap former Delivery speed: 70-150 m/min, Drafting system: 3 over 3, Draft range: 1.3 – 2.2	8
3	Comber No. of combing head: 8, No. of delivery:1, material: suitable for cotton fibre (Rectilinear comber), nips/min: 250-400	9 to 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 Draw frame	1a. State the objects of Draw frame. 1b. Discuss importance of drafting and doubling on yarn quality. 1c. Explain sliver blending in Draw frame. 1d. Explain passage of material on Draw frame. 1e. Describe the function of individual part in Draw frame. 1f. Determine drafting parameters. 1g. Identify the elements of drafting arrangements. 1h. Distinguish different types of drafting systems. 1i. Describe different types of top roller weighting system. 1j. Explain technological design change in modern Draw frame. 1k. Identify the defects observed in Drawn sliver.	1.1 Objectives of Draw frame. 1.2 Principles of drafting & doubling, Effects of drafting & doubling on yarn quality. 1.3 Sliver blending in Draw frame. 1.4 Passage of material & functions of Important parts in Draw frame. 1.5 Creel in Draw frame. 1.6 Terminologies used in Drafting system- Actual draft, Mechanical draft, Break draft, Main draft, Drafting force. 1.7 Factors influencing drafting force • Stick slip phenomena • Perfect and real drafting • Drafting irregularity • Factors influencing drafting irregularity 1.8 Elements of drafting arrangements. 1.9 Different types of drafting systems used on Draw frame. • 3 over 3 roller drafting system with pressure bar • 4 over 3 roller drafting system with pressure bar • 5 over 4 roller drafting system with pressure bar 1.10 Different types of Top roller weighting Systems. • Dead weight weighting system • Top arm weighting system • Magnetic weighting system 1.11 Electrical stop motion. 1.12Routine maintenance in draw frame. 1.13 Technological design change in modern Draw frame.

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
		• Drafting roller arrangement. • Top roller weighting arrangement. • Online monitoring and auto leveling. • Suction arrangement. • Automation in doffing. • Power driven creels. • Sliver guides. • Safety measures. 1.14 Drawn sliver defects, their causes & remedies.
Unit– II Comber preparatory process	2a. State the importance of fiber length distribution curve. 2b. Explain Requirements of the card and Draw frame with respect to Combing. 2c. State the Importance of the even passage between Card and Comber. 2d. Judge parameters influencing the Combing operation. 2e.Explain the importance Of lap quality for Combing processes. 2f. Differentiate lap doubling and sliver doubling process.	2.1 Influence of Combing operation on fiber length distribution curve • Baer Sorter Diagram 2.2 Requirements of the card with respect to Combing. • Card sliver purity • Card sliver evenness 2.3 Requirements of the draw frame with Respect to Combing. • Pre-drawing (Breaker Draw frame)- combing preparation • Post drawing (Finisher Draw frame) - combing process. 2.4 Requirement of the even passage between Card and Comber. 2.5 Preparation of stock for Combing. 2.6 Combing preparation process Lap/Web Doubling (Conventional process) • Brief study of Sliver lap machine. • Brief study of Ribbon lap machine. • Limitation of conventional Sliver lap and Ribbon lap sequence. 2.7 Sliver Doubling (Modern process) • Detailed study of Super lap former.
Unit –III Comber	3a. Define objects of Combing, types of Combing. 3b. Describe Combing cycle. 3c. Explain noil extraction Theory. 3d. Judge various parameters for better	3.1 Objects of Combing, value of Combing. 3.2 Types of Combing. 3.3 Detail study of cycle of operation in Comber. 3.4 Brief study of following motion in Comber. -Feeding, Nipping, Cylinder combing, Top comb combing, Detaching. 3.5 Noil Extraction Theory • Noil elimination with counter (backward) feed

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
	quality of Combed sliver. 3e. Describe Combed sliver defects. 3f. Explain modern developments in Combing process. 3g. Install the recycling machine to process reusable comber waste.	• Noil elimination with concurrent (forward) Feed 3.6 Parameters influencing the Combing Operation. • Raw material (fibre length, uniformity, stiffness, fineness, impurities). • Material preparation (fiber parallelization, batt thickness, batt evenness, orientation of hooks). • Factors associated with machine (condition of comb, nips/min, operation of comb, sliver forming element, drafting arrangement). • Machine settings (feed/nip, feed type, detachment setting, tooth density in comb, penetration of top comb, piecing). • Ambient conditions (temperature, humidity). 3.7 Define the combing efficiency. 3.8 Waste extraction & its control-waste Setting. 3.9 Combed sliver defects, their causes &remedies. 3.10 Routine maintenance of Comber. 3.11 Significant developments in combing. • Cylinder clothing • Increase in nips per minute • Optimizing lap strength • Clamping line distance • Concentric nipper movement • Additional gripping arrangement • Asymmetric web pan • Safety measures 3.12 Reusable fibre waste recycling process in Comber.
Unit– IV Production calculation	4a. Calculate the production based on machine capacity.	4.1 Production calculation for Draw frame, Lap former &Comber. 4.2 Calculate draft & production of Draw frame. 4.3 Calculate draft & production of Comber. 4.4Calculate draft & production of Lap former.

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	Draw frame	14	4	6	10	20
II	Comber preparatory process	10	2	6	8	16
III	Comber	14	4	6	10	20
IV	Production calculation	04	4	4	6	14
Total		42	**14**	**22**	**34**	**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 Draw frame of different manufacturers based on your industrial visit.
b) Prepare a report on Comber of different manufacturers based on your industrial visit.
c) Collection of various machine specifications, and process parameters for Draw frame Lap former, Comber from industries.(LMW, Rieter, Trutzschler)
d) Visit a nearby spinning unit, and prepare a report with suitable machinery sketches.
e) Prepare a presentation on recent technological advancement of Draw frame, Lap former and Comber.
f) Prepare a comparative report from e-brochures and manuals available from different machine manufacturers for Draw frame, Lap former and Comber.
g) Present a seminar PPT on any of the following relevant topic- Draw frame, Lap former and Comber.
h) Explore library/internet facilities for preparing report on Draw frame, Super lap former and Comber.
i) 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 of different feed and delivery material of Draw frame and Comber and prepare a chart with machine specifications.
b) **Drawing quality and maintenance**: Draw line diagram of various auto leveler used in Draw frame (Sliver measuring device) and enlist merits and demerits of each system.
c) **Sliver analysis:** Analyze number of fibres in cross section, calculate hank of sliver and weight/unit length (Linear density).
d) **Sliver defects analysis:** Prepare a report on identification of various defects observed in Drawn or Combed slivers, provide reasons for those defects and suggest possible remedies to avoid them.
e) **Draw frame and comber settings:** Prepare a report on various essential changes in required in Draw frame and Comber and their settings while changing the raw material from natural fibre to man-made fibre.
f) **Machine specifications:** Prepare a report on machine specifications of Draw frame, Super lap former and Comber from different manufacturers with part numbers mentioned.
g) **Fibre waste**: Prepare a report on fibre wastes with necessary charts and suggest strategies for its 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-III Spinning preparation	Klein Werner	Rieter Machine Works Ltd., Winterthur, Switzerland, 2014, ISBN 10 3-9523173-3-3-0/ ISBN 13 978-3-9523173-3-4
3	Fundamentals of Spun Yarn Technology	Carl A. Lawrence	CRC Press publication, Florida. ISBN 0-203—00958-4 Master E-book ISBN 1-56676-821-7 (Print Edition)
4	NCUTE ExtensionProgram-Drawing, Combing and Roving	Dr. R. Chattopadhyay Dr. R. S. Rengasamy	NCUTE PilotProgram, Indian Institute of Technology, New Delhi, 2003
5	Handbook of Yarn Production	Peter R. Lord,	Science and Economics, CRC Press publication, New York, 2002. Woodhead Publishing ISBN 1 85573 696 9 CRC Press ISBN 0-8493-1781-9
6	Spun Yarn Technology	Oxtoby Eric	Butterworth's (Publishers) Limited, UK,1983, ISBN: 0-408-01464--4

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 II	Spinning Technology-II (Course Code:)						
	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 drafting, doubling and combing to produce even and fault free sliver with high production efficiency.						
Course Outcomes CO a) Use Draw frame machine to produce uniform fault free sliver.	2	2	3	1	3	2	3
CO b) Select relevant machine/process for Combing preparatory to produce even lap sheet.	3	1	2	1	3	2	3
CO c) Use Comber to produce good quality of sliver by reducing and reusing fibre wastages.	2	2	3	1	3	2	3
CO d)Calculate the production of Draw frame, Lap former and Comber.	3	3	1	-	1	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	Parmar Priti Mrugeshkumar, Lecturer in Textile Manufacturing Technology	R. C. Technical Institute, Ahmedabad	079-27664785	pritimparmar84@gmail.com
2	Dipal H. Panchal, Lecturer in Textile Manufacturing Technology	R. C. Technical Institute, Ahmedabad	079-27664785	dipalpanchal23@gmail.com
3	Nabokumar Chargaram Barman, Lecturer in Textile Manufacturing Technology	Sir Bhavsinhji Polytechnic Institute, Bhavnagar.	0278-251-5393	ncbarman.textile@gmail.com