GUJARAT TECHNOLOGICAL UNIVERSITY (GTU)

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

CourseTitle: Spinning Technology-III
(Course Code: 4342901)

Diploma programme in which this course is offered	Semester in which offered
Textile Manufacturing Technology	4th Semster

1. RATIONALE

Spinning is the process of converting fibre in to Yarn. Continuous development and automation has improved the production of spinning industry. This course is intended to impart knowledge of recent technological development in Roving frame and Ring frame. Roving frame and Ring frame are important machineries of the spinning operation because Yarn quality is influenced by operation of these machines. Quality of yarn is directly related to the quality of Roving. To ensure even quality of yarn, the roving must have good quality. This course provides knowledge of recent development in Drafting region, automation and material handling.

Now days there is greater demand of fancy yarn in world. There are different types of process available to produce fancy yarn. Doubling frame is used to produce such kind of fancy yarn. This course also provides skill to produce different types of fancy 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:

- **Apply basic principles of drafting, twisting, winding and package building to produce good quality of yarn 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 Roving frame to produce uniform fault free roving.

b) Use Ring frame to produce different range of yarn count with quality product.

c) Select relevant machine/process to produce different types of double and fancy yarn.

d) Calculate the production of Roving frame, Ring frame and Doubling frame.

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 Roving frame with a neat labeled sketch.	I	02*
2	Determine the principle of Twisting and Winding on Roving frame.	I	02*
3	Demonstrate the Flyer with a neat labelled sketch.	I	02*
4	Demonstrate the Builder mechanism with a neat labelled sketch.	I	02*
5	Demonstrate the passage of material through Ring frame with a neat labelled sketch.	I	02*
6	Demonstrate the modern drafting system in Ring frame with a neat labelled sketch.	I	02*
7	Demonstrate different types of Ring and Traveller with a neat labelled sketch.	I	02*
8	Demonstrate spindle and different types of spindle drive with a neat labelled sketch.	II	02*
9	Demonstrate Cop building mechanism with a neat labelled sketch.	III	02*
10	Demonstrate principle of Compact spinning with a neat labelled sketch.	III	02*
11	Demonstrate the passage of material through Doubling frame with a neat labelled sketch.	III	02*
12	Demonstrate the manufacturing process of different Fancy yarn with a neat labelled sketch.	III	02*
13	Study Energy consumption in Spinning process.	III	02*
14	Calculate the production of Roving frame and Ring frame from 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 Roving frame Delivery: Single, Flyer speed: up to 1000 rpm, No. of sliver fed: 2, Drafting system with pressure bar, Draft range: 9 – 25	1 to 4
2	Miniature Ring frame Spindle speed: 12000 – 18000 rpm, Drafting system: 3 over 3, Draft range: 15 – 45, Yarn count: 1 – 120 Ne	5 to 10
3	Doubling frame Spindle speed: 10000 – 12000 rpm, No of Spindle: 40-60	11 to 12

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 Roving frame	1a. State the objects of Roving frame. 1b. Explain passage of material through Roving frame. 1c. Distinguish different types of drafting systems. 1d. Describe principle of Twisting and Winding. 1e. Identify the elements of flyer. 1f. Describe principle of Builder motion. 1g. Explain technological design change in Modern Roving frame. 1h. Identify the defects observed in Roving.	1.1 Objectives of Roving frame. 1.2 Importance of Roving process. 1.3 Passage of material through Roving frame & functions of Important parts in Roving frame. 1.4 Modern drafting system - Three-cylinder, double-apron drafting System. 1.5 Principle of Twisting and Winding in roving frame. 1.6 Detail study of Flyer assembly. 1.7 Objectives of Builder motion and working Principle of Builder motion. 1.8 Principle of differential motion. 1.9 Technological design change in modern Roving frame. • Drafting - Three roller drafting, Four roller drafting. • Twisting • Building motion • Drive system • Other features - Creel, Package size, Roving tension control, Roving tension sensor, Flyers, Suctions, • Online monitoring, Inverter drive, Safety measures 1.10 Roving defects, their causes & remedies.
Unit– II Ring Frame	2a. State objects of Ring frame. 2b. Explain passage of material through Ring frame. 2c. Describe the principles of twisting and winding in ring frame. 2d. Identify the elements of drafting arrangements.	2.1 Objectives of Ring frame. 2.2 Passage of material & functions of Important parts in ring frame. 2.3 Principles of Twisting and winding in ring frame. 2.4 Detail study of drafting system of ring frame. - Roller Inclination, different types of top roller

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
		Pressure Loading, various apron arrangement, Spacer and cradle.
	2e. State importance of Ring and Traveler.	2.5 Importance of Ring and Traveller.
	2f. Classify different types of rings.	2.6 Classification of Ring. - Brief study of different types of Ring. Flange Ring, PSM Ring, Anti-wedge Ring, Self lubricated Ring, Orbit Ring, SU Ring.
	2g. Determine the ring parameters.	-Flange width and number , Ring Diameter- importance & specification. - Running-in of new ring.
	2h. State the function of traveller.	2.7. Study of Traveller. - Function of Traveller.
	2i. List the factors of selection of Traveller.	- Requirement of Traveller. - Factors to be consider for selection of traveler.
	2j. Distinguish different types of traveller.	- Different types and shape of Traveller. - Wire profile of Traveller.
	2k. Determine the traveller parameters.	- Traveler mass, Traveller no. - Traveler clearer.
	2l. State the function of spindle.	2.8 Function and requirement of spindle. - Spindle structure.
	2m. Explain the spindle structure and bearing.	- Spindle bearing.
	2n. Distinguish types of spindle drives.	- Types of Spindle drive (1)Tape drive, (2)Tangential belt Drive (3)Direct drive.
	2o. Describe the function & importance of the cop build mechanism.	2.9 Study of Cop building mechanism.
	2p. Describe control of the yarn tension & ballooning.	2.10 Brief study of Yarn Ballooning and its control.
	2q. Define term spinning triangle and Angle of yarn pull.	2.11 Brief study of Spinning triangle and its Influence on yarn structure. - Angle of yarn pull.
	2r. Explain technological design change in Modern Ring frame.	2.12 Technological design change in Modern Ring frame - Spindle drive - Roving/ Yarn break detection Stop motion - Automatic doffing - Ring data and ISM(Individual spindle monitoring)
	2s. Differentiate between ring spinning and	2.13 Principle of Compact spinning, Comparison of Ring spinning and Compact

Unit	Unit Outcomes (UOs) (4 to 6 UOs at different level)	Topics and Sub-topics
	compact spinning. 2t. Explain control of yarn and package defect. 2u. Identify the different types of yarn faults and package faults. 2l. Determine parameter related to Energy Consumption in spinning.	Spinning, Advantages of compact spinning. 2.14 Different types of yarn faults and package faults, their causes & remedies. 2.15 Brief study of Energy consumption in spinning.
Unit– III Doubling Frame and production of Fancy yarn	3a. Define the objects of Doubling frame. 3b. Explain passage of material through Doubling frame. 3c. Judge the effect of yarn parameter on doubled yarn properties. 3d. State the uses of doubled yarn. 3e. Describe the production of different types of fancy yarn.	3.1 Objectives of Doubling frame. 3.2 Passage of material through Doubling frame & functions of Important parts in Doubling frame. 3.3 Effect of yarn parameter on doubled yarn Properties. 3.4 Uses of Typical doubled Yarn • Voile Yarn. • Embroidery. • Sewing thread. • Tyre cord yarn. • Lace yarn. 3.5 Production of different Fancy yarn. • Snarl yarn. • Loop Yarn. • Slub yarn. • Spot yarn, Flake yarn, Milange yarn etc.
Unit– IV Production calculation	4a. Calculate the production based on machine capacity.	4.1 Calculate draft, twist & production of Roving frame. 4.2 Calculate draft, twist &production of Ring frame. 4.3 Calculate production of Doubling frame. 4.4 Calculate Resultant count.

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	Roving Frame	10	4	6	6	16
II	Ring frame	18	8	14	12	34
III	Doubling Frame and production of Fancy yarn	08	4	4	4	12
IV	Production calculation	06	2	2	4	08
Total		42	**18**	**26**	**26**	**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 Roving frame of different manufacturers based on your industrial visit.
b) Prepare a report on Ring frame of different manufacturers based on your industrial visit.
c) Collection of various machine specifications, and process parameters for Roving frame and Ring frame.
d) Visit a nearby spinning unit and prepare a report with suitable machinery sketches.
e) Prepare a presentation on recent technological advancement of Roving frame and Ring frame.
f) Present a seminar PPT on any of the following relevant topic- Roving frame, Ring frame and Fancy yarn.
g) Explore library/internet facilities for preparing report on Roving frame, Ring frame and Doubling frame.
h) 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 Roving frame and Ring frame and prepare a chart with machine specifications.
b) **Roving analysis: C**alculate hank of Roving and weight/unit length (Linear density).
c) **Roving defects analysis:** Prepare a report on identification of various defects observed in Roving, provide reasons for those defects and suggest possible remedies to avoid them.
d) **Yarn analysis:** Calculate Count of yarn, Twist and CSP value and prepare chart.
e) **Machine specifications:** Prepare a report on machine specifications of Roving frame and Ring frame.
f) **Yarn defect analysis:** Prepare a report on identification of various defects observed in yarn, provide reasons for those defects and suggest possible remedies to avoid them.
a) **Doubled and fancy yarn:** Prepare a report on different types of double and fancy yarn production method. Collect sample of doubled and fancy yarn form industries.

13. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication with place, year and ISBN
1	The Rieter Manual of Spinning, Volume-III-Spinning Preparation	Klein Werner	Rieter Machine Works Ltd., Winterthur, Switzerland, 2014, ISBN 10 3-9523173-1-4/ ISBN 13 978-3-9523173-1-0

S. No.	Title of Book	Author	Publication with place, year and ISBN
2	The Rieter Manual of Spinning, Volume-IV Ring Spinning	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	NCUTE Pilot programmes in Ring Spinning.	Prof. K. R. Salhotra Dr. R. Alagirusamy Dr. R. Chattopadhyay	NCUTE PilotProgram, Indian Institute of Technology, New Delhi, 2000
6	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
7	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 IV	Spinning Technology-III (Course Code: 4342901)						
	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, twisting, winding and package building to produce good quality of yarn with high production efficiency.						
Course Outcomes CO a) Use Roving frame to produce uniform fault free roving.	3	2	2	1	1	2	2
CO b) Use Ring frame to produce different range of yarn count with quality product.	3	1	2	2	2	2	3
CO c) Select relevant machine/process to produce different Fancy yarn.	2	2	3	-	1	2	3
CO d) Calculate the production of Roving frame, Ring frame and Doubling frame.	3	-	1	-	1	2	2

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	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	Chetan G. Patel Lecturer in Textile Manufacturing Technology	Dr. S & S S Ghandhy college of Engineering and Technology, Surat	0261-2655799	cgptextile@gmail.com
4	Nabokumar Chargaram Barman, Lecturer in Textile Manufacturing Technology	Sir Bhavsinhji Polytechnic Institute, Bhavnagar.	0278-251-5393	ncbarman.textile@gmail.com