GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3152901
Semester : V
Subject Name: Yarn Manufacture III

Type of course: Professional Core Course

Prerequisite: Student should have knowledge of ginning, Blow room, carding, draw frame, lap former, comber and speed frame.

Rationale: Ring frame is the last machine in the production chain of fiber to yarn conversion process. It is designed to convert roving to final yarn by drafting and twisting. Majority of spun yarn is produced using ring frame including newer development of compact spinning. Also it is important to understand value addition through doubling, twisting, fancy etc.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	4	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	Objects of Ring frame. Operating Principle of ring frame, Structural configuration of the machine. Creel: Objectives of creel, Types of creel, Modern creel or Umbrella creel. Drafting System : Function, importance, arrangement of drafting assembly (evolution of the design of drafting systems on the ring frames), conceptual structure of the drafting system – The top rollers and bottom rollers – construction, types function and maintenance. Top arm roller weighting system – study of weighting options – spring, pneumatic, magnetic – Fibre guiding devices – long and short aprons, cradles, concept of e-drafting. Recent modifications in its design.	5
2	Twisting process and Twisting elements: Twist, Twist factor, Twisting principle, Twist flow in ring frame, Direction of twist and the arrangement for setting yarn twist direction on ring frame, Factor determining amount of twist for ring spun yarn. Ring and Traveller : The function and importance of ring and travelers. A) Ring : Ring shape – Standard, T flanged single and double sided, anti-wedge, SV ring, Inclined flanged, enlarged and reduced etc. ; Ring material, brief note on ring manufacture ; Methods of mounting ring on ring frame ; Flange width and number, ring diameter – importance and specifications ; Fibre lubrication on the ring ; Running in of new rings.	6

	B) Traveller : Task and Function; Traveller shape and its applications; Traveller mass and its importance ; Materials used per Travellers; Traveller wire profile; The traveller clearer.	
3	Spindle: Function, Importance, general construction of a spindle, design developments in spindles used on ring frames, spindle bearings, influence of spindle on the spinning process. Spindle drive – Types of drives used to drive spindles – (i) tape drive, (ii) tangential belt drive, (iii) direct drive, concept, design in working merits and demerits of each type.	4
4	The thread guide devices: Functions and its importance, The thread guide or lappet guide, Balloon control ring, Balloon separators. Yarn Tension in Spinning: Concept and importance, tension variations during spinning – factors affecting tension in yarn, balloon theory. Theory of yarn tension at ring frame, Methods of maintaining uniform yarn tension at ring frame, Balloon control and methods to control balloon shape.	5
5	Drive to machine: single motor, dual motor, variable speed (mechanical, electronically controlled and inverter) drive – design features, operating principle and merits and demerits of each. Cop Buildup: Cop shape, The winding process, The winding mechanism, base formation of cop, Motor powered cop formation. End breaks in ring spinning – importance and mechanism of end breaks, factors affecting end breaks.	4
6	Doffing: Preparation for doffing, Manual doffing and automatic doffing. Auxiliary equipment: Fiber extraction or waste collection system, Blowers/ suction system. Spinning The spinning Geometry: Terms used (a) The spinning triangle, formation, dimensions and its influence on end breakage and yarn structure (b) The spinning length (c) Spinning angle (d) Roller over hang (e) Other dimensions in spinning geometry. Calculations regarding production and twist.	4
7	Compact Spinning: Basic problem of hairiness of yarns on Conventional Ring frame – Solution to the problem, implementation of the basic solution, Advantages of condensing. Types of compact spinning systems used, their merits and demerits. Comparison of compact yarns and conventional ring spun yarns.	4
8	Doubling: Objectives of doubled or folded yarn, Study on conventional ring doubling machine, Direction of twist used in to produce double or ply yarn a) S on Z or Z on S, b) Z on Z or S on S list of its yarn products. Two for one Twister: Principle of TFO, Passage of yarn, Special features of TFO, Advantages over ring doubling.	4
9	Fancy yarn: Definition of fancy yarn, Different varieties of fancy yarn, Use of fancy yarn, Grandrelle yarn, Mock grandrelle or Marl yarn, Spiral yarn, Gimp yarn, Corkscrew yarn, Curl or loop yarn, Snarl yarn, Knop yarn, Cloud yarn, Slub yarn, Knickerbocker yarn, Nub	4

	yarn, Spot yarn, Flake yarn, Chenille yarn. Production of Fancy yarn: Knop yarn, Loop yarn, Snarl yarn, Spiral yarn, Stripe yarn, Slub yarn and Gimp yarn.	
10	Recent developments. Automation in Ring Frame.	2

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	30	30	10	5	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. A Practical Guide to Ring Spinning, W.Klein, Vol . IV.
2. Developments in Ring spinning & Doubling, NCUTE.
3. Elements of Ring Frame and Doubling, Khare A R, Sai book Centre, Mumbai, 1999.
4. Spinning of Man Made and Blends on Cotton System, Salhotra K R, The Textile Association of India, Mumbai, 1989.
5. Fundamental of Spun Yarn Technology, C. A. Lawrence, CRC Press.
6. Advances in yarn spinning technology, C. A. Lawrence
7. Two for one Twister technology and Technique for spun yarns by H. S. Kulkarni and HVS Murthy.
8. Advances in technology of yarn production, R Chattopadhyay, NCUTE

Course Outcomes: After learning the course, students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the Ring frame, doubling, fancy yarn and compact spinning process.	30
CO-2	Compare different type of ring and traveler, ring spinning and compact spinning.	25
CO-3	Express the fundamentals of drawing, twisting and package building process and of doubling and fancy yarn manufacturing.	30

CO-4	Calculate the production and efficiency of machine.	5
CO-5	State the latest development in ring frame.	10

List of Experiments:

1. To study the passage of yarn through different parts of ring spinning machine.
2. To study the drafting, twisting and winding zone in ring frame.
3. To study the building motion in ring frame.
4. Calculation of draft constants, twist constant, coils per inch and production of ring frame.
5. To ascertain the effect of break draft and total draft on yarn unevenness and strength (mill based study).
6. Estimation of spinning tension as a function of traveller weight, yarn count and balloon height (mill based study).
7. To perform various settings and maintenance operation on ring frame such as:
    a. Ring rail levelling
    b. Spindle gauging
    c. Spindle eccentricity
    d. Lappet eccentricity
8. To study the influence of spindle speed and traveller weight on hairiness.
9. Ring frame settings – Spindle gauging, lappet guide centering, spindle centering, etc.
10. Measurement of various parameters related to spinning geometry of different ring frames.
11. Study of Ring-doublers – passage, gearing, calculation related to twist, speed and production.
12. Study of TFO – passage, gearing, calculations related to twist, speed, production.
13. Manufacture of multi-twist and multi-count yarn.
14. Production of slub yarns and other fancy yarns by using Fancy yarn making device.

Major Equipment: Ring frame, Ring Doubler, TFO.

List of Open Source Software/learning website: https://nptel.ac.in, World Wide Web, Google Search Engine etc.