

GUJARAT TECHNOLOGICAL UNIVERSITY

TEXTILE TECHNOLOGY (29)

YARN MANUFACTURING III

SUBJECT CODE: 2152901

B.E. 5th SEMESTER

Type of course: Engineering

Prerequisite: Students should have knowledge of Yarn Manufacturing – I and II.

Rationale: Yarn Manufacturing III covers the basics of yarn formation, doubling of yarn, twisting of yarns and production of fancy yarns.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1.	<p>Objects and principle of operation of ring spinning frame. Study of passage of material through the machine – structural configuration of the machine :</p> <p>Creel – Function, importance, study of conventional and modern creels</p> <p>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.</p> <p>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.</p>	7	16.67
2.	<p>Detailed study of ring frame mechanism with waste collecting system, Over head travel system, Inverter, Servo drive.</p> <p>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.</p> <p>Drives – (A) 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.</p> <p>(B) Drive to machine – single motor, dual motor, variable speed (mechanical, electronically controlled and inverter) drive – design</p>	5	11.90

	features, operating principle and merits and demerits of each. The thread guide devices – Function, importance, types (fixed, rising and falling) settings.		
3.	<p>Ring and Traveller : The function and importance of ring and travelers.</p> <p>A) Ring :</p> <p>a) Ring shape – Standard, T flanged single and double sided, anti-wedge, SV ring, Inclined flanged, enlarged and reduced etc.</p> <p>b) Ring material, brief note on ring manufacture.</p> <p>c) Methods of mounting ring on ring frame.</p> <p>d) Flange width and number, ring diameter – importance and specifications.</p> <p>e) Fibre lubrication on the ring</p> <p>f) Running in of new rings</p> <p>B) Traveller:</p> <p>a) Task and Function</p> <p>b) Traveller shape and its applications</p> <p>c) Traveller mass and its importance</p> <p>d) Materials used per Travellers</p> <p>e) Traveller wire profile</p> <p>f) The traveller clearer</p>	4	9.52
4.	<p>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.</p> <p>Top arm roller weighting system – study of weighting options – spring, pneumatic, magnetic – Fibre guiding devices – long and short aprons, cradles, concept of e-drafting.</p> <p>Recent modifications in its design.</p> <p>End breaks in ring spinning – importance and mechanism of end breaks, factors affecting end breaks.</p>	4	9.52
5.	<p>Compact Spinning : Basic problem of hairiness of yarns on Conventional Ring frame – Solution to the problem, implementation of the basic solution, Advantages of condensing.</p> <p>Types of compact spinning systems used, their merits and demerits.</p> <p>Comparison of compact yarns and conventional ring spun yarns.</p> <p>auto doffing in detail.</p>	5	11.90
6.	<p>Various systems of doubling the yarn.</p> <p>Object of ply twisting - Scope of ply twisting - Methods of ply twisting, concept of balance of twist.</p> <p>2. Study of conventional Ring doubling machines. calculation relating to production, efficiency and twist – Limitation of ring doubling system</p>	4	9.52
7.	<p>Production of folded yarns and their uses, Production of sewing threads, Two-for-one twisting.</p> <p>Study of Two For One Twisters – evolution of TFO, basic concepts, study of design and construction of two for one twisting machine.</p> <p>Machine design aspects, drives used, power requirement, calculations relating to efficiency, production and twist. Advantages over ring doubling. Techno economics. Modern developments in TFO machines.</p>	4	9.52
8.	<p>Fancy yarn production – classification of fancy yarns - basic principle - study of productions methods - spinning techniques for the production of fancy yarns – Design and construction of the basic profiles such as Spiral, Gimp, Loop, Snarl, Knop, Cover, Slub, Chenille, Marl, Grandrelle, Nepp. Combination of profiles – analysis of fancy yarns.</p>	4	9.52

	Production and preparation of Melange yarn, Lycra, Elastane yarns, Singed yarn etc.		
9.	Calculations regarding production and twist.	2	4.76
10.	Recent developments. Automation in Ring Frame : Need, the potential for automation, concept and principle of operation of auto doffing, merits and demerits, inter connected transportation.	3	7.14

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	20	5	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. Theory of Ring spinning, W.Klein, Vol . IV.
2. Essential facts of cotton spinning, T.K.Pattabhiram.
3. Developments in Ring spinning & doubling, NCUTE.
4. Essentials of Cotton spinning, Salhotra.
5. Practical calculations in spinning, T. K. Pattabhiram.
6. Spinning calculations, H.R.Shreenivasmurthy
7. Elements of Ring Frame and Doubling, . Khare A R, Sai book Centre, Mumbai, 1999.
8. Spinning of Man Mades and Blends on Cotton System, Salhotra K R, The Textile
9. Association of India, Mumbai, 1989.
10. Spinning: Drawing, Combing and Roving, Chattopadhyay R and Rengasamay R, NCUTE-Pilot Programme, 1999.
11. Fundamental of Spun Yarn Technology, Lawrence C A, CRC Press, USA,2003.
12. Fundamentals of Spinning – P. Lord / C. A. Lawarance
13. Technology of Cotton Spinning – J. Janakiram
14. Trade Literature and Bulletins of Rieter LMW, Marzoli
15. NCUTE Pilot programmes in spinning.
16. SITRA Focus series.
17. Manual of Textile Technology – Short Staple Series.
18. Vol IV A Practical Guide to Ring Spinning – W. Klein
19. Advances in Spinning – S. M. Ishtiaque
20. Two for one Twister technology and Technique for spun yarns by H. S. Kulkarni and HVS Murty.

Course Outcome:

After learning the course the students should be able to:

1. Calculate the draft to be required to produce the yarn at the ring spinning machine.
2. Produce different types of doubled yarns.

3. Set and produce different types of twisted yarns.
4. Set and produce different types of fancy yarns.
5. Know the remedial measures to be taken for different quality related problems at different machines.
6. Calculate the production and efficiency of all the machines.

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:
 - ◆ Ring rail levelling
 - ◆ Spindle gauging
 - ◆ Spindle eccentricity
 - ◆ Lappet eccentricity
8. To study the influence of spindle speed and traveller weight on hairiness.
9. Ring frame settings – Spindle gauging, lappet guide centring, spindle centring, 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.

Design based Problems (DP)/Open Ended Problem: Apart from above experiments a group of students has to undertake one open ended problem/design problem. Few examples of the same are given below.

1. Develop a drafting system of Ring Frame.
2. Develop a spindle assembly of Ring Frame.
3. Develop an arrangement of twisting on TFO.

Major Equipment: Ring Frame, Doubling Frame, Two-for-One Twister

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

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.