

GUJARAT TECHNOLOGICAL UNIVERSITY

TEXTILE TECHNOLOGY (29)

FIBRE PHYSICS

SUBJECT CODE: 2142904

B.E. SEMESTER IV

Type of course: Engineering and Science

Prerequisite: Zeal to learn the subject

Rationale: This course covers the basics of Physical Properties of all textile fibres.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		PA (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	0	3	70	20	10	0	0	0	100

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment; OEP-Open Ended problem; AL-Active learning;

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	Introduction to Fibre Structure Requirements for fibre forming polymers. Fine and morphological structure of Cotton – Flax – Jute – Silk – Wool – Viscose – Polyester – Polyamide – Polyacrylonitrile – Polyolefins; Structural models and their limitations; Investigation methods of fibre structure and their limitations; Microscopic methods: SEM, TEM, AFM. X-ray diffraction methods (WAXS, SAXS); Spectroscopic methods: UV-vis; FTIR; Density measurements; sonic modulus	8	22 %
2.	Moisture Absorption Properties Definitions of humidity; moisture regain and moisture content; Relation between regain and relative humidity; Effect of stress and temperature on regain; Heat of sorption; Swelling of fibres; Quantitative theory of moisture absorption.	8	22 %
3.	Tensile Properties Definitions: breaking strength, breaking extension, tensile stress, tensile strain, mass specific stress, yield point, initial modulus, secant modulus, work of rupture and work factor; Stress-strain curves for various textile fibres and their significance. Factors influencing tensile properties of fibres; Elastic properties; Methods of tensile testing – CRL / CRT/ CRE methods and their limitations; Mechanical conditioning of Fibres; Visco-elastic properties: Time effects – Dynamic mechanical analysis of fibres; Torsional and flexural rigidity – Measurement techniques; Stress-strain of an ideal fibre	8	22 %
4.	Optical and Frictional Properties	7	20 %

	Refractive index of fibres; Measurement and factors influencing the results; Birefringence and optical orientation factor; Reflection of light; Lustre index; factors influencing lustre; Absorption of light – dichroism, dichroic ratio; Fibre friction; Theories of friction – Amonton’s law; Bowden’s adhesion shearing mechanism; Lincoln’s law; Measurement of friction and factors influencing fibre friction; Friction in wool; theory of directional frictional effect; Significance of friction coefficient		
5.	Electrical and Thermal Properties Conduction; dissociation of ion pairs; Measurement of electrical resistance of fibres; Dielectric properties; Static electricity – Thermal properties – Structural changes in fibres on heating; Thermal transitions; Heat setting; Thermal decomposition of fibres; Thermo gravimetric analysis and interpretation of results; Typical TGA graph of cotton and viscose	5	14 %

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
15	23	22	5	5

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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. Physical Properties of Textile Fibres, W. E. Morton and J. W. S Hearle.
2. Textile Science, G. Ghol
3. Microscopy Of Textile Fibre, Greaves & Saville

Course Outcome:

After learning the course the students should be able to

1. Know the structure of different fibres.
2. Know the moisture absorption and tensile properties of different fibres.
3. Know the optical and frictional properties of different fibres.
4. Know the electrical and thermal properties of different fibres.

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.