GUJARAT TECHNOLOGICAL UNIVERSITY

TEXTILE PROCESSING (28)
PHYSICAL CHARACTERISTICS OF TEXTILE FIBRES
SUBJECT CODE: 2162806
B.E. 6th SEMESTER

Type of course: Textile Processing Engineering

Prerequisite: Zeal to learn the subject

Rationale: This subject includes the study of various physical properties like mechanical, tensile, electrical, optical, dielectric properties, etc. of all natural as well as synthetic textile fibres. It also includes the morphological studies of various textile fibres like cotton, wool, nylon, etc. It further involves different techniques to identify fibre structure i.e. X-ray diffraction, IR spectroscopy, 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)	
					PA	ALA	ESE	OEP		
3	0	0	3	70	20	10	0	0	0	100

Content:

Sr. No.	Topic	Total Hrs.	% Weightage
1	Requirements for fibre formation: Linearity, Degree of orientation, chemical resistance, Higher melting point etc.	02	5
2	Inter polymer forces of attraction: Hydrogen bond, Vander Waal's forces, salt linkages, cross links etc.	02	5
3	Study of fine structure and polymer system of different natural and synthetic fibres viz. cotton, wool, silk, polyester, nylon, etc.	06	14
4	Various traditional and newer concepts behind order and disorder of fibres to reveal its structure viz. fringed-micelle structure, chain-folding structure, spheruletic crystallization, shish-kebab structure, etc.	03	7
5	Techniques to investigate fibre structure: • Principle, application, construction and working of electron microscopic techniques – Reflection electron microscope, transmission electron microscope and scanning electron microscope • Principle, application and working of spectroscopic techniques – IR spectroscopy, UV/VIS spectroscopy, NMR spectroscopy, etc. • Principle, application and working of diffraction investigations – Optical diffraction and X-ray diffraction	03	7
6	Mechanical properties of textile fibres: • Theories of Tensile Properties - Technical terminologies, quantities of stress-strain curves, factors determining the result, principles of instrumentation, results for stress-strain curves of all textile fibres, Factors influencing tensile	06	14

	properties • Theories of Mechanical properties – approaches, structural effects in fibres, effect of orientation, phenomenon of ultimate failure and creasing • Elastic recovery – introduction and measurement, effect of different parameters, changes occurring on properties • Time effects and Visco-elastic properties – time-dependence, concept of creep, factors affecting creep, visco-elastic behaviour of fibres		
7	Fibre structure and water relations: • Equillibrium absorption of water – humidity, moisture regain and moisture content, hysteresis, measurement of moisture regain, relation between regain and humidity, results for different textile fibres and their comparison, factors affecting the results Swelling – technical significance, swelling and its measurement in different directions, results • Theories of mechanical sorption – adsorption and adsorption, effect of hydrophilic groups sorption, limited swelling, surface adsorption, relations between absorption, swelling and elastic properties	04	9.5
8	Thermal Properties: Technical parameters, structural changes in fibres on heating, Thermal transitions, melting phenomenon, concept of heat-setting	03	7
9	Optical Properties: Concept of Refraction, refractive index and birefringence, Correlation between refractive index, swelling and density of a fibre, effect of orientation on birefringence, phenomenon of dichroism, relation between reflexion and lustre, result of refractive indices and birefringence of different fibres, etc.	04	9.5
10	Electrical Properties: • Dielectrical properties – permittivity, dielectric constant, impedance, factors influencing dielectric properties, etc. • Electrical resistance – specific resistance, methods and results of measurement, factors influencing electrical resistance • Static Electricity – introduction, measurement techniques, generation and magnitude of charge, action of surface coating	05	12
11	Fibre friction – technological effects, measurement and results, factors influencing the results, nature of friction	02	5
12	Fibre Density – Introduction and measurement, values of densities for different fibres, its effect on order	02	5

Suggested specification table with marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
18	20	14	08	08	02

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. Textile Fibre - Morton & Hearl
2. Textile Science - G. Ghoel
3. Microscopy of Textile Fibre - Greaves & Saville

Course outcome:

After learning the content of the subject the students will be able to:

1. Get detailed idea about morphological structure of different fibres.
2. Compare the structure of fibres with that of various properties of them.
3. Understand the behaviour of fibres towards any agencies like tensile load, source of light, etc.
4. Compare various properties of different fibres such that the best combination of blend can be developed depending on the requirement.
5. Utilise the techniques to obtain the functional groups present within the polymeric chain of them.
6. Understand the relation of fibre structure towards water absorbance and/or repulsion.
7. Know the effect of temperature on various synthetic fibre based on thermal studies.

List of Open Source Software/learning website:

1. http://www.wto.org/
2. http://www.wtin.com/
3. http://textileinformation.blogspot.in/
4. http://www.fibre2fashion.com/
5. http://textilelearner.blogspot.in/
6. http://www.fashion-era.com/

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.