

GUJARAT TECHNOLOGICAL UNIVERSITY

TEXTILE ENGINEERING (25)
ADVANCED FIBER PROPERTIES
SUBJECT CODE: 2732504
M.E. 3rd SEMESTER

Type of course: Elective

Prerequisite: Physical properties of fibres or fiber science at BE level

Rationale: It is very important to understand the basics and advanced properties of fibres as fibres are the only material to start any textile activity. Fiber properties decide the way in which yarn and fabric will behave during manufacturing and use

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks		Practical Marks				
			ESE (E)	PA (M)	ESE (V)		PA (I)			
					ESE	OEP	PA	RP		
3	2#	2	5	70	30	20	10	10	10	150

Content:

Sr. No	Content	Total Hrs	% Weightage
1	Molecular architecture, configuration, conformation, amorphous and crystalline phases, glass transition, plasticization, crystallization, melting, factors affecting Tg and Tm.	5	15
2	Introduction to fibre structure and requirements of fibre forming polymers	3	10
3	Moisture Relations: Moisture sorption and desorption in fibres Sorption isotherms, Heats of sorption, Swelling and theories of moisture sorption.	6	15
4	Mechanical properties: Mechanism of deformation in fibres; Principles of elasticity and viscoelasticity; Creep and stress relaxation; Boltzmann superposition principle; Dynamic mechanical properties; Model theory of viscoelasticity; Time- temperature superposition principle; Stress strain relations, Yield and fracture.	11	20
5	Fibre friction: its nature, theory, application and measurement; Optical properties: Polarizability and refractive index. Birefringence and its measurement; Thermal Properties:	8	20
6	Thermal expansion, Thermal conductivity; Electrical Properties: Dielectric properties, effect of frequency and temperature on dielectric constant, Electrical resistance and its measurement, Static electricity and measurement of static charge in fibres.	9	20

Reference Books:

1. Physical Properties of Textile Fibres, W. E. Morton and J. W. S Hearle.
2. Handbook of Textile Fiber Structure Vol. 1, Ed. Eichhorn S. J., Hearle J.W.S, Jaffe M & Kikutani T.
3. Handbook of Textile Fiber Structure Vol. 2, Ed. Eichhorn S. J., Hearle J.W.S, Jaffe M & Kikutani T.

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 Experiments:

1. Characterization of textile fibres by Infrared spectroscopy
2. Density measurements.
3. Thermal analysis such as Thermogravimetric Analysis (TGA), Differential Scanning calorimetry (DSC) and Thermo-Mechanical Analysis (TMA), Dynamic Mechanical Analysis (DMA)
4. Sonic modulus of textile materials.
5. X-ray diffraction studies.
6. Birefringence measurement
7. Optical microscopy studies; Scanning Electron Microscopy (SEM) of fibres.

Design based Problems (DP)/Open Ended Problem:

- 1 Analyze critically fibre parameters affecting performance.
- 2 What are the latest developments with respect to the characterization of fiber structure?

Major Equipment:

Infrared spectroscopy, Density measurement instrument, TGA, DSC, TMA, DMA, Sonic Modulud, XRD, Birefringence, SEM etc

List of Open Source Software/learning website:

<http://nptel.iitm.ac.in>, World Wide Web, Google Search Engine etc.

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.