GUJARAT TECHNOLOGICAL UNIVERSITY

TEXTILE ENGINEERING (25)
MODERN FIBER TECHNOLOGY
SUBJECT CODE: 2712510
SEMESTER: I

Type of course: Elective

Prerequisite: Basic knowledge of texturizing process at BE level

Rationale: There has been quite great amount of developments in fiber research. Due to increased use of man-made fibers in apparel, home textiles and technical textiles, the recent developments in fibers are very essential.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks		Practical Marks				
				ESE (E)	PA (M)	PA (V)		PA (I)		
						ESE	OEP	PA	RP	
3	2	2	5	70	30	20	10	20	0	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	General definition of man made or manufactured fibres, introduction to general principles of spinning and spinning processes.	3	7
2	Basic principles of fluid flow during fiber spinning, factors affecting shear viscosity. Elongational flow, spinnability and flow instabilities. Extruder design, spin head, spinneret, quench chamber.	10	25
3	Spin finish application, wind up mechanism.	4	8
4	Manufacture and specifications of raw materials and monomers. Types, methods of manufacture, mechanism of polymerisation and production techniques of viscose, nylon 6 and 66, PET, PAN and PP.	12	30
5	Introduction to new developments. Other fibres including PU, PVA, PE, PVC and polyvinylidene chloride.	5	15
6	Primary and secondary variables and their effect on melt spinning. High speed spinning, spinning of microfibre, solution spinning process: Dry and wet spinning. Heat-setting of fibres.	6	15

Reference Books:

1. Vaidya A A, "Production of Synthetic Fibres", 1st Ed., Prentice Hall of India, New Delhi,1988.
2. Gupta V B and Kothari V K, "Manufactured Fibre Technology", 1st Ed., Chapman and Hall, London, 1997.
3. Mark H F, Atlas S M and Cernia E, "Man Made Fibre Science and Technology", Vol. 1, 2, 3, 1st Ed., Willey Inter Science Publishers, New York, 1967.
4. Macintyre J E, "Synthetic Fibres", Woodhead Fibre Science Series, UK, 2003.
5. Fourne F, "Synthetic Fibres: Machines and Equipment, Manufacture, Properties", Hanser Publisher, Munich, 1999

Course Outcome:

After learning the course the students should be able to:

1. Understand the production processes of manmade fibres.
2. Analyse the effect of production parameters on the properties of manmade fibres.
3. Understand the post spinning processes of drawing, heat setting and texturing.
4. Distinguish between wet and dry spinning
5. Criticise the limitations of melt spinning process.
6. Criticise the limitations of solution spinning process

List of Experiments:

1. Experiments related to fibre production processes
2. Effect of moisture and temperature on MFI of PET and PP
3. Melt spinning of PET, PP & nylon-6 filament yarns on laboratory spinning machines
4. Single and two stage drawing of the as-spun yarns or industrial POY
5. Demonstration of high speed spinning machine
6. Wet and dry heat setting of PET and nylon drawn yarns
7. Effect of temperature and tension on heat setting
8. Determination of structure and mechanical properties of as spun, POY, drawn and heat set yarns using DSC, X-ray, FTIR, density, sonic modulus
9. Effect of shear rate, temperature on polymer solution viscosity.
10. Wet spinning or dry jet wet spinning of PAN copolymers.
11. False twist and air jet texturing processes
12. Determination of structure of textured yarn under microscope

Open Ended Problems:

1. What are latest trends of consumption of man-made fibers globally and in India?
2. Explore possibilities of usage of modern fibers in technical textiles.
3. Explore recent developments in high performance, high functional, high Kansei and high tech fibers and their applications.

Major Equipments: Lab model spinning machine, MFI, Heat Setting machine, Dynamic Tensile Strength tester, DSC, X-Ray, FTIR, Texturising machine, Microscope - optical and projection

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