PTX4I101 FIBRE SCIENCE & TECHNOLOGY-II

Course Objectives:

To enable the students to

- Impart knowledge related to the structure and morphology of textile fibres.
- Understand the different characteristics of each fibre.
- Impart knowledge about process of producing bulk and textured yarn.
- Impart knowledge about high performance fibres

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Course Outcomes:

After successful completion of this course, the students will be able to

- Gain knowledge on the physical, chemical and morphological structures of natural and man-made fibers .
- Know and Measure important fibre properties such as fibre length, fineness, strength, moisture regain and content % etc.
- Correlate the physical properties of fibre to its microstructure and its influence to other characteristics.
- Have knowledge on formation of texturised yarn.
- Have knowledge on different high performance fibres.

Module-I (10 Hours)

Structure of Fibers: Study of structures of natural and man-made fibers – physical, chemical and morphological structures of natural and man-made fibers. Methods of investigation of fibre structure: Identification of chemical structure by IR spectroscopy. Identification of physical structure by X-ray, SEM,NMR etc.

Molecular Characterization: Molecular weight averages, method of determination of molecular weight: primary methods – end group analysis, osmometry, light scattering. Secondary methods – viscometry, gel permeation chromatography (Brief study).

Module-II (10 Hours)

Mechanical Characterization: Tensile characteristics –Study of strength, elongation, work of rupture, initial modulus, work factor and yield point – determination of tensile strength of single fibre, bundle strength of cotton fibre. Stress-strain relations of natural and manmade fibres - influence of humidity and temperature on tensile characteristics .Elastic recovery, Time effects- Study of creep phenomena. Brief study about torsional and flexural rigidity of commercially important fibres.

Module-III (12 Hours)

Physical Characterization: Fibre length - Technical significance of fibre length measurements in case of staple fibres – measurement of effective length, 2.5% and 50 % span length, Uniformity ratio and length distributions of cotton fibre; crimp; **Fibre fineness :** Fibre linear density, Technical significance of fibre fineness/linear density - methods of measuring fineness of cotton fibres, jute, flax, wool, silk and man-made fibres; Maturity of cotton fibre and its influence on fineness, concept of micro denier fibre; **Moisture Content and Regain:** Moisture content and regain - relative and absolute humidity, effect of moisture on fibres.

Optical Properties: Reflection and Lustre- refractive index and its measurement - birefringence, factors influencing birefringence. **Frictional properties:** frictional and surface characteristics of natural and synthetic fibres. **Electrical Properties:** Electrical resistance of fibres, measurements, factor influencing the dielectric properties of fibres. Static electricity problems and elimination technique.

Module-IV (08 Hours)

Texturing: Introduction, purpose, bulked and textured yarns, methods of texturing thermoplastic and non-thermoplastic yarns- basic principles, feed material characteristics-study of the methods of texturisation - twist-set-detwist, false twist, edge crimp, stuffer box crimp; knit de-knit techniques of texturing and the techniques of modified stretch yarn; properties and uses of textured yarn.

High performance fibres.: Introduction to Kevlar , Nomex, Glass fibre, Carbon fibre, PVA fibre, PVC fibre etc.

Books Recommended :

1. 1 Morton W E and Hearle J W S, "Physical Properties of Textile Fibres", Woodhead Publishing Limited, England, 2008.
2. 2.Meredith R. and Hearle J. W. S., "Physical Methods of Investigation of Textiles", Wiley Publication, New York, 1989
3. Meredith R., "Mechanical Properties of Textile Fibres", North Holland, Amsterdam, 1986
4. Ugbolue S C O, "Structure and Property Relationships in Textile Fibres", The Textile Institute, Manchester, 1990
5. Raheel M. (ed.), "Modern Textile Characterization Methods", Marcel Dekker, 1995.
6. Mukhopadhyay S. K., "The Structure and Properties of Typical Melt Spun Fibres" Textile
7. Progress, Vol. 18, No. 4, Textile Institute, 1989.
8. Mukhopadhyay S. K., "Advances in Fibre Science" The Textile Institute, 1992.
9. Hearle J.W.S., "Polymers and Their Properties, Vol.1. Fundamentals of Structures and Mechanics", Ellis Horwood, England, 1982
1. Greaves P.H. and Aville B.P., "Microscopy of Textile Fibres", Bios Scientific, U.K., 1995
2. Saville, "Physical Testing of Textiles", M. K. Book Distributors, 1998
3. Booth J.E " Principle of Textile Testing", Butterworth