



# GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Textile Engineering

Subject Code : ME02025101

Subject Name : High Performance Fibres

w. e. f. Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Course

<b>Prerequisite:</b>	Basic knowledge of textile fibre manufacturing methods and properties at undergraduate level
<b>Rationale:</b>	High performance fibres are popularly being used as a raw material for manufacturing technical textiles and other textile materials, thus it is necessary to acquire knowledge about the manufacturing methods and properties of various high-performance fibres known for their high tensile properties or thermal resistance.

## Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Acquire knowledge about the manufacturing methods and fibres structure for high-performance fibres.	R,U
02	Know the physical and chemical properties of different high-performance fibres.	R, U, A
03	Know the latest developments in the field of fibres.	R, U, A
04	Differentiate between the structure and properties of high-performance fibres.	R, U, A
05	Recall the use of high-performance fibres in different applications.	R, U, A

\*Revised Bloom's Taxonomy (RBT)

## Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR		C	Theory		Tutorial / Practical	
			ESE (E)		PA / CA (M)	PA/CA (I)	ESE (V)	
03	00	02	04	70	30	20	30	150



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## Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Introduction, brief history and development of high-performance fibre	04	8
2.	Aramid fibres, polymerisation of meta and para-aramid, Concept of Liquid crystalline state, dry-jet wet spinning of para-aramid and meta-aramid, structure and properties of aramids, applications	10	25
3.	Carbon fibre, precursors for carbon fibre, Rayon based, PAN based and Pitch based carbon fibres, stabilisation, carbonisation and graphitisation, comparison of the carbon fibres from different precursors, surface treatment of carbon fibres, properties and applications	10	25
4.	Glass fibre, fibre manufacture, fibre finish, fibre properties and application	09	17
5.	Introduction about other high performance fibre, e.g. UHMWPE, Aromatic polyester, PBO and PEEK, concepts of conductive textiles	12	25
<b>Total</b>			<b>100</b>

## Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
25	30	20	15	5	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

## References/Suggested Learning Resources:

### (a) Books:

1. High Performance Fibres, by J. W. S. Hearle, Woodhead Publishing, 2001
2. High Performance Fibres by S. K. Mukhopadhyay, Textile progress Vol. 25, Textile Institute, Manchester, 1993.
3. NPTEL course on High Performance and Speciality Fibres by M. Jassal, IIT Delhi.
4. Manufactured Fibre Technology, Edited by V. B. Gupta and V. K. Kothari (1997) Chapman and Hall, London.
5. Production of Synthetic Fibres, A.A.Vaidya, Prentice Hall of India Pvt. Ltd., New Delhi 1988.
6. Man-made Fibres Production, Processing Structure, Properties and Applications, Vol. I and II, V.B.Gupta and K.K.Kothari (Ed), Dept. of Textile Technology, IIT, New Delhi 1988



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**(b) Open source software and website:**

1. <https://nptel.ac.in>
2. World Wide Web, Google Search Engine etc.

**Suggested Course Practical List:**

1. Polymerisation of meta and para-aramid.
2. Study production of carbon fibre base on rayon precursors.
3. Study production of carbon fibre base on PAN precursors.
4. Study production of carbon fibre base on Pitch precursors.
5. Study the stabilisation, carbonisation and graphitisation processes for different carbon fibre precursors.
6. Surface treatment of carbon fibres.
7. Study manufacturing process of glass fibre.
8. Study manufacturing process of UHMWPE fibre.
9. Study manufacturing process of Aromatic polyester fibre.
10. Study manufacturing process of PBO and PEEK fibre.
11. Test the different properties of conductive textiles.

**List of Laboratory/Learning Resources Required:**

Miniature spinning machine for polymer, twin screw extruder, Thermal conductivity tester, FTIR Tester, SEM Tester, TG tester, DCA Tester, UTM testing equipments etc.

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