GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: MAN MADE FIBER TECHNOLOGY
(COURSE CODE: 3352901)

Diploma Programme in which this courses offered	Semester in which offered
Textile Manufacturing Technology	5th Semester

1. RATIONALE

Manmade fiber technology is a part of textile engineering where textile fibers are developed from artificial sources. The demand of manmade fibers is on the rise and they are required in the ever growing market for apparel, industrial applications and for functional uses. Global demands for manmade fiber is continuously increasing year by year and innovations continue to generate the new products. This subject provide knowledge regarding manmade fiber technology and various manmade fibers, their classification, physical property, and manufacturing process which is very essential for yarn spinning, weaving and processing also.

2. LIST OF COMPETENCY

The course content should be taught and implemented with the aim to develop require skills in students so that they are able to acquire following competency:

- **Plan and supervise production of different manmade fiber**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

i. Maintain polymerization process technologies efficiently
ii. Plan and supervise production process of Nylon 6, Nylon 6.6 fiber and Acrylic fiber
iii. Use Melt, Wet and Dry spinning process technologies.
iv. Explain Spin Finish and Specialty in manmade fibers
v. Describe Tow-to-Top conversion technologies.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Student Activity; **P** -Practical; **C** – Credit;; **ESE** -End Semester Examination; **PA** - Progressive Assessment.

5. COURSE DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Linear Polymer and Raw Material	1a. Differentiate between manmade and synthetic fibres 1b. Describe the features of the raw materials used for the production of manmade fibers 1c. Describe the salient features of Polymerization process 1d. Distinguish Monomer, Polymer and degree of Polymerization 1e. Identify the different types of polymers. 1f. Differentiate the polymerization reactions.	1.1 Properties of manmade fibre and synthetic fibre. 1.2 Raw material used for manmade fiber: DMT, TPA, MEG, CAPLROLACTM, ADIPIC ACID, ACRYLONITRYLE 1.3 Polymerisation process 1.4 Monomer, Polymer, degree of Polymerization. 1.5 Polymers: Criteria for fiber forming polymers 1.6 Polymerisation reactions 1.7 Condensation polymerisation and Addition polymerisation
Unit– II Production Process of Important Manmade Fiber	2a. Describe the structure, properties of fibers and the polymerization process 2b. Explain the production process of Polyester using flow diagram. 2c. Describe the production process of Nylon 6 and Nylon 6.6 fibers 2d. Describe the production process of Acrylic fibers and the criteria for selecting raw material 2e. Sketch the flow chart of the production of viscose rayon fibers. 2f. Describe the salient features of high performance fibers. 2g. Describe the salient features of HSHM fibers.	**Production process of important Man Made Fibers** 2.1 ***Polyester Fiber:*** Structure, properties Polymerization process 2.2 ***Nylon 6 and Nylon 6.6 fibers***: structure, properties, continuous polymerization process (V.K. tube method), poly condensation mechanism 2.3 ***Acrylic Fiber:*** structure, properties, Suspension polymerization, solution polymerization 2.4 ***Viscose Rayon fibers:*** Raw material structure, properties, flow diagram of production of Viscose rayon fiber. 2.5 ***High performance fibres***: structure, properties, Aramid Fibers like Nomax, kevlar. Carbon. Polypropylene, Polyethylene, Micro fibers. 2.6 ***HSHM fibres and application.*** • Glass fibre – structure, properties. • Silicon Carbide - structure, properties. • Boron- structure, properties

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit–III Melt, Wet and Dry spinning	3a. Explain Melt spinning process. 3b. Distinguish Single, Double Extruder, Manifold and spin block. 3c. Determine process parameters related to manmade fibers 3d. Describe the salient features of high speed spinning. 3e. Explain spin draw process.	**Melt spinning** 3.1 Melt spinning equipment • Single and Double Extruder. • Mani fold – spin block section. • Quenching system. 3.2 Variables and condition for Melt spinning and High speed spinning. 3.3 Variables and condition for Melt spinning and High speed spinning. 3.4 Spin draw processes: H4S process and FDY process.
	3f. Explain wet spinning process. 3g. Determine process parameters related to Fiber formation and coagulation variables. 3h. Differentiate between Dry spinning process and dry jet Wet spinning process 3i. Distinguish the Melt, Wet and Dry Spinning 3j. Explain Drawing process.	**Wet and Dry spinning** • Preparation of Dope (Solution). • Wet spinning process: Affecting factors • Post spinning operation. • Fiber formation and coagulation • variables. • Dry spinning process.: Affecting factors • Dry jet Wet spinning process. 3.5 Melt, Wet and Dry Spinning. 3.6 Drawing process.
Unit-IV Spin Finish and Specialty in Manmade Fibers	4a. Describe the properties and functions of spin finish. 4b. Compare the method of applications of Spin finish. 4c. Determine Factors affecting spin finish.	**Spin Finish** 4.1 Spin finish: Functions, Desirable properties, Chemical constitute, affecting factors 4.2 Method of application: Dipping roller method, Metered finish system 4.3 Problems encountered during the use of Spin Finish.
	4d. Explain limitations of synthetic fibers. 4e. Describe the salient features of modified polyester fibers and modified nylon fiber 4f. Distinguish between Bi-component fiber and Lycra (elastomeric fiber)	**Specialty Man Made Fibers (Modified synthetic fibers)** 4.4 Limitations of synthetic fibers. 4.5 Modified polyester fibers: Hydrophilic, Hollow, Low pilling, Flame Retardant Silky, Cationic Dyeable polyester fiber 4.6 Modified nylon fiber 4.7 Bi-component fiber and Lycra (elastomeric fiber)
Unit-V Tow-to-Top Conversion	5a. Explain principle of operation of Tow-to-top conversion. 5b. Differentiate the features of various cutting methods.	5.1 Principle of operation and objectives Tow-to-top conversion 5.2 Cutting methods: Crush cutting, Stretch break, Abrasive method.

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
I	Linear Polymer and Raw Material	04	2	2	2	06
II	Production Process of Important Manmade Fiber	12	6	10	4	20
III	Melt, Wet and Dry Spinning	11	4	12	2	18
IV	Spin Finish and Specialty in Manmade Fibers	12	4	10	4	18
V	Tow-to-Top conversion	3	2	4	2	8
	Total	**42**	**18**	**38**	**14**	**70**

Legends: R = Remember; U= Understand; A= Apply and above levels (Bloom's Revised 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.

7. SUGGESTED LIST OF EXERCISES / PRACTICALS:

Note: Here performance outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed and demonstrated appropriately, they would contribute to the development of demonstrated learning in behavioral terms in affective domain.

As a whole, the total approach towards acquisition of knowledge, skills, abilities and behavior and demonstration of the same would lead to the development of ***Course Outcomes.*** *Thus over all development of* ***Programme Outcomes (****as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hrs. required
1	I	Obtain important features of manmade fibre.	02
2	II	Draw and explain the process flow chart for Polyester fibre	02
3	II	Draw and explain the process flow chart for Nylon fibre.	02
4	II	Draw and explain the process flow chart for Acrylic fibre.	02
5	II	Draw and explain the process flow chart for viscose rayon fibre.	02
6	II	Describe structure property and application of high performance fibers.	04
7	III	Draw and explain melt spinning equipments.	04
8	III	Draw sketch and Explain melt spinning process.	02
9	III	Draw sketch and Explain spin draw process.	02
10	III	Draw sketch and Explain wet spinning process.	02
11	IV	Obtain salient features of spin finish.	02
12	IV	Describe methods of spin finish.	02
13	IV	Sketch the microscopic view of modified synthetic fibre.	04

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hrs. required
14	V	Demonstrate tow to top conversion process.	02
		Total	**32**

8. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like: course/topic based seminars, internet based assignments, teacher, guided self learning activities, course/library/internet/lab based mini-projects.

i. Explore library/internet for production technologies being used for production of different manmade fibers and make a report.
ii. Collect Sample of manmade fibers.
iii. Visit to manmade fiber industry and preparing report with sketches.
iv. Prepare production flow chart of different manmade fibers.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any)

i. Educational video and CDs related to production technologies for manmade fiber
ii. Demonstrate models of production plants based on different technologies.
iii. Arrange expert lectures of experienced textile engineers working in manmade fiber industry.

10. SUGGESTED LEARNING RESOURCES

A) List of Books

S. No.	Title of Books	Author	Publication
1	Synthetic fibres	Vaidya, A.A.	Mahajan Publishers Pvt. Limited, Ahmedabad
2	Manmade fibres: Production, Processing, structure and applications	Gupta, V.B. and Kothari, V.K.	IIT Delhi
3	Textile Asia (T) 1976 16 Nigam	Banerjee, N. N .	
4	High polymers, Structure and Properties.		Plastic Institute.
5	Manmade fibres	Moncrief	
6	Manmade fibres	V.A. Shenai	

B) List of Major Equipment/ Instrument with Broad Specifications

i. Textile Laboratory – projection microscope

C) List of Software/Learning Websites

i. http:// www.uptti.ac.in/manmadefibre.php
ii. http:// www.minglebox.com/.../Diploma-in-Textile-Technology-Man-Made-Fibre-Technology
iii. http:// www.uptti.ac.in/manmadefibre.php
iv. http:// en.wikipedia.org/wiki/Uttar_Pradesh_Textile_Technology_Institute
v. http:// www.engineering.careers360.com/man-made-fiber-technology
vi. www.fibersource.com

vii. www.whatispolyester.com
viii. www.epa.gov.
ix. www.textileschool.com

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE

Faculty Members from Polytechnics

- **Prof. V. N. Soni**, HOD Textile Manufacturing , R.C T I, Ahmedabad
- **Prof. Y.M. Gandhi,** HOD Textile Manufacturing , B.P.T I, Bhavnagar
- **Prof. R T Patel**, Lecturer in Textile Manufacturing, R.C T I, Ahmedabad
- **Prof. B.B. Bhatt**, Lecturer in Textile Manufacturing, B.P.T I, Bhavnagar
- **Prof. S. M. Zala**, Lecturer in Textile Manufacturing, Sir B.P.T.I, Bhavanagar
- **Prof.Ms. P.M.Parmar**, Lecturer in Textile Manufacturing, R.C T I, Ahmedabad

Co-ordinator and Faculty Member from NITTTR Bhopal

- **Dr. C. K. Chugh**, Professor Department of Mechanical Engineering
- **Dr. Joshua Earnest,** Professor, Department of Electrical and Electronics Engineering