Program Name	: Diploma in Textile Manufacturers
Program Code	**: TX**
Semester	**: Third**
Course Title	**: Basics of Fibre Science**
Course Code	**: 22368**

1.   RATIONALE

Manufacturing of textiles is an art of producing a fabric from yarn which are made from fibrous materials. These textile fibres are from natural, modified natural as well as man- made origin. A textile manufacturing technologist must have the adequate knowledge of these fibers, their origin, manufacturing processes, and their physical and chemical properties. This will help him to select methods to convert them into yarn and fabrics. It will also help him in wet processing of the fabric made from these fibres. This subject intends to equip students with the concepts, principles and methods of production of man-made fibres and filaments which are helpful in processing during subsequent processes, process control and quality assurance.

2.   COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Apply principles of fibre science to select methods of manufacturing natural and synthetic fibres/filaments.**

3.   COURSE OUTCOMES (COs)

The theory and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

   a.   Identify fibre forming polymers.
   b.   Use the relevant method for manufacturing fibres.
   c.   Select the natural fibres for processing them.
   d.   Analyse the properties of regenerated fibres/filaments.
   e.   Analyse the properties of synthetic fibres/filaments.
   f.   Select method of manufacturing textured yarn for required end use.

4.   TEACHING AND EXAMINATION SCHEME

Teaching Scheme			Credit (L+T+P)	Examination Scheme												
					Theory							Practical				
L	T	P		Paper Hrs.	ESE		PA		Total		ESE		PA		Total	
					Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
3	-	-	3	3	70	28	30*	00	100	40	--	--	--	--	--	--

(*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the COs.

Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P - Practical; C – Credit; ESE - End Semester Examination; PA - Progressive Assessment

5.   COURSE MAP (with sample COs, PrOs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the centre of this map.
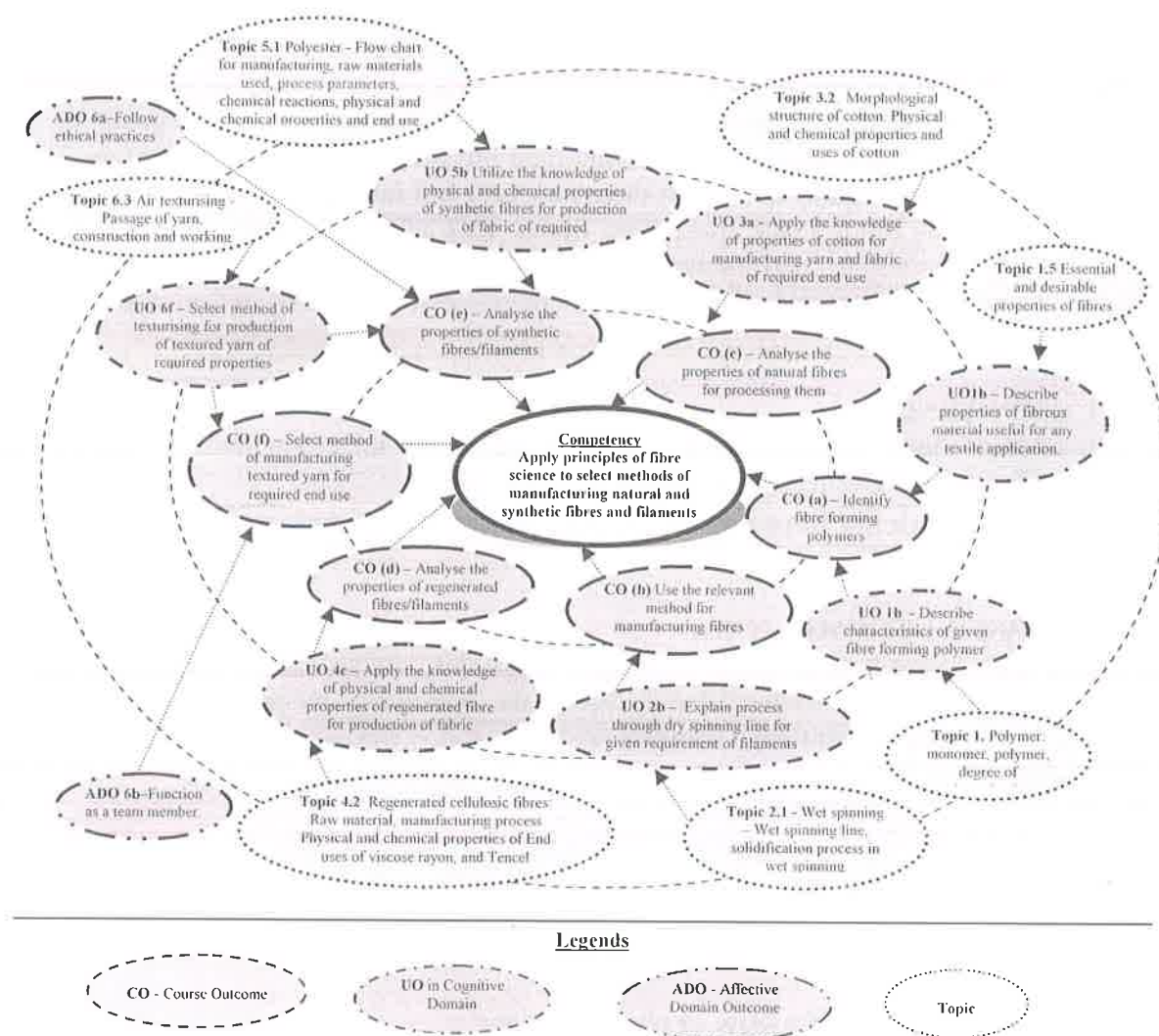

Figure 1 - Course Map

6.   SUGGESTED PRACTICALS/ EXERCISES

Not applicable

7.   MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

Not applicable

8.   UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit –I Fibre forming polymers	1a. Differentiate the properties of the given types of fibres. 1b. Differentiate the properties of the given types of filaments. 1c. Describe importance of the given fibre structure useful for specified textile application. 1d. Describe characteristics of given fibre forming polymer.	1.1 Substrate: Fibre, Filament, Essential and desirable properties of fibres 1.2 Fibre structure: crystalline, mesomorphous and amorphous regions and their importance. 1.3 Polymer: monomer, polymer, degree of polymerization. polymerisation techniques, addition and condensation polymerization, Characteristics of fibre forming polymers . 1 . 4
Unit II- Methods of fibres Manufacturing	2a. Explain the given terms. 2b. Describe with sketches the function of the specified part of melt spinning machine. 2c. Describe with sketches the function of the specified part of dry spinning machine. 2d. Describe with sketches the function of the specified part of wet spinning machine. 2e. Explain with sketches the process flow of material through given type of spinning line for given requirement of filaments.	2.1 Definition- LOY MOY, POY, FOY yarns 2.2 Melt spinning-Melt spinning method and equipment 2.3 Dry spinning- Preparation of dope, dry spinning unit, solidification process in dry spinning. 2.4 Wet spinning – Wet spinning line, solidification process in wet spinning.
Unit –III Natural Fibres	3a. Describe with sketches the morphological structure of given natural fibre. 3b. Describe end uses of the given type of fibre 3c. Describe with sketches the morphological structure of given animal fibre 3d. Describe the physical and chemical properties of the given type of fiber for producing yarn, for the specified application	3.1 Morphological structure of cotton. Physical and chemical properties and uses of cotton. 3.2 Unconventional Natural Fibres: Morphological structure and chemical constitution of Jute, Coir, and Flax. physical and chemical properties and uses of Jute , Coir and Flax. 3.3 Animal Protein fibres: Source and grading of wool, Morphological structure of wool, physical and chemical properties of wool, varieties of silk, production of raw silk, morphological structure, physical and chemical properties and uses of wool and silk.
Unit-IV Regenerated Fibre	4a. Identify essential requirements of the given type of spinning with justification. 4b. Describe with sketches the	4.1 Essential requirements of wet spinning with reference to polymer properties 4.2 Regenerated cellulosic fibres: Raw

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
	manufacturing process of given regenerated fibre. 4c. Describe the physical and chemical properties of regenerated fibre for production of fabric of specified characteristics. 4d. Identify various end uses of given type of fibre.	material, manufacturing process Physical and chemical properties of End uses of viscose rayon, and Tencel.
Unit –V Synthetic Fibres	5a. Describe with sketches the manufacturing of the given type of synthetic fibre using the flow chart. 5b. Describe the physical and chemical properties of the given type of fibre for production of the fabric of specified characteristics. 5c. Identify various end uses of given type of fibre.	5.1 Polyester - Flow chart for manufacturing, raw materials used, process parameters, chemical reactions, physical and chemical properties and end use. 5.2 Nylon 66 - Flow chart for manufacturing, raw materials used, process parameters, chemical reactions, physical and chemical properties and end use. 5.3 Polypropylene - Flow chart for manufacturing, raw materials used, process parameters, chemical reactions, physical and chemical properties and end use 5.4 Polyacrylonitrile - Flow chart for manufacturing, raw materials used, process parameters, chemical reactions, physical and chemical properties and end use.
Unit VI- Texturising	6a. Compare the salient properties of the given types of yarn. 6b. Describe the properties of relevant textured yarn for specified end use application. 6c. Select the method of texturising for production of textured yarn of specified properties with justification. 6d. Explain with sketches the functions of given parts of friction disc texturising machine. 6e. Describe the importance of the specified process parameters on texturising machine.	6.1 Texturising : purpose ,classification stretch and bulk yarn, advantages of textured yarn. Properties of textured yarn, concept of false twist. 6.2 Friction disc texturising- Passage of yarn, construction and working and process parameters. 6.3 Air texturising - Passage of yarn, construction and working and process parameters. 6.4 Factors influencing texturising time, temperature, twist and tension and their significance.

Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.

9.   SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic concepts of fibre Manufacturing	4	2	2	4	8
II	Methods of Synthetic fibres Manufacturing	6	2	2	6	10
III	Natural Fibres	10	2	2	8	12
IV	Regenerated fibres	6	3	3	6	12
V	Synthetic fibres	12	2	4	8	14
VI	Texturising	10	2	4	8	14
	Total	48	13	17	40	70

Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)
Note: This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

10.   . SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages for each activity, also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

a. Collect different fibres/filaments used in industry. Collect data on the name of the company, price of the same.
b. Collect data on the names of fibres/filaments and the technique of production of the same.
c. Collect data on various types of silk yarn produced in India and their prices.
d. Collect data of various end uses of Viscose Rayon, and Tencel.
e. Collect data of various Polyester filament yarn used in industry, their specifications, and end use.
f. Collect data on various types of texturising machines used in various texturising units, make of texturising machines, name of the units, speeds used for texturising of polyester

11.   SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
b. *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the

development of the COs through classroom presentations (see implementation guideline for details).

d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities..*

e. Guide student(s) in undertaking micro-projects.

f. Assign Mini projects to students.

g. Apply the concepts learnt in this course to address specific problems.

h. Use different instructional strategies in classroom teaching.

i. Use video programs available on the internet also to teach some topics.

12. SUGGESTED MICRO-PROJECTS

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be *individually* undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should *not exceed three.*

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects are given here. Similar micro-projects could be added by the concerned faculty:

a. Prepare a drawing showing a sketch of crystalline region, amorphous region and mesomorphous region and state their importance.

b. Draw a detailed classification chart of fibre used in textile industry with examples of each variety.

c. Prepare a chart showing the schematic diagrams of different techniques used for man-made fibre production.

d. Prepare a chart for morphological structure of cotton and wool and label the parts.

e. Prepare a chart showing comparison of various physical and chemical properties of cotton, wool and silk.

f. Prepare a chart showing photograph of various end uses of unconventional fibres – Jute, Coir, and Flax.

g. Prepare a chart showing photographs of different varieties of silk produced in India and write characteristics of each variety. In the same chart show life cycle of silkworm and manufacturing process of silk yarn.

h. Draw a chart for manufacturing of Viscose Rayon giving all the details of the process.

i. Draw a schematic diagram of manufacturing of Polyester filament yarn starting from raw material on a board.

j. Prepare a chart depicting each method of texturising schematically.

k. Collect various textured yarns available in the industry, write the particulars of the same and write end uses.

13.   SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Artificial Fibres	Moncrieff, R.W.	National Trade Press Limited, London
2	A Textbook on Fibre Science and Technology	Mishra, S.P.	New Age International, New Delhi ISBN-13: 978-8122412505
3	Textile Fibres	Shenai, V.A.	Sevak Publications, New Delhi
4	Handbook of Fibre Science and Technology	Lewin, Menachem and Piearce, Eli M.	Marvel Dekkar Inc. ISBN 0-8247-7010-2 (volume I) ISBN 0-8247-7335-7 (Volume IV)
5	Synthetic Fibre Production	Vaidya, A.A.	PHI Learning. New Delhi, 2016 ISBN 0 87692-578-6
6	Handbook of Textile Fibres – Animal Fibres	Cook, J. Gordon	Merrow Publishing Co. Limited. ISBN 0904095 39 8
7	Handbook of Textile Fibres- Man-made Fibres	Cook, J. Gordon	Merrow Publishing Co. Limited. ISBN 0904095 40 1
8	Yarn Texturising Technology	Hearle,J W; Hillock ,S L. and Wilson, D.K.	Woodhead Publications Limited. ISBN 1 85573 575 X
9	Manufactured Fibre Technology	Gupta, V.B. and Kothari, V.K.	Springer (India) Private Limited. ISBN 978-81-3220789-4

14.   SUGGESTED SOFTWARE/LEARNING WEBSITES

 a.   www.nptel.ac.in/courses/116102026/3
 b.   www.textileapex.blogspot.in/2014/08/polymer.html
 c.   www.nptel.ac.in/courses/116102026/36
 d.   www.tikp.co.uk/knowledge/technology/fibre-and-filament-production/melt-spinning/
 e.   www.textilecentre.blogspot.com/2016/09/morphological-structure-of-cotton-fibre.html
 f.   www.nopr.niscair.res.in/bitstream/123456789/32483/1/IJFTR%2017%281%29%201-8.pdf
 g.   www.namateco.com/attachments/086_Natural%20Fibers%20and%20the%20Environment.pdf
 h.   www.textilebd-yarn.blogspot.in/search?updated-max=2012-02-20T09%3A53%3A00-08%3A00&max-results=4
 i.   www.ied.ineris.fr/sites/default/interactive/bref_text/breftext/anglais/bref/BREF_tex_gb4.html
 j.   www.costfp1205.com/en/events/Documents/sixtatroedsson3dec.pdf
 k.   www.madehow.com/Volume-2/Polyester.html
 l.   www.tikp.co.uk/knowledge/technology/texturing/
 m.   www.teonline.com/knowledge-centre/polyester-manufacturing.html
 n.   www.indiantextilejournal.com/News.aspx?nId=iPGy2X/alahEuCFZSBjPTA.