

Revised Curriculum

For

Master of Technology



**Department of Textile
Technology**

Master of Technology
in
Fibre Science & Technology

Master of Technology in Fibre Science and Technology

- 32 TXL711 Polymer and Fibre Chemistry**
- 33 TXL712 Polymer and Fibre Physics**
- 34 TXL713 Technology of Melt Spun Fibres**
- 35 TXL714 Advanced Materials Characterization Techniques**
- 36 TXL715 Technology of Solution Spun Fibres**
- 37 TXP711 Polymer and Fibre Chemistry Laboratory**
- 38 TXP712 Polymer and Fibre Physics Laboratory**
- 39 TXP716 Fibre Production and Post Spinning Operation Laboratory**
- 40 TXL742 Theory and Practice of Textile Finishing**
- 41 TXL744 Colouration of Textiles**
- 42 TXD802 Major Project Part I**
- 43 TXD804 Major Project Part II**
- 44 TXL 710 High Performance and Specialty Fibers**
- 45 TXL 719 Functional and Smart Textiles**
- 46 TXL724 Textured Yarn Technology**
- 47 TXL740 Science and Applications of Nanotechnology in Textiles**
- 48 TXL741 Environmental Management in Textile and Allied Industries**
- 49 TXL743 Principles of Colour Measurement and communication**
- 50 TXL 745 Green processing techniques and certification**
- 51 TXL 746 Bio-processing of Textiles**
- 52 TXL 773 Medical Textiles**
- 53 TXS 806 Independent Study**
- 54 TXV 701 Process Control and Economics in manmade Fibre Production**
- 55 TXV 706 Special Module in Fibre Science**
- 56 TXV 707 Special Module in Textile Chemical Processing**

Master of Technology in Fibre Science and Technology

Department of Textile Technology

New Scheme

Sem.	Courses (Number, abbreviated title, L-T-P, credits)						Lecture Courses	Contact h/week				Credits
								L	T	P	Total	
I	TXL711 Polymer & Chemistry (3-0-0) 3	TXP711 Polymer & Fibre Chemistry Lab (0-0-2) 1	TXL712 Polymer & Fibre Physics (3-0-0) 3	TXP712 Polymer & Fibre Physics Lab (0-0-2) 1	TXL713 Technology of Melt Spun Fibres (3-1-0) 4	TXL744 Colourat ion of Textiles (3-0-0) 3	4	12	1	4	17	15
II	TXL715 Technology of Soln Spun Fibres (3-0-0) 3	TXP716 Fibre Production & Post Spinning Operation Lab (0-0-4) 2	TXL742 Theory & Practice of Textile Finishing (2-0-2) 3	TXL714 Characterizatio n of advanced materials (1-0-0) 1	PE-1 (3-0-0) 3	PE-2 (3-0-3) 3	5	12	0	6	18	15
Summer	TTD801 Major Project Part 1(TTF)						0					
III	TXD802 MajProj Part 1 (TTF) (0 - 0 - 12) 6				PE-3 (3-0-0) 3	PE-4 (3-0-0) 3	2	6	0	12	18	12
IV	TXD804 MajProj Part 2 (TTF) (0 - 0 - 24) 12						0	0	0	24	24	12

Total- 54

M. Tech. (Fibre Science and Technology) – The proposed scheme

The overall credit structure for the new scheme:

Category	PC	PE	Total
Credits	42 (including 18 project credits)	12	54

List of core courses:

Course name and structure

TXL711 Polymer and Fibre Chemistry (3-0-0) **3**
TXL712 Polymer and Fibre Physics (3-0-0) **3**
TXL713 Technology of Melt Spun Fibres (3-1-0) **4**
TXL714 Advanced Materials Characterization Techniques (1-0-0)
TXL715 Technology of Solution Spun Fibres (3-0-0) **3**
TXP711 Polymer and Fibre Chemistry Laboratory (0-0-2) **1**
TXP712 Polymer and Fibre Physics Laboratory (0-0-2) **1**
TXP716 Fibre Production and Post Spinning Operation Laboratory (0-0-4) **2**
TXL742 Theory and Practice of Textile Finishing (2-0-2) **3**
TXL744 Coloration of Textiles (3-0-0) **3**
TXD802 Major Project Part I (0-0-12) **6**
TXD804 Major Project Part II (0-0-24) **12**

List of elective courses:

TXL700 Modelling and Simulation in Fibrous Assemblies (2-0-2) **3**
TXL 710 High Performance and Specialty Fibers(3-0-0) **3**
TXL 719 Functional and Smart Textiles (3-0-0)**3**
TXL724 Textured Yarn Technology (3-0-0) **3**
TXL 734 Nonwoven Science and Engineering (3-0-0) **3**
TXL740 Science and Applications of Nanotechnology in Textiles (3-0-0) **3**
TXL741 Environmental Management in Textile and Allied Industries (3-0-0) **3**
TXL743 Principles of Colour Measurement and communication (2-0-2) **3**
TXL 745 Green processing techniques and certification 2-1-0 **3**
TXL 746 Bio-processing of Textiles (3-0-0) **3**
TXL 750 Science of Clothing Comfort (3-0-0) **3**
TXL 752 Design of Functional Clothing(3-0-0) **3**
TXL 772 Computational Methods for Textiles (2-0-2) **3**
TXL 773 Medical Textiles (3-0-0) **3**
TXL 775 Technical Textile (2-1-0) **3**
TXL 777 Product Design & Development (3-0-0) **3**
TXL 781 Project Appraisal & Finance (2-1-0) **3**
TXL 782 Production and Operations Management of Textile Industry (3-0-0) **3**
TXL 783 Design of Experiments and Statistical Techniques (3-0-0) **3**
TXL 784 Supply Chain Management in Textile Industry (3-0-0) **3**
TXS 806 Independent Study (TTF) (0-3-0) **3**
TXV 701 Process Control and Economics in manmade Fibre Production (1-0-0) **1**
TXV 702 Management of Textile Business (1-0-0) **1**
TXV 706 Special Module in Fibre Science (1-0-0) **1**
TXV 707 Special Module in Textile Chemical Processing (1-0-0) **1**

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Process Control and Economics in manmade Fibre Production
3.	L-T-P structure	1-0-0
4.	Credits	1
5.	Course number	TXV 701
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students, PE for M. Tech. (Textile engineering/Fibre Science and Technology) students, OC for others

7.	Pre-requisites (course no./title)	90 credits for B. Tech. (Textile Technology) students, none for M. Tech. (Textile engineering/Fibre Science and Technology) students
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	None

9.	Not allowed for (indicate program names)	No such restriction
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem X Either sem
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11.	Faculty who will teach the course: Visiting Faculty	
12.	Will the course require any visiting faculty?	Yes

13.	Course objective (<i>about 50 words</i>): To introduce the aspects of process control and economics of manmade fibre production to the students.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Introduction to manmade fibres. Consumption pattern in India and World. Factors affecting their growth. Economics of manmade fibre production. Modern polyester manufacturing plant technology. Capacities, raw materials and economics. Process and parameters at polymerization. Melt spinning and draw line. Control of modulus, tenacity, crimp properties, Dye affinity during production. Typical properties of polyester staple fibre. Partially oriented yarn and fully drawn yarn.	
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	Commodity and specialty polyester fibres. Recycled polyester staple fibres. Bio-degradable polyester PLA. Applications, properties and selection of fibres as per end uses.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Introduction to Man Made Fibres(MMF), Consumption Pattern in India and Globally	1
2	Economics of MMF Production, Factors affecting their Growth, How and why Polyester has overtaken other MMF	1
3	Polyester Fibre Technologies, Modern Polyester Plants, Capacities, Raw Materials and Poly Process	1
4	Melt Spinning, Spinneret Profiles and Parameters, Spin Packs, Pack Preparation and Checking, TEG and Ultrasonic Cleaning of Packs Pack Life and breaks, Quench Parameters, Factors affecting the Spinning Performance, Finish application for Facilitating Drawing process, Take up Speeds, concept of LOY, POY and FDY	2
5	Draw Line Composition, 2 stage Drawing, Control of Draw parameters, Thermosetting of Drawn Tow, Tow Cooling and application of Surfactants, composition of Surfactants, Crimping and Relaxation, Factors affecting the DL Performance	2
6	Process control in Polyester Staple Fibre Production, Denier, control of Modulus and tenacity, Crimp Properties(CN, CR & CS), Control of Dye Affinity, L and b colour, Luster, Concept of Merge number.	1
7	Typical properties of Polyester Staple Fibre(PSF), Partially oriented yarn(POY) and Fully Drawn yarn (FDY)	1
8	Commodity and Specialty Polyester Fibres- Bright, Optical Bright, Super High Tenacity, Trilobal, Hollow, Conjugate, Fibre Fill-Siliconized and Slick, Bi component	1
9	Recycled Polyester Staple Fibre, Economics, Bio Degradable Polyester PLA	1
10	Applications, Spinning , Knitting and Non Wovens, properties and Selection of Fibres as per End Use	1
11	Examination	2
COURSE TOTAL (14 times 'L')		14

16. Brief description of tutorial activities: NOT APPLICABLE

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17. Brief description of laboratory activities NOT APLICABLE

Module no.	Experiment description	No. of hours
1		
COURSE TOTAL (14 times 'P')		

18. Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
	N A	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Course Based on Practical References and Data.

It is a special course- reading material needed would be referred to and intimated to the students in the class.

20. Resources required for the course (*itemized & student access requirements, if any*)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	-
21.2	Open-ended problems	-
21.3	Project-type activity	-
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	Group discussions (20 %)

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Special Module in Fibre Science
3.	L-T-P structure	1-0-0
4.	Credits	1
5.	Course number	TXV 706
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students, PE for M. Tech. (Textile engineering/Fibre Science and Technology) students, OC for others

7.	Pre-requisites (course no./title)	90 credits for B. Tech. (Textile Technology) students, none for M. Tech. (Textile engineering/Fibre Science and Technology) students
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	None

9.	Not allowed for (indicate program names)	No such restriction
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem
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11.	Faculty who will teach the course: Visiting Faculty	
12.	Will the course require any visiting faculty?	Yes

13.	Course objective (<i>about 50 words</i>): To introduce the special topics of fibre science.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The course aims at introducing new or highly specialized technological aspects in fibre science. The course topics and content is likely to change with each offering depending upon the current requirement and expertise available with the department including that of the visiting professionals.
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15. Lecture Outline (*with topics and number of lectures*)

Module no.	Topic	No. of hours
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	N A	
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16. Brief description of tutorial activities: NOT APPLICABLE

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17. Brief description of laboratory activities NOT APPLICABLE

Module no.	Experiment description	No. of hours

18. Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
	N A	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Course Based on Practical References and Data.

It is a special course- reading material needed would be referred to and intimated to the students in the class.
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20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	-
21.2	Open-ended problems	-
21.3	Project-type activity	-
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	Group discussions (20 %)

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Special Module in Textile Chemical Processing
3.	L-T-P structure	1-0-0
4.	Credits	1
5.	Course number	TXV 707
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students, PE for M. Tech. (Textile engineering/Fibre Science and Technology) students, OC for others

7.	Pre-requisites (course no./title)	90 credits for B. Tech. (Textile Technology) students, none for M. Tech. (Textile engineering/Fibre Science and Technology) students
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	None

9.	Not allowed for (indicate program names)	No such restriction
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem
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11.	Faculty who will teach the course: Visiting Faculty	
12.	Will the course require any visiting faculty?	Yes

13.	Course objective (<i>about 50 words</i>): To introduce the special topics of textile chemical processing.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The course aims at introducing new or highly specialized technological aspects in textile chemical processing. The course topics and content is likely to change with each offering depending upon the current requirement and expertise available with the department including that of the visiting professionals.
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15. Lecture Outline (*with topics and number of lectures*)

Module no.	Topic	No. of hours
	N A	

16. Brief description of tutorial activities: NOT APPLICABLE

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17. Brief description of laboratory activities NOT APPLICABLE

Module no.	Experiment description	No. of hours

18. Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
	N A	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Course Based on Practical References and Data.

It is a special course- reading material needed would be referred to and intimated to the students in the class.
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20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course(Percent of student time with examples, if possible)

21.1	Design-type problems	-
21.2	Open-ended problems	-
21.3	Project-type activity	-
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	Group discussions (20 %)

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	High Performance and Specialty Fibers
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TXL710
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students, PE for M. Tech. (TE and TF) students

7.	Pre-requisites (course no./title)	TXL212 and EC75 for B. Tech. students
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Yes, <20% TXL715
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supersedes any existing course	TTL311

9.	Not allowed for (indicate program names)	Non-Textile students
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Manjeet Jassal, Ashwini Agrawal, Mangala Joshi, Bhanu Nandan, Rajiv Srivastava, Samrat Mukhopadhyay	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): This course would provide an understanding of basic concepts related to the manufacture of high performance and specialty fibres. The course also aims to relate the interdependence of structure, properties and applications of these fibres.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Definition, classification and structural requirements of high performance and specialty fibres, Polymerization, spinning and properties of aramids, aromatic polyesters, rigid rod and ladder polymers such as PBZT, PBO, PBI, PIPD, Manufacture of carbon fibres from polyacrylonitrile, viscose and pitch precursors, Concept of gel spinning and spinning of UHMPE fibres, Elastomeric polymers and fibres, Lyocell fibre production, Conducting fibres, Thermally and chemically resistant polymers and fibres, Methods of synthesis, production and properties of: glass and ceramic fibres. Specialty fibres: profile fibres, optical fibres, bicomponent fibres and hybrid fibres, Superabsorbent
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	polymers and fibres.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Introduction to high performance and specialty fibres: Definitions and classification. Structural requirements of high performance fibres.	2
2	Aramids: Polymerization, spinning and properties of aromatic polyamides.	3
3	Polymerization, spinning and properties of thermotropic liquid crystalline co-polyesters.	3
4	Polymerization, spinning and properties of other rigid rod polymers such as PBZT, PBO, PBI, PIPD	4
5	Precursors for carbon fibre manufacture, Preparation and properties of PAN precursor suitable for carbon fibre. Manufacturing of carbon fibres from PAN precursors, viscose and pitch fibres.	6
6	Gel spinning concept, Technical requirements for gel spinning process, Spinning process, structure and properties for UHMWPE fibre.	3
7	Glass and ceramic fibre: Glass for fibres and manufacturing process and applications. Chemistry of preparation, introduction to non-oxide and oxide based ceramic fibres, basalt fibres and their applications.	3
8	Preparation and properties of thermally/chemically resistant polymers and fibres	2
10	Elastomeric fibres: Synthesis chemistry of segmented polyurethanes, spinning and properties of polyurethane fibres.	2
11	Polyvinyl alcohol based fibres	2
12	Conducting fibres: Polymer conductivity, processing of conducting polymers into fibres and fibre coatings. Spinning and properties of polyaniline (PANI) fibre. Applications.	3
13	Ultra-fine fibres: definition, manufacturing, characteristics and applications of microdenier fibres	1
14	Specialty fibres from new polymers, hybrid fibres, nano-composite fibres	4
15	Other specialty fibres: absorbent fibres , hollow fibres and profile fibres, bi-component fibres, optical fibres	4
COURSE TOTAL (42 times 'L')		42

16.	Brief description of tutorial activities-	Not Applicable
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17.	Brief description of laboratory activities	Not Applicable
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18. Brief description of module-wise activities pertaining to self-study component

The self study component would involve study of additional information (than that covered in the class) on the specified topic. These will be evaluated as term papers, assignments, group discussions or as short questions in exams.

Module no.	Description	No. of hours
2-10	Broad scientific search using science finder on selected high performance fibres.	5
2-10	Recent literature of selected high performance fibres.	10
12-15	Patent search on selected specialty fibres.	5
12-15	Study of selected patents and compilation of a report.	10
1-13	Term paper and presentation on selected topics assigned in the class	12

19.	Suggested texts and reference materials:
1. V. K. Kothari, Textile fibres: Developments and Innovations, First edition, IAFL publications, 2000 2. Salem David R., Structure Formation in Polymeric Fibres, First edition, Hanser Publishers, 2000. 3. Ward I M, Developments in Oriented Polymers, Elsevier Applied Science, 1987 4. Yang H H, Kevlar aramid fiber, John Wiley & Sons, Chichester, 1993. 5. Mukhopadhyay S K, 'High-performance fibres', <i>Textile Progress</i>, 1993, 25, 1-85. 6. Ozawa S and Matsuda K, High Technology Fibers Part B, edited by Lewin M and Preston J, Marcel Dekker, New York, 1989. 7. Some review and research papers	

20.	Resources required for the course (<i>itemized & student access requirements, if any</i>)	
20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	-
21.2	Open-ended problems	-
21.3	Project-type activity	-
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	Presentations, Group discussions (20 %)

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Polymer and Fibre Chemistry
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TXL711
6.	Status (<i>category for program</i>)	DC for M. Tech. (Fibre Science and Technology)

7.	Pre-requisites (course no./title)	None
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	TTL711

9.	Not allowed for (indicate program names)	AllUG students PG students of non-textile disciplines
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Prof. Bhuvanesh Gupta, Prof. Manjeet Jassal, Prof. Mangala Joshi, Dr. Rajiv Srivastava, Dr. Bhanu Nandan
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): The objective of the course is to introduce graduate students to the polymeric materials and to excel them about polymerization processes, structure property relationship of polymers and fiber forming polymers.
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14.	Course contents (<i>about 100 words</i>) (Include laboratory/design activities): The course will deal with chain and step growth polymerization methods, polymer's
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	macromolecular architecture, molecular weight of polymers, copolymerization, cross-linked polymers, general structure and characteristics of polymers, spectroscopic analysis of polymers, properties of fiber forming polymers and their applications.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1	Polymers and polymerization, natural and synthetic polymers, organic reactions and mechanisms– Introduction, Basic concepts	2
2	Polymer's molecular weight - concept of macromolecules, average molecular weights, polydispersity, molecular weight determination techniques	4
3	Polymerization – Chain growth polymerization, types of monomers and initiators, reaction kinetics	3
4	Polymerization – Ionic polymerizations, ROP	3
5	Advanced methods of chain growth polymerization – ZN, Metallocene catalysis, ATRP, RAFT, CRP	3
6	Polymerization processes – Bulk, solution, suspension and emulsion polymerizations, batch and continuous processes	4
7	Copolymerization	2
8	Production of PE, PP and acrylics – Chemistry aspects	3
9	Polymerization – Step growth polymerization, features and reaction kinetics	5
10	Polymeric networks – cross-linked polymers	2
11	Production of Nylons and Polyesters – Chemistry aspects	3
12	Spectroscopic analysis (IR, UV and NMR) of polymers	4
13	Structure-property relationship- transitions in polymers	2
14	Fiber forming polymers – structural requirements and applications	2
COURSE TOTAL (14 times 'L')		14 x 3 = 42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	NA	

17. Brief description of laboratory activities

Module no.	Description	No. of hours
	NA	

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1, 13	Polymer's basic structure, natural and synthetic polymers, structure-property relationship, transitions in polymers	4
2	Molecular weight averages in polymers, polydispersity, viscometry, gel permeation chromatography, colligative properties	4
3	Chain growth polymerization – types of initiators and monomers, kinetics	3
4-5	Special methods – ionic, ring-opening, Zeigler-Natta, metallocene, controlled radical polymerizations	6
6	Types of processes- bulk, solution, suspension, emulsion and interfacial polymerization	4
7	Copolymerization and Mayo-Lewis equation	2
8	Commercial production of PE, PP and acrylics	3
9-10	Step growth polymerization – types of monomers, kinetics, cross-linked polymers	7
11	Commercial production of nylons and polyesters	3
12	Spectroscopic analysis of polymers by IR, UV and NMR	4
14	Fiber forming polymers	2
	TOTAL	42

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. George Odian Principles of Polymerization
2. Carraher Polymer Chemistry
3. Gupta and Kothari Manufactured Fiber Technology
4. M. Lewin, E. M. Pearce, Handbook of Fiber Chemistry 2nd Ed., Marcel Dekker, 1998.

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos etc.)	None
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility for regular interaction, LCD projector, screen and white/black board
20.7	Site visits	None
20.8	Others (please specify)	None

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	None
21.2	Open-ended problems	20 %

21.3	Project-type activity	None
21.4	Open-ended laboratory work	None
21.5	Others (please specify)	None

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Polymer and Fibre Chemistry Laboratory
3.	L-T-P structure	0-0-2
4.	Credits	1
5.	Course number	TXP711
6.	Status (<i>category for program</i>)	Core for M. Tech. (Fibre Science and Technology) students

7.	Pre-requisites (course no./title)	None
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	TTL711

9.	Not allowed for (indicate program names)	M. Tech. (CPSE), B. Tech. / M. Tech. (Chem. Engg.)
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Prof. Bhuvanesh Gupta, Prof. Manjeet Jassal, Prof. Mangala Joshi, Dr. Rajiv Srivastava,
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): The objective of the course is give them hands-on training on polymerization of monomers by different polymerization techniques, identification of different polymers by chemical tests and measurement of molecular weight and intrinsic viscosity, and to provide the students with practical knowledge of analyzing chemical structure of polymers by spectroscopic methods.
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14.	Course contents (<i>about 100 words</i>) (Include laboratory/design activities): Identification of fibres by chemical and burning tests, polymerization of vinyl monomers such as styrene, acrylamide using bulk polymerization, solution polymerization, emulsion
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	polymerization, radiation induced polymerization. Condensation polymerization and interfacial polymerization of nylon-6, Molecular weight measurement. Intrinsic viscosity and end group analysis, preparation of phenol-formaldehyde resin. Analysis of chemical structure by FTIR, UV spectroscopy.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
	N A.	
COURSE TOTAL (14 times 'L')		

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	NA	

17. Brief description of laboratory activities

Module no.	Topic	No. of hours
1	Identification of fibers by chemical and burning tests	1
2	Polymerization of vinyl monomers such as styrene, acrylamide using bulk polymerization	1
3	Polymerization of vinyl monomers such as styrene, acrylamide using solution polymerization	1
4	Polymerization of vinyl monomers such as styrene, acrylamide using emulsion polymerization	1
5	Condensation polymerization of nylon-6	1
6	Interfacial polymerization of nylon-6	1
7	Molecular weight measurement	1
8	Intrinsic viscosity	1
9	End group analysis	1
10	Unsaturation determination	1
11	Composition of fibres in blends	1
12	Plasma Processing of Fibres	1
13	Preparation of phenol-formaldehyde resin	1
14	Analysis of chemical structure by FTIR, UV spectroscopy	1
COURSE TOTAL (14 times 'L')		14

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. E.M. McCaffery, □Laboratory preparation for Macromolecular Chemistry□, MC Graw Hills N.Y. 1970
2. E. A. Collins, J. Bares and F.W. Billmeyer, Jr., □Experiment in Polymer Science□ Wiley-Interscience, N.Y. 1973
3. D. Braun, H. Cherdon and W. Kern, □Techniques of Polymer synthesis and Characterization□, Wiley-Interscience, London. 1971
4. □Macromolecular Synthesis□, Vols.1-6 Wiley-Interscience
5. W.R. Sorenson and T. W. Campbell, □Preparative Method of Polymer Chemistry□ Wiley-Interscience, N.Y. 1968
6. R.W. Lenz, □Organic Chemistry of Synthetic High Polymer□ Wiley-Interscience, N.Y. 1967
7. A. Raave □Organic Chemistry of Macromolecules□, Marcel Dekker New York 1967
8. G. Odian, □Principles of Polymerization□, MC Graw Hills N.Y. 1970
9. F.W. Billmeyer, Jr., □textbook of Polymer Science□, Springer- Verlag, N.Y.!973
10. B. Vollmert, □Polymer Chemistry□, Springer- Verlag, N.Y.!973
11. R.B. Seymour, □Introduction of Polymer Chemistry□, MC Graw Hills N.Y. 1971
12. F. Rodriquez, □Principles of Polymer System□, MC Graw Hills N.Y. 1970

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	None
20.2	Hardware	
20.3	Teaching aides (videos, etc.)	None
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility for regular interaction, LCD projector, screen and white/black board
20.7	Site visits	None
20.8	Others (please specify)	None

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	None
21.2	Open-ended problems	20 %
21.3	Project-type activity	None
21.4	Open-ended laboratory work	None
21.5	Others (please specify)	None

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Polymer and Fiber Physics
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TXL712
6.	Status (<i>category for program</i>)	Core for M. Tech. (Fibre Science and Technology)

7.	Pre-requisites (course no./title)	N.A.
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	TTL712

9.	Not allowed for (indicate program names)	All UG students PG students non-textile disciplines
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Bhanu Nandan, Ashwini K. Agrawal, Manjeet Jassal, Mangala Joshi, Rajiv Srivastava, Sourabh Ghosh
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12.	Will the course require any visiting faculty? (yes/no)	NO
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13.	Course objectives (<i>about 50 words</i>): The objective of the course is to familiarize the students with polymer composition and structure, chain configuration and conformation, molecular motion and how those parameters determine material properties. The course will cover the underlying physics and physical properties of polymers in melt, solution and solid state. After completing this course, students should be able to explain how polymer structure determines material properties, such as viscoelastic behavior, transparency, moisture absorption, retention etc. in commonly used textile fibres.
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14.	Course contents (about 100 words) (Include laboratory/design activities): Molecular architecture, configuration, conformation of ideal and real chains, Random Walk models of polymer conformations, Gaussian chain, Self-avoiding walks and excluded-volume interaction, the amorphous phase and its chemical-physical aspects, the glass transition phenomenon, the WLF-equation, crystalline state and its chemical-physical aspect, cross-linked polymers and rubber elasticity, behaviour of polymers in solutions and mixtures, viscoelasticity and rheology of polymers, mechanical properties, physical properties of fibres: moisture absorption properties, mechanical properties, optical properties, thermal properties.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1.	Basic structures of polymers, Molecular architecture, configuration, conformation of ideal and real chains, Random Walk models of polymer conformations, Gaussian chain, Self-avoiding walks and excluded-volume interaction,	4
2.	Amorphous/glassy phase in polymers and its chemical-physical aspects, glass transition phenomena and factors affecting it, WLF equation	4
3.	Crystalline state: Molecular morphology (chain folding), superstructural morphology (spherulites), thermodynamics and kinetics of polymer crystallization, mechanism - nucleation and growth, factors affecting crystallization and melting	6
4.	Cross-linked polymers and rubber elasticity	2
5.	Behavior of polymers in solution and mixtures: Flory interaction parameter; Flory-Huggins/lattice models for polymer mixing, Experimental investigations of binary mixtures; determination of interaction parameters	2
6.	Mechanical properties: Mechanism of deformation in fibres, Stress-strain relations, Yield and fracture, Elastic recovery, Mechanical properties of natural and man-made fibres, comparison of properties of various fibres correlated with their fine structures	5
7.	Elasticity and Viscoelasticity of polymers: Principles of Elasticity and viscoelasticity, Time independent response: small strain (glassy) and large strain (rubbery) response, Time dependent properties: creep and stress relaxation, Viscoelastic Models : Maxwell model, Kelvin Model, Eyring Model, Time-temperature equivalence	4
8.	Characterization techniques: Wide Angle X-Ray Diffraction (WAXD), Differential scanning calorimetry (DSC), Thermogravimetric Analysis (TGA), Thermomechanical Analysis (TMA) / Dynamic Mechanical analysis (DMA), polarized light optical microscopy (PLOM) methods of investigating structure of polymer/fibers	6
9.	Moisture absorption properties of fibers: Rate of moisture absorption and desorption, Heat of sorption, water retention and swelling. Theories of	4

	moisture absorption- general view, absorption in crystalline and amorphous regions, quantitative theories.	
10.	Optical properties of fibers: Polarizability and refractive index, Birefringence and its measurement, Hermantz Orientation Factor, Absorption and Dichroism , Reflection and Lustre	2
11.	Thermal and electrical properties of fibers: Thermal expansion. Specific Heat, Thermal conductivity, Dielectric properties, effect of frequency and temperature on dielectric constant. Electrical resistance and its measurement, static electricity and measurement of static charge in fibres	3
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
Not applicable		

17. Brief description of laboratory activities

Module no.	Description	No. of hours
Not applicable		

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1	Experimental determination of polymer chain conformation	4
3	Research articles pertaining to arguments on different models for chain folding during polymer crystallization	6
4	Detailed theoretical treatment of rubber elasticity	4
5	Phase diagrams in polymer solution and blends	4
6	Molecular aspects of fracture and healing in polymers	4
7	Polymer rheology, Newtonian and Non-Newtonian fluids, melt and solution viscosities	6
8	Research articles related to use of these techniques for characterization of polymer/fibers	8
9-11	Comparison of properties in different natural and man-made fibers, research articles on investigation of these properties in different fibers	6

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Morton W E, Hearle JWS, Physical properties of Textile Fibres, Woodhead Publishing (2008)
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2. Robert J. Young, Lovell P A, Introduction to Polymers, CRC Press, 3rd Edition (2011)
3. Gedde Ulf W, Kluwer Polymer Physics, academic Publishers (1999)
4. Sperling L. H., Introduction to Physical Polymer Science, Wiley, 4th Edition (2013)

20. Resources required for the course (*itemized & student access requirements, if any*)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course(*Percent of student time with examples, if possible*)

21.1	Design-type problems	-
21.2	Open-ended problems	-
21.3	Project-type activity	20%
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	Presentations (20%)

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Polymer and Fibre Physics lab
3.	L-T-P structure	0-0-2
4.	Credits	1
5.	Course number	TXP712
6.	Status (<i>category for program</i>)	Core for M. Tech. (Fibre Science and Technology) students DE for others

7.	Pre-requisites (<i>course no./title</i>)	none
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	UG Core Lab TTP 212 (30%)
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	No

9.	Not allowed for (<i>indicate program names</i>)	UG students/M. Tech (Polymer Science)
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem -
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11.	Faculty who will teach the course Prof. Mangala Joshi, Prof. Manjeet Jassal, Prof. Ashwini Agrawal, Dr. Bhanu Nandan, Dr. Rajeew Srivastava
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): The objective of this laboratory course is to acquaint the students with the experimental techniques used for characterization of fibers for their physical and chemical structure, morphology and important mechanical properties such as tensile, flexural rigidity , creep and
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	stress relaxation behavior using a combination of techniques such IR Spectroscopy, X Ray Diffraction, Thermal characterization, microscopy etc. This practical knowledge is essential to investigate structure and properties of fibers.
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14.	Course contents (about 100 words) (Include laboratory/design activities): Laboratory Experiments on Characterization of fibres by Infrared spectroscopy, Density measurements; Thermal analysis: Thermogravimetric Analysis (TGA), Differential Scanning calorimetry (DSC) and Thermo-Mechanical Analysis (TMA); Dynamic Mechanical Analysis (DMA); Sonic modulus ;X-ray diffraction studies; Birefringence measurement; Optical microscopy studies; Scanning Electron Microscopy (SEM) of fibres: Creep and Stress Relaxation study, Mechanical property testing such as tensile and flexural rigidity.
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15. Lecture Outline(with topics and number of lectures) **NA**

Module no.	Topic	No. of hours
COURSE TOTAL (14 times 'L')		

16. Brief description of tutorial activities: NA

Module no.	Description	No. of hours

17. Brief description of laboratory activities

Module no.	Description	No. of hours
1.	A. Physical Property Characterization 1. To determine density of fibers by Density Gradient Column	1

2.	B. Thermal Characterization 1. To determine the glass transition (T_g), melting (T_m) and crystallization temperature (T_c) of fibers by Differential Scanning Calorimetry (DSC). 2. To study thermal degradation of fibers through Thermo Gravimetric Analysis TGA method. 3. To study thermal contraction of fibers through Thermo mechanical Analyzer (TMA). 4. To study the Dynamic Mechanical properties (DMA) of fibers such as storage modulus, loss modulus and tangent delta.	4
3.	C. Morphological Characterization 1. To determine the crystallinity and orientation of fiber samples by X - ray diffraction. 2. To determine the birefringence of fiber samples. 3. To determine the sonic modulus of the fiber. 4. To study the morphology of the given fiber sample by Infrared spectroscopy. 5. To study the longitudinal & cross-sectional view of textile fibers by 6. Scanning Electron Microscope (SEM). 7. To study the spherulitic growth of PP by using polarizing optical microscope.	7
4.	D. Mechanical Properties 1. To study the effect of strain rate on tensile properties of fibers. 2. To study the creep behavior of fibers. 3. To determine the flexural rigidity of textile fibers.	2
Total		14

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1.		

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. Dr. Mangala Joshi , Experiments in Fibre Physics : A Laboratory Manual ; IIT Delhi (2011) (Copy Righted)
2. D. Campbell, and J.R. White, Polymer Characterization – Physical Techniques, by, Chapman and Hall, 1989.
3. Ed., Edith A Turi, Thermal characterization of Polymeric Materials, Academic Press, 1981.

20. Resources required for the course (*itemized & student access requirements, if any*)

20.1	Software	
20.2	Hardware	
20.3	Teaching aides (videos, etc.)	
20.4	Laboratory	Laboratory equipped with modern instruments used for characterization of fibres
20.5	Equipment	
20.6	Classroom infrastructure	
20.7	Site visits	
20.8	Others (please specify)	

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	20%
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Technology of Melt-spun Fibres
3.	L-T-P structure	3-1-0
4.	Credits	4
5.	Course number	TXL713
6.	Status (<i>category for program</i>)	Core for M. Tech. (Fibre Science and Technology)

7.	Pre-requisites (course no./title)	N.A.
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	TTL713

9.	Not allowed for (indicate program names)	All UG students PG students of non-textile disciplines
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Ashwini K. Agrawal, Manjeet Jassal, Mangala Joshi, Sourabh Ghosh, Bhanu Nandan
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): Building conceptual understanding of the three transport phenomena- momentum, heat and mass and their relevance to fibre manufacturing process, concepts of melt spinning and post spinning processes. Effect of process parameters on structure development of three important commodity fibres- nylon 6, poly (ethylene terephthalate) and polypropylene.
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14.	Course contents (about 100 words) (Include laboratory/design activities): Importance of transport phenomena in fibre manufacturing; Fundamentals of momentum transfer, heat transfer, mass transfer, building differential equations using shell balance and generalized equations; Polymer rheology- shear flow, elongational flow; Melt spinning lines for filament and staple fibre; Role of spin finish; Necessary conditions for fibre formation, elasticity versus plasticity of melts; Melt instabilities; Thermodynamic limitations; Force balance and heat balance in melt spinning; Low speed melt spinning; Necking and stress induced crystallization in high speed melt spinning; Effect of process parameters on fibre spinning and structure of nylon 6, PET and PP; Drawing Process and its necessity; Neck or flow deformational drawing; Drawing machines; Effect of parameters on structure development in nylon 6, PET, PP; Types of heat setting, Effect of setting parameters on structure and properties; Concept of bulking/texturing.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1	Importance of Transport Phenomena in fibre manufacturing	1
	- Fundamentals of momentum transfer	7
	- Fundamentals of heat transfer-conduction and convection	7
	- Fundamentals of mass transfer	6
2	Shear and elongational flow	1
3	Melt spinning line	2
4	Concepts of melt spinning	
	- Necessary conditions for fibre formation, melt instabilities	4
	- Force and heat balance in melt spinning process	1
	- Low speed spinning and process parameters	2
	- High speed spinning and process parameters	3
5	Drawing and effect of process parameters	4
6	Heat setting and effect of process parameters	3
7	Introduction of bulking processes	1
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	Discussion of examples in transport phenomena, developing differential equations using shell balance and generalized equations, class presentations on specialized melt spun fibers such as PTT, melt spun acrylic, ceramic, PLA, PEEK, liquid crystalline, conducting, others.	

17. Brief description of laboratory activities: Not applicable

Module no.	Description	No. of hours
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18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1	Newtonian and non-Newtonian fluid, various models	4
1	Identify and study textile processes where transport phenomena are involved	2
1	Design of fabric conductivity testing instrument	6
1	Design of continuous heat-treatment of filament machine	6
3	Study of staple fiber spinning line	4
3	Bicomponent fiber spinning	4
4-6	Study of preparation, melt spinning and properties of any one specialized melt spun fiber	10
4-6	Preparation of term paper and power point presentation	6
	Total:	42

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1.	R. B. Bird, W. E. Stewart and E. N. Lightfoot, Transport phenomena, 2 nd edition, John Wiley & Sons, Inc., NY, 2002. (Text book)
2.	A. K. Agrawal, Manufactured Fibre Technology, E-learning courses from IITs and IISc, NPTEL (Web based Text book)
3.	Andrzej Ziabicki, Fundamentals of fibre formation, John Wiley & Sons, NY, 1976 (Reference)
4.	T. Nakajima (English edition by K. Kajiwaru and J E McIntyre, Advanced fiber spinning technology, English edition, Woodhead Publishing Limited, England, 1994. (Reference)
5.	V. B. Gupta and V. K. Kothari, Manufactured fibre technology, Chapman & Hall, London, 1997 (Reference)

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	
20.2	Hardware	
20.3	Teaching aides (videos, etc.)	Notes on web
20.4	Laboratory	
20.5	Equipment	
20.6	Classroom infrastructure	White board/chalk board
20.7	Site visits	
20.8	Others (please specify)	

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	30%
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21.2	Open-ended problems	
21.3	Project-type activity	20%
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Advanced Materials Characterization Techniques
3.	L-T-P structure	1-0-0
4.	Credits	1
5.	Course number	TXL714
6.	Status (<i>category for program</i>)	Core for M. Tech. (Fibre Science and Technology)

7.	Pre-requisites (course no./title)	N.A.
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	No

9.	Not allowed for (indicate program names)	All UG students PG students of non-textile disciplines
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☒ 2 nd sem ☐ Either sem -
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11.	Faculty who will teach the course Bhanu Nandan, Ashwini K. Agrawal, Bhuvanesh Gupta, Manjeet Jassal, Mangala Joshi, Rajiv Srivastava, Sourabh Ghosh
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): This course aims to provide a systematic understanding of the principles, equipment and practices of some advanced material characterization techniques based on microscopy, chemical, physical and structural analysis. The course will equip students with the knowledge of a broad range of advanced characterization techniques such that they clearly understand the capabilities of such methods and their role in process-structure-property relationship.
14.	Course contents (about 100 words) (Include laboratory/design activities):

	Relevance of advanced characterization techniques in material development; scattering techniques (SAXS/WAXS); advanced surface characterization techniques (X-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), secondary ion mass spectroscopy (SIMS)); microscopy techniques: basics of electron-materials interaction; SEM combined with FIB techniques; TEM and cryo-TEM; chemical analysis utilizing microscopy techniques; AFM; confocal laser microscopy.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1.	Relevance of advanced characterization techniques in material development	1
2.	Scattering techniques, SAXS and WAXS, synchrotron radiation sources and use of combined SAXS/WAXS analysis in studying polymer/fiber structure development using in-situ measurements.	3
3.	Advanced surface characterization techniques (XPS, AES, SIMS), importance of surface characterization techniques	3
4.	Microscopy techniques: basics of electron-materials interaction	1
5.	SEM, use of focused ion beam (FIB) combined with SEM	1
6.	TEM, STEM, Cryo-SEM/TEM	2
7.	chemical analysis utilizing microscopy techniques	1
8.	AFM	1
9.	Confocal laser microscopy	1
COURSE TOTAL (14 times 'L')		14

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
Not applicable		

17. Brief description of laboratory activities

Module no.	Description	No. of hours
Not applicable		

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
2	Synchrotron radiation sources and their importance	2
2-9	Recent literature on the use of these techniques in material characterization	4

2-9	Literature on the use of these techniques in characterization of fiber/textile materials	2
2-9	Detailed instrumentation of the techniques, major manufacturers, availability of these techniques in major research/teaching institutes in India.	2
2-9	Special preparation techniques for these measurements	2
1-9	Term paper and presentation on related topics	2

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1.	Sam Zhang, Lin Li, Ashok Kumar Materials Characterization Techniques; CRC press, (2008)
2.	A. K. Tyagi, Mainak Roy, S. K. Kulshreshtha and S. Banerjee Advanced Techniques for Materials Characterization, Materials Science Foundations (monograph series); Volumes 49 – 51 (2009)
3.	Editors: C.R. Brundle, C.A. Evens, Jr, S. Wilson, Encyclopedia of Materials Characterization, Butterworth-Heinmann, Boston (1992)
4.	Yang Leng, Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, Wiley-VCH, second edition (2013)

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	Laboratory visits may be required of available relevant equipments in the department/institute
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	-
21.2	Open-ended problems	-
21.3	Project-type activity	-
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	Presentations (20%)

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Textile
2.	Course Title (<i>< 45 characters</i>)	Technology of Solution Spun Fibres
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TXL715
6.	Status (<i>category for program</i>)	Core for M.Tech fibre Science

7.	Pre-requisites (course no./title)	TXL711/TXL713
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Less than 15% overlap with TXL710
8.2	Overlap with any UG/PG course of other Dept./Centre	
8.3	Supersedes any existing course	TTL715

9.	Not allowed for (indicate program names)	All UG students PG students of non-textile disciplines
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Dr. Manjeet Jassal, Dr. Ashwini Agrawal, Dr. Mangala Joshi
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): This course would provide an understanding of basic concepts related to solution spinning of fibres.
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14.	Course contents (<i>about 100 words</i>) : PAN properties; Solution rheology and its dependence on parameters. Effect of parameter on entanglement density, fibre spinning and subsequent drawing; Various solvent systems; Dope preparation; Wet and dry spinning processes; Effect of process parameters such as dope concentration, bath concentration, temperature and jet stretch ratio on
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	coagulation rate, fibre breakage and fibre structure; Modeling of coagulation process; properties and structure of dry and wet spun fibres; Dry jet wet spinning. Solution spinning of PAN. Bicomponent and bulk acrylic fibres. Acrylic fibre line, crimping and annealing, tow to top conversion systems; Viscose rayon process, Spinning with and without zinc sulfate; Polynosics and high performance cellulosic fibre; Non viscose processes, Lyocell spinning process, structure and properties; Gel spinning of PE, Gel spinning of PAN and PVA. Introduction to high performance fibres and their spinning systems such as rigid rod polymer, liquid crystalline polymers, polylactic acid and spandex fibre manufacturing.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1	Solid state structure and properties of PAN.	2
2	Introduction of solution spinning process, dope preparation, wet, dry-jet and dry spinning process	1
3	Concepts of solution spinning process: polymer solution rheology and instabilities, spinnability, mechanics of solution spinning process, kinetics of solution spinning process, thermodynamics of coagulation,	4
4	Phase separation, phase diagram, mechanism of fibre coagulation and morphology. Effect of dope concentration, bath concentration, temperature and jet stretch ratio on coagulation rate, fibre breakage and fibre structure; modeling and simulation of phase diagrams.	4
5	Dry jet wet spinning of PAN, melt spinning of PAN, Bicomponent and bulk acrylic fibres, Acrylic fibre line, crimping and annealing, tow to top conversion.	4
6	Viscose rayon process, wet spinning, Zinc sulfate spinning; Polynosics and other high performance cellulosic fibres.	4
7	Non-viscose processes, Lyocell spinning process, structure development during spinning and properties.	4
8	Modified cellulosic fibre: Cellulose acetate and triacetate fibre.	2
9	Introduction to rheology and spinning of liquid crystalline polymers such as Aramids	4
10	Fundamentals of gel spinning process, Spinning of UHMWPE, PVA and PAN fibres	6
11	Elastomeric fibres: Chemistry of segmented polyurethanes, wet spinning, reactive spinning and dry spinning of polyurethane fibres. Structure property correlations.	4
12	Polylactic acid fibre manufacturing	3
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities: NA

Module no.	Description	No. of hours
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17. Brief description of laboratory activities:NA

Module no.	Description	No. of hours
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- 18. Brief description of module-wise activities pertaining to self-study component :** The self-study component would involve study of additional information (than that covered in the class) on the specified topic. These will be evaluated as term papers, assignments, group discussions or as short questions in exams.

Module no.	Description	No. of hours
1	To study comparison of structure, thermal and rheological properties of PAN homo and copolymers,	6
4	To study and understand the effect of polymer modification on coagulation behavior or phase separation.	8
6-7	To compile and compare the properties of cellulose fibres produced by viscose and nonviscose processes	6
8	To study the spinning of modified cellulosic fibres(in presence of nanomaterial additives)	8
9	To study the different types of liquid crystalline polymers and their solution rheology	4
1-12	Term paper and presentation on related topics	10
	Total	42

19. Suggested texts and reference materials

1. Masson, James C., Acrylic Fiber Technology and Applications, Marcel Dekker, Inc., 1995
2. Lewin M., Handbook of Fibre Chemistry, Third edition, Taylor and Francis, 2007
3. Salem David R., Structure Formation in Polymeric Fibres, First edition, Hanser Publishers, 2000.
4. Nakajima T., Advanced Fiber Spinning Technology, first edition, Woodhead Publisher, 2000
5. Ziabicki A, Fundamentals of Fibre Formation, John Wiley Publications, 1976
6. Hearle J W S, High Performance fibres ,
7. Yang H H, *Kevlar aramid fiber*, John Wiley & Sons, Chichester, 1993.
8. Gupta V B and Kothari V K , Manufactured fibre Technology,
9. Mukhopadhyay S K, 'High-performance fibres', *Textile Progress*, 1993, 25, 1–85.
10. Ozawa S and Matsuda K, *High Technology Fibers Part B*, edited by Lewin M and Preston J, Marcel Dekker, New York, 1989.
11. Some review and research papers

20. Resources required for the course (*itemized & student access requirements, if any*)

20.1	Software	-
20.2	Hardware	-
20.3	Teaching aides (videos, etc.)	Laptop, Tablet
20.4	Laboratory	-
20.5	Equipment	-
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	-
20.8	Others (please specify)	-

21. Design content of the course(*Percent of student time with examples, if possible*)

21.1	Design-type problems	-
21.2	Open-ended problems	-
21.3	Project-type activity	-
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	Presentations, group discussions (20%)

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Fibre Production and Post Spinning Operation Laboratory
3.	L-T-P structure	0-0-4
4.	Credits	2
5.	Course number	TXP716
6.	Status (<i>category for program</i>)	Core for M. Tech. (Fibre Science and Technology)

7.	Pre-requisites (course no./title)	None
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	TTP716

9.	Not allowed for (indicate program names)	M.Tech. (CPSE), B.Tech. / M.Tech. (Chem. Engg.)
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Prof. Bhuvanesh Gupta, Prof. Manjeet Jassal, Prof. Mangala Joshi, Dr. Rajiv Srivastava,
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): The objective of this laboratory course is to provide the students hands on experience on fibre forming processes of melt spinning and solution spinning, drawing, heat setting, and characterization of the fibres thus produced using various techniques like X-ray, DSC, FTIR, Density, sonic modulus etc.
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14.	Course contents (<i>about 100 words</i>) (Include laboratory/design activities): Experiments related to fibres production processes. Effect of moisture and temperature on
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	MFI of PET and PP. Melt spinning of PET, PP & nylon-6 filament yarns on laboratory spinning machines. Single and two stage drawing of the as-spun yarns or industrial POY. Demonstration of high speed spinning machine. Wet and dry heat setting of PET and nylon drawn yarns. Effect of temperature and tension on heat setting. Determination of structure and mechanical properties of as spun, POY, drawn and heat set yarns using DSC, X-ray, FTIR, density, sonic modulus. Effect of shear rate, temperature on polymer solution viscosity using Brookfield Rheometer and ball-fall method. Wet spinning or dry jet wet spinning of PAN copolymers. False twist and air jet texturing processes. Determination of structure of textured yarn under microscope.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1	N A	
COURSE TOTAL (14 times 'L')		

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	NA	

17. Brief description of laboratory activities

Module no.	Topic	No. of hours
1	Melt spinning of polyethylene terephthalate (PET) filament yarn using the laboratory spinning unit	1
2	Drawing and heat setting of as spun PET filament yarn	1
3	Study of the effect of moisture on melt flow index of PET Chips	1
4	Study of the effect of Quenching bath temperature on structure of PP Tape using Betol extrusion line	1
5	Melt spinning and cold drawing of nylon 6 using laboratory spinning and drawing machines	1
6	Study of the effect of temperature and thermal treatment on MFI of polyolefin	1
7	Demonstration of Fuji machine parts	1
8 A	Study of crystal structure of PP tapes and nylon 6 fibre using WAXD	1
8 B	Tensile properties (Stress strain Plots) of as spun and drawn samples of PET and Nylon 6	1
9	Demonstration of high speed spinning Hills pilot plant	1
10	Dry jet wet spinning of acrylonitrile copolymers	1
11	Effect of parameters on heat setting of PET filament yarn	1

12	Texturing of filament yarn	1
13	Testing of samples	1
COURSE TOTAL (14 times 'L')		14

18.	Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)
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Module no.	Description	No. of hours
	NA	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

- | |
|---|
| 1. Agrawal A, Jassal M, Bajaj P, Fibre Manufacture and Characterization- A laboratory manual for M. tech. Students, IIT Delhi |
|---|

20. Resources required for the course (*itemized & student access requirements, if any*)

20.1	Software	None
20.2	Hardware	
20.3	Teaching aides (videos, etc.)	None
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility for regular interaction, LCD projector, screen and white/black board
20.7	Site visits	None
20.8	Others (please specify)	None

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	None
21.2	Open-ended problems	20 %
21.3	Project-type activity	None
21.4	Open-ended laboratory work	None
21.5	Others (please specify)	None

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	TEXTILE TECHNOLOGY
2.	Course Title (<i>< 45 characters</i>)	Textured Yarn Technology
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TXL724
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students, PE for M. Tech. (Textile Engineering/Fibre Science & Technology) students

7.	Pre-requisites (<i>course no./title</i>)	No pre-requisites for M. Tech. Students 75 valid credits for undergraduate students
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8	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supersedes any existing course	TTL724

9.	Not allowed for (<i>indicate program names</i>)	No such restriction
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Kushal Sen, V K Kothari, R S Rengasamy
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12.	Will the course require any visiting faculty?	No
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13.	Course objective (<i>about 50 words</i>): This is an advance level course in Texturing, designed for master's level students who have received an undergraduate degree in Textile Technology and as higher level elective for undergraduate students. The course focuses on prevalent science and technology with an emphasis on recent developments in texturing process and technology. Analysis of mechanisms and mechanics as also development in machinery would be covered.
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14.	Course contents (about 100 words) (Include laboratory/design activities): Principles of texturing and modern classification; False twist texturing process-mechanisms and machinery, optimization of texturing parameters, barre', structure-property correlation of textured yarns; Draw-texturing- the need and fundamental approaches; Friction texturing- the need and development, mechanics of friction texturing, latest development in twisting devices, optimization of quality parameters. Noise control in texturing. Air jet texturing- Principle, mechanisms, development of jets and machinery, process optimization and characterization, air jet texturing of spun yarns. Air interlacement- Principle and mechanism, jet development and characterization. Bulk continuous filament yarns- Need, principle, technology development. Hi-bulk yarns- Acrylic Hi-bulk yarn production, mechanism and machines involved, other such products. Solvent and chemical texturing- Need, texturing of synthetic and natural fibres.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Principles of texturing and modern classification	2
2	False twist texturing process- mechanisms and machinery, optimization of texturing parameters, barre', structure-property correlation of textured yarns	6
3	Draw-texturing- the need and fundamental approaches	3
4	Friction texturing- the need and development, mechanics of friction texturing, latest development in twisting devices, optimization of quality parameters	6
5	Noise control in texturing.	1
6	Air jet texturing- Principle, mechanisms, development of jets and machinery , process optimization and characterization	7
7	Air jet texturing of spun yarns	2
8	Air interlacement- Principle and mechanism, jet development and characterization	2
9	Bulk continuous filament yarns- Need, principle, Technology development	3
10	Hi-bulk yarns- Acrylic Hi-bulk yarn production, mechanism and machines involved, other such products	5
11	Solvent and chemical texturing- Need, texturing of synthetic and natural fibres	5
12	COURSE TOTAL (42 times 'L')	42

16. Brief description of tutorial activities: NA

Module no.	Description	No. of hours
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17. Brief description of laboratory activities: NA

Module no.	Description	No. of hours
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18.	Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses) The self-study component would involve study of additional information (than that covered in the class) on the specified topic.	
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Module no.	Description	No. of hours
1-2	False twist texturing process- mechanisms and machinery, optimization of texturing parameters, barre', structure-property correlation of textured yarns	8
3-4	Draw-texturing- the need and fundamental approaches. Friction texturing- the need and development, mechanics of friction texturing, latest development in twisting devices, optimization of quality parameters	10
5-7	Noise control in texturing. Air jet texturing- Principle, mechanisms, development of jets and machinery, process optimization and characterization. Air jet texturing of spun yarns	10
8-9	Air interlacement- Principle and mechanism, jet development and characterization. Bulk continuous filament yarns- Need, principle, Technology development	8
10-11	Hi-bulk yarns- Acrylic Hi-bulk yarn production, mechanism and machines involved, other such products. Solvent and chemical texturing- Need, texturing of synthetic and natural fibres	6
	<i>The self study would be ensured by way of submission of assignments, design problems, case studies and term papers</i>	

19.	Suggested texts and reference materials: 1. J W S Hearle, L Hollick and D K Wilson, Yarn texturing technology, Woodhead Publishing, 2001 2. G.D, Wilkinson; Draw-Textured Yarn Technology, Published by Monsanto Textiles Company, 1974 3. Ali Demir, Hassan M. Behery, Synthetic Filament Yarn: Texturing Technology, Prentice Hall, 1997 4. Bohumil Piller Bulk continuous filament yarns: production, processing and applications; Textile Trade Press, 1973 However, as it is an advanced level course, no book is specifically recommended. References to relevant research articles shall be made available in class.
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20. **Resources required for the course** (*itemized & student access requirements, if any*)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT, video films
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	Lab demo

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	15%
21.2	Open-ended problems	15%
21.3	Project-type activity	-
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	Discussion (20%)

Date: 17.02.2015

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Functional and Smart Textiles
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TXL 719
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students and PE for M. Tech. (TE and TF) students

7.	Pre-requisites (course no./title)	TXL212/TXL221/TXL231 and EC 75
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	With High Performance Fibres and Composites course (TTL 718) <15%, Medical Textile (TTL746) <15%
8.2	Overlap with any UG/PG course of other Dept./Centre	Yes <15% Polymer Composite (PTL712) in CPSE
8.3	Supersedes any existing course	No

9.	Not allowed for (indicate program names)	No restriction
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem First semester
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11.	Faculty who will teach the course- B Gupta, Ashwini Agrawal, Manjeet Jassal, Mangala Joshi , Saurabh Ghosh, Samrat Mukhopadhyay	
12.	Will the course require any visiting faculty?	Not Required

13.	Course objective (<i>about 50 words</i>). The objective of the course is to acquaint the students with an overview of Technical Textiles in general and its application in areas such as composites, medical textiles, protective textiles, sportswear, and emerging smart and intelligent textiles. This awareness and knowledge is very relevant due to the current demand and growth in technical textiles world over.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Definition and Classification of Functional and Smart textiles ; Introduction to Composites : Theory, Types, Properties ; High Performance fibers, thermoplastic and thermosetting
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	Resins; Composite Manufacturing and Applications; Coated and laminated Textiles: materials, formulations, techniques and applications ; Protective Textiles- Materials, design, principles and evaluation for protection against fire, harmful radiation, chemicals and pesticides; Sportswear: design, testing and materials – fibers , yarns, fabrics for temperature control and moisture management; Medical textiles: Classification, types and products, Health and Hygiene Textiles- protection against microbes, Wound management- dressings, suture and bandages, Implants and drug delivery systems ; Smart and Intelligent Textiles : Passive and Active functionality, stimuli sensitive textiles, Electronic Textiles : wearable computers, flexible electronics.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No of lectures
1.	Introduction: Definition, Classification, Types and Future scope	1
2	Introduction to Composites : Theory of Composites, Types and properties of Composites	2
3	Composite Materials : High Performance fibers and resins , glass, carbon, aramids, high performance polyethylene (Spectra and Dyneema), Thermoplastic and Thermosetting Resins;	2
4	Composite Manufacturing Practices and Applications	2
5	Coated and Laminated Textiles, Coating materials, formulations, techniques and applications	3
6	Protective Textiles- Classification, Category; Requirements for protection against fire, UV, electromagnetic and nuclear radiation, chemicals and pesticides	4
7	Protective Textiles : Materials, Design, principles and evaluation of protective clothing;	5
8	Sportswear : Materials - fibers , yarns, fabrics for temperature control and moisture management; design & Testing	3
9	Medical textiles : Classification, types and products, Materials used: Biopolymers, biocompatibility, biodegradability, structure and design,	3
10	Health and Hygiene Textiles- protection against microbes, Wound management- dressings, suture and bandages, evaluation and Testing, Textile based implants and drug delivery systems	3
11	Specialty Finishes for Smart and Functional textiles: Plasma, Nanofinishes etc.	3
12	Smart and Intelligent Textiles: Definition, Classification, Passive and Active functionality	3
13	Stimuli sensitive textiles, smart textiles for thermal protection: use of Phase Change Materials, shape memory polymers	4
14	Electronic Textiles: wearable computers, flexible electronics, camouflage and other Defense applications.	4
	Total lecture (42 times 'L')	42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	N A	

17. Brief description of laboratory activities

Module no.	Description	No. of hours
	N A	

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1-2.	Study the various types of Composites, classify them using various routes. Evaluate Composites in terms of various properties when compared to other materials.	3
3	Study the manufacturing and use of High Performance fibers – like glass, carbon, aramids, high performance polyethylene (Spectra and Dyneema) in composites. Study the routes in which these fibres can be used in composite application. Make a detailed comparison of Thermoplastic and Thermosetting Resins and give applications where each of this class can be favoured.	3
4	Draw schematic of all the Composite Manufacturing processes. Prepare a table of products, components which can be preferably composites, and a third column to choose the route in which such components can be manufactured. The reason behind choice of each route can be justified in the fourth column.	3
5	Design of Coated and Laminated Textiles for specific applications such as Tarpulin Fabrics, Inflatables, Infrastructure- civil/ buildings etc. Learning different coating technologies such Dip coating, Solution coating and Melt coating Learning laminating technologies: hot melt, adhesives etc. Making formulations for coatings using different fillers and additives	4
6	Structure and Properties of Different high performance materials available for protective textiles – Non-wovens (Tyvek), Saran coated Tyvek, Nomex Fiber , Kevlar, HPPE (Spectra/Dyneema) etc. Design criteria for protective textiles based on hazard type and level such as thermal, chemical, biological, electrical, nuclear, UV radiation etc.	4
7	Design and Application of Protective Textiles against Electrical Hazards Design and Application of Protective Textiles against Bio Hazards Design and Application of Protective Textiles for Nuclear and Biological warfare Design and Application of Protective Clothing against fire hazards Testing methods and Standards for different categories of Protective textiles	8
8-10	Sportswear : Design Criteria and requirements for sportswear, materials with good absorbency, wicking and breathability and comfort commercially available for sportswear, Testing methods and standards for sportswear	3
11	Recent research articles related to specialty finishes by plasma reactions	4
12-13	Dual responsive polymers (Temperature and pH/ electrical stimuli sensitive)	4

13	Understanding the applications of phase change materials in sectors other than Textiles	3
14	Approaches for making camouflage textiles and their applications in Defence or other sectors	3

19. Suggested texts and reference materials :

a. Wellington Sears Handbook of Industrial Textiles – Sabit Adanur b. Protective Clothing : Systems and Materials- Matsua Raheel c. Protective Clothing – Textile Progress(Vol 22,no.2/3/4), 1992, Textile Institute d. Hand book of Technical Textiles- A R Horrocks and S C Anand, Woodhead Publishing Ltd., 2000 e. Smart Fibers, Fabrics and Clothing- X Tao, Woodhead Publishing Ltd. 2001

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	-
21.2	Open-ended problems	10
21.3	Project-type activity	10
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	-

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Science and Applications of Nanotechnology in Textiles
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TX740
6.	Status (<i>category for program</i>)	DE for B. Tech. (TT), M. Tech. (TE/TF) students

7.	Pre-requisites (course no./title)	EC75 for UG students
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	
8.2	Overlap with any UG/PG course of other Dept./Centre	NO Approx 5- 10% overlap with EPL 444/ PHL 726- Physical and chemical techniques for nanomaterial synthesis i.e Carbon nanotubes etc.
8.3	Supersedes any existing course	TTL740

9.	Not allowed for (indicate program names)	No Restriction
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☒ 2ndsem ☐ Either sem -
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11.	Faculty who will teach the course	Mangala Joshi, Manjeet Jassal, Bhanu Nandan, Ashwini K. Agrawal, Rajeev Srivastava
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12.	Will the course require any visiting faculty? (yes/no)	NO
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13.	Course objectives (about 50 words): The objective of the course is to acquaint the students with the fundamentals of nanoscience and nanotechnology in general and scope of its application in polymers and textiles in particular. This awareness and knowledge is very relevant due to the current worldwide focus on 'Nano'. The course will cover the basic concepts on the synthesis and applications of nanomaterials, nanocomposites, nanofibres, nanofinishing and nanocoatings to create smart and intelligent high performance textiles.
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14.	Course contents (about 100 words) (Include laboratory/design activities): Introduction to Nanoscience and Nanotechnology; Size and surface dependence of their physical and chemical properties such as mechanical, thermodynamical, electronic, catalysis etc.; Synthesis of Nanomaterials used in Textiles such as carbon nanotube, fullerenes, metal and metal oxide nanoparticles i.e. nano silver, nano silica, nano titania, nano zinc oxide, nano magnesium oxide etc.; Surface functionalization and Dispersion of nanomaterials; Nanotoxicity , Characterization techniques i.e. XRD, AFM, SEM/TEM, DLS etc.; Nanomaterial applications in textiles and polymers; Nanocomposites: definition types, synthesis routes ; nanocomposite fibres and coatings e.g. gas barrier, antimicrobial, conducting etc.; Nanofibres: preparation, properties and applications i.e. filtration, tissue engineering etc.; Nanofinishing: self-cleaning, antimicrobial, UV protective etc.; Nanocoating on textile substrates: Plasma Polymerization, Layer-by-layer Self Assembly, Sol-Gel coating etc.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1.	Introduction: fundamental concepts of nanoscience and nanotechnology, Application in different fields of science and technology including textiles, Nanotechnology Synthesis and fabrication , Basic Approaches : Bottom-up and Top Down	2
2.	Nanomaterials; Size, structure and surface dependence of physical and chemical properties of nanomaterials i.e. conductivity, mechanical, optical, electronic, catalysis etc.	2
3.	Basics of nanomaterial properties : Bonding and Band Structure in nanoparticles, Quantum Confinement, Surface Plasmon Resonance	3
4.	Introduction to nanomaterials used in textiles/polymers i.e. carbon nanotubes, nanofibres, layered silicate based clays, metal & metal oxide based nanoparticles i. e. nano silver, nano silica, nano zinc oxide, nano titania etc. Hybrid nanostructured fillers such as polyhedral oligomeric silsesquioxanes (POSS), Toxicity issues of nanomaterials	3
5.	Basic physical and chemical techniques of synthesis of nanomaterials i.e Ball Milling, PVD & CVD, Chemical Route- Sol-Gel, Reverse Micellar, Precipitation, Controlled Hydrolysis ,Reduction, Hydrothermal etc.	4
6.	Dispersion of nanomaterials; Principles of colloidal science; colloidal stability, surface charge, zeta potential etc; Techniques for measurement of	3

	zeta potential, particle size and particle size distribution: Dynamic light scattering (DLS) and Transmission electron microscopy (TEM) etc.	
7.	Techniques for dispersion of nanomaterials in solvents or polymeric solutions: mechanical, ultrasonication, surfactant, surface functionalization	2
8.	Nanocomposites: Basic concepts, definition, types, nano vs. macrocomposites, synthesis routes: in situ, solution and melt; characterization i.e. XRD & TEM, Interface, concept of hybrid nanocomposites	4
9.	Nanocomposite fibre: effect of nanofillers on spinning and drawing, examples: carbon nanotube or carbon nanofibres based, nanoclays based, metal oxide based, POSS based; Nanocomposite coatings : gas barrier, flame resistant etc.	3
10.	Nanofinishing : self-cleaning , lotus leaf effect, antimicrobial, UV protection etc.	3
11.	Nanocoatings on textiles: plasma polymerization, self-assembly (L-B-L) approach, chemical vapor deposition, physical vapor deposition, sol-gel method	4
12.	Surface characterization techniques: AFM, XPS, SEM, SEM/EDX etc	4
13.	Nanofibres: definition, synthesis routes – electro-spinning in detail ; other techniques such as melt blowing using a molecular die, splitting of bi or multi component fibre	3
14.	Applications of nanofibres and examples – filtration, barrier fabric, wipes, scaffolds for tissue engineering, nanocomposites based on nanofibres, function of nanofibres	2
COURSE TOTAL		42

16. Brief description of tutorial activities: NA

Module no.	Description	No. of hours

17. Brief description of laboratory activities NA

Module no.	Description	No. of hours

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1.	Synthesis of Nanomaterials such as Carbon Nanotubes, nanofibers, graphene, metal and metal oxides nanoparticles, POSS etc.	6

2.	Learning applications of characterization techniques such as DLS, UV Visible spectroscopy, XRD, SEM/TEM, AFM, Raman, XPS, EDX to study nanomaterials	10
3.	Integration of nanomaterials on Textiles to impart functional properties such as self-cleaning, anti-microbial, anti-static, UV protective etc.	8
4.	Design and application of Bio Sensor, Chemical Sensor	4
5.	Design and application of conducting textiles using carbon nanomaterial	4
6.	Nanomaterials and environment	2
7.	Nanomaterials and water purification	2
8.	Polymer Nanocomposites based on nanoclays	2
9.	Polymer nanocomposites based on Carbon nanotube, Graphene	2
10.	Polymer nanofibers and applications in Tissue engineering , filtration, protective clothing	2
	(Methodology : Self Study followed by report writing and power point presentation)	
	Total	42

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1.	Charles P Poole, Jr and Frank J Owens, Introduction to Nanoscience and Nanotechnology ; Wiley India -Student Edition(2006)
2.	Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, Nanoscale Science and Technology, John Wiley and Sons (2005)
3.	M Joshi and A Bhattacharya, Nanotechnology : A New Route to High Performance Textiles, Textile Progress, Vol 43, No.3, Sep (2011)
4.	Ed. P Brown and K Stevens, Nanofibres and Nanotechnology in Textiles, Woodhead Publishing Co. UK (2007)
5.	Ed. Deopura BL, R Alagirusamy, M Joshi and Gupta B, 'The Impact of Nanotechnology on Polyesters and Polyamides' , A chapter in the book titled "Advances in Polyesters and Polyamides", Woodhead Publishing Co. UK (2008)
6.	Ed. T J Pinnavia & G W Beall Polymer Clay Nanocomposites, John Wiley and Sons Ltd. England (2000)
7.	Seeram Ramakrishna, K Fujihara, W Teo and TL Zumie Ma , An Introduction to Electrospinning and Nanofibres, , World Scientific Publishing Co. Ltd. (2005)
8.	Zhen Guo, Li Tan, Fundamentals and Applications of Nanomaterials, (Artech House) London (2009)
9.	Hari Singh Nalwa, Encyclopedia Of Nanoscience and Nanotechnology, American Scientific Publishers, 10 Volumes Set (2004)

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	
20.2	Hardware	

20.3	Teaching aides (videos, etc.)	LCD Projector
20.4	Laboratory	
20.5	Equipment	Black Board/ Chalk
20.6	Classroom infrastructure	Class Room with Audio Visual facility
20.7	Site visits	
20.8	Others (please specify)	

21. Design content of the course*(Percent of student time with examples, if possible)*

21.1	Design-type problems	10 %
21.2	Open-ended problems	10%
21.3	Project-type activity	20%
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Environmental Management in Textile & Allied Industries
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TXL741
6.	Status (<i>category for program</i>)	DE for M. Tech. (TF) students

7.	Pre-requisites (course no./title)	None
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	TTL744

9.	Not allowed for (indicate program names)	M. Tech. (CPSE), B. Tech. / M. Tech. (Chem. Engg.)
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem
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11.	Faculty who will teach the course Prof. Bhuvanesh Gupta, Prof. Manjeet Jassal, Prof. Mangala Joshi, Dr. Rajiv Srivastava
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): The objective of the course is to educate the students about Importance of ecological balance and environmental protection, and to excel them about pollutant types, waste management and control, waste treatment and minimization, as well as Eco friendly textile processing and safe working practices.
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14.	Course contents (<i>about 100 words</i>) (Include laboratory/design activities): Importance of ecological balance and environmental protection. Definition of waste and pollutant. Pollutant Categories and types. International and Indian legislation and enforcing agencies in pollution control. Waste management approaches; Environmental Management
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	Systems' ISO 14000. Environmental impact along the textile chain from fibre production to disposal. Toxicity of intermediates, dyes and other auxiliaries etc. Pollution load from different wet processing operations. Textile effluents and their characterization. Technology and principles of effluent treatment. Advanced colour removal technologies, Recovery and reuse of water and chemicals. Air and noise pollution and its control. Eco labeling schemes. Industrial hygiene and safe working practices. Analytical testing of eco and environmental parameters. Eco friendly textile processing: waste minimization. Standardization and optimization, process modification. Safe & ecofriendly dyes and auxiliaries. Organic cotton, natural dyes, naturally coloured cotton, Solid (fibre & polymer waste) recycling recovery of monomers, energy recovery and chemical modification of fibre waste.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1	Importance of ecological balance and environmental protection.	1
2	Definition of waste and pollutant. Pollutant Categories and types.	2
3	International and Indian legislation and enforcing agencies in pollution control.	2
4	Waste management approaches; Environmental Management Systems' ISO 14000.	2
5	Environmental impact along the textile chain from fibre production to disposal.	3
6	Toxicity of intermediates, dyes and other auxiliaries etc.	3
7	Pollution load from different wet processing operations.	2
8	Textile effluents and their characterization.	3
9	Technology and principles of effluent treatment.	2
10	Advanced colour removal technologies, Recovery and reuse of water and chemicals.	3
11	Air and noise pollution and its control.	2
12	Eco labeling schemes.	2
13	Industrial hygiene and safe working practices.	2
14	Analytical testing of eco and environmental parameters.	2
15	Eco friendly textile processing: waste minimization, standardization and optimization, process modification.	4
16	Safe & ecofriendly dyes and auxiliaries. Organic cotton, natural dyes, naturally coloured cotton.	3
17	Solid (fibre & polymer waste) recycling recovery of monomers, energy recovery and chemical modification of fibre waste.	4
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	NA	

17. Brief description of laboratory activities

Module no.	Description	No. of hours
	NA	

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1.	Integration of environment and quality management system for sustainable development of textile products	6
2.	Sustainable Textiles: Life Cycle and Environmental Impact	6
3.	Major contributing sources in textile industry for water and air pollution – in details	4
4.	Major contributing sections in textile industries for noise, land and thermal pollution – in details	4
5.	Toxicology of textile dyes and auxiliaries	6
6.	Decolorization of effluent with ozone	5
7.	Biotechnological treatment of textile dye effluent	4
8.	Students can choose a topic from Environmental Management in Textile & Allied Industries and present it.	7
	Total:	42

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. F.M.D. Chequer, G.A. Rodrigues de Oliveira, E.R.A. Ferraz, J.C. Cardoso, M.V.B. Zanoni, D. Palma de Oliveira, 'Textile Dyes: Dyeing Process and Environmental Impact' (Chapter 6) in "Eco-Friendly Textile Dyeing and Finishing", ed. Melih Günay, InTech, 2013, ISBN: 978-953-51-0892-4 (Open access). 2. G. Tchobanoglous, F. Kreith, Handbook of Solid Waste Management, 2nd Edition, McGraw-Hill, 2002, ISBN: 9780071356237.

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	None
20.2	Hardware	
20.3	Teaching aides (videos, etc.)	None
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility for regular interaction, LCD projector, screen and white/black board
20.7	Site visits	None
20.8	Others (please specify)	None

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	None
21.2	Open-ended problems	20 %
21.3	Project-type activity	None
21.4	Open-ended laboratory work	None
21.5	Others (please specify)	None

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	TEXTILE TECHNOLOGY
2.	Course Title (<i>< 45 characters</i>)	Theory and Practice of Textile Finishing
3.	L-T-P structure	2-0-2
4.	Credits	3
5.	Course number	TXL742
6.	Status (<i>category for program</i>)	Core for M.Tech. (Fibre Science and Technology) students

7.	Pre-requisites (<i>course no./title</i>)	None
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	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	30% overlap with a UG course TXL141
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supersedes any existing course	TTL742

9.	Not allowed for (<i>indicate program names</i>)	B.Tech. Textile Technology
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☒ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Prof Deepti Gupta, Dr BS Butola, Dr.SamratMukhopadhyay, Dr.Wazed Ali, Dr.Mangala Joshi
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12.	Will the course require any visiting faculty?	No
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13.	Course objective (<i>about 50 words</i>): To familiarize students with recent advances in the field of textile finishing. Chemical finishes to improve performance and mechanical finishes to enhance appearance and feel. Principles of chemical finishing, new and Eco friendly technologies for finish application, testing and evaluation of finished products.Challenges and future directions in textile finishing.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Classification of finishes- mechanical/chemical/functional/aesthetic. Developments in mechanical finishes - calendering, raising,emerising. Low wet pick up technologies. Principles and chemistry of chemical finishes- easy care, antimicrobial, anti UV, antistat, softening, Flame retardant, water repellent. Specialised finishes for aroma, wellness, freshness and insect
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	repellence. New technologies for finishing - microencapsulation, plasma, inkjet printing, ultrasonic spray. Nanotechnology for special finishing effects. Finishing of technical textiles. Membranes and laminates for multipurpose performance.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1.	Introduction and classification of textile finishing Applications of finishing- conventional and futuristic. Chemical finishes for performance enhancement and mechanical for handle, drape and appearance. Challenges and future trends.	1
2.	Technologies for reducing consumption of water in finishing Low wet pick up methods-Engraved rolls, Kiss rolls, transfer techniques, foam and spray technology.	2
3.	Technology of Dewatering Advances in dewatering technology- Mechanical-Porous Bowls, vacuum extraction, centrifugation. Capillary active and gas kinetic-suction pipe/roller, mach nozzle, jet squeeze, venturi nozzle.	2
4.	Technology of drying textiles Drying of fibres, packages and fabric. Conduction drying, convective dryers, radiant dryers- RF and IR, Ultra sound dryers.	2
5.	Mechanical finishes: Calendering Effects obtained with calendering and applications. Process variables in calendering- machine parameters and fabric parameters. Calendar deformations, technologies for deflection control.	2
6.	Mechanical finishes: Raising, brushing and emerising Applications, properties and performance of raised fabrics. Technology of raising woven and knit fabrics, parameters affecting the final effect.	2
7.	Chemical finish: Easy care finishing Introduction and history. Chemistry of easy care finish- reactants and catalysts, formaldehyde and non-formaldehyde based cross linking agents, technology of finish application and testing and properties of cross linked fabrics.	2
8.	Chemical finish: Flame retardant finishing Cycle of pyrolysis of textiles,thermal degradation behaviour of natural and synthetic fibres, mechanism of flame propagation. Inherently FR fibres, FR finishing. Approaches of flame retardancy, chemistry of FR agents, mechanisms of FR. Temporary, semi durable and durable finishes for cotton. Testing for flammability.	2
9.	Chemical finish: Antimicrobial finish Textiles as carriers of microbes, microbes and human body, protection from biological attack. Inherently AM fibres. Technology of antimicrobial finishes, mechanism of microbial inhibition. Chemistry of AM agents- conventional and futuristic. Type of AM- bound, leaching type, slow release, renewable. Ecological effects of AM agents. Testing methods.	2
10.	Chemical finish: UV protective,Antistat, Softeners Chemistry, principle, application and testing	3
11.	Oil and water repellent finish Principle of repellency, chemistry of repellent agents.	2
12.	Technologies for functional finishing Microencapsulation, plasma, nanotechnology	2
13.	Advances in finishing technology Wellness finishes, coating and lamination, sustainable finishes, ecology of finishes.	4

TOTAL	28
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16.	Brief description of tutorial activities: Not applicable
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17.	Brief description of laboratory activities:	
Module no.	Topic	No. of hours
1	Finishes for handle modification	4
2	Easy care finish for cotton	4
3	Finish for UV protection	4
4	Antimicrobial treatment	4
5	Finish for water repellency	4
6	Finish for flame retardancy	4
7	Presentation and discussion of results	4

18. Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1	Drivers for textile finishing industry. Challenges faced by industry. Directions in ecofriendly finishing of textiles.	3
2-3	Energy and water consumption in textile processing- equations. Technologies for water and energy conservation.	3
4	Advances in dewatering systems. Efficiency of conductive, convective and radiant systems of drying.	3
5-6	Machinery developments in Mechanical finishes. Review of last ITMA	4
7	History of easy care finish. Developments in low and zero formaldehyde finishes. Future of easy care finishes.	3
8	History of FR finishes. Developments in intumescent, applications and legislation for FR finishes.	3
7	Applications of AM finishes in odour repellent, wellness and hygiene applications. Chemistry of new AM agents. Ecofriendly AM agents.	3
8	Softeners for technical textiles. Ecological impact of textile softeners. Developments in simulation of fabric feel and handle.	3
9	Repellency in textiles, Membranes for breathable textiles. Design of waterproof breathable clothing. Non fluoro based repellents.	3
10	Methods used for production of microcapsules, application of microencapsulation in finishing. Nano technologies for textile finishing- potential and challenges. Plasma as a pre-treatment and plasma enhanced finish deposition.	4
11	Preparation and presentation of term paper on advances in textile finishing	5

19.	Suggested texts and reference materials: 1. Heywood, D, Textile Finishing, 2003, Society of Dyers and Colourists. 2. Chemical Finishing of Textiles, Schindler WD and Hauser, PJ 2004, Woodhead Publishing. 3. Encyclopedia of textile finishing: 3-volume-set, H-K RouetteWoodhead Textiles
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	Series No. 22. 4. Tomasino, C, Chemistry and Tech. of Fabric Preparation and Finishing, http://www.tx.ncsu.edu/jtاتم/volume3issue3/Articles/ITMA/bagley_ITMA_full.pdf 5. Gulrajani, ML, Advances in the Dyeing and Finishing of Technical Textiles, 2013, Woodhead Publishing. 6. Elbadawi A. M. & Pearson J. S, FOAM TECHNOLOGY IN TEXTILE FINISHING, 2003, Textile Progress, 33:4, 1-31, http://dx.doi.org/10.1080/00405160308688960 7. Harifi, T., & Montazer, M., Past, Present and Future Prospects of Cotton Cross-linking: New Insight into Nano Particles, <i>Carbohydrate Polymers</i>, 2012, 88(4):1125–1140 doi:10.1016/j.carbpol.2012.02.017 8. Windler, L, Height, M and Nowack, B, Comparative evaluation of antimicrobials for textile applications, <i>Environment International</i>, 2013, 53, 62–73, http://dx.doi.org/10.1016/j.envint.2012.12.010. 9. Hauser, P., “Advances and Trends in Textile Wet Processing Chemicals.” JTATM, Volume 5, Issue 1, Winter 2006 10. Liang, S, Neisius, NM, Gaan, S, Recent developments in flame retardant polymeric coatings, <i>Progress in Organic Coatings</i>, 2013. http://dx.doi.org/10.1016/j.porgcoat.2013.07.014 11. Gao, Y and Cranston, R, Recent Advances in Antimicrobial Treatments of Textiles, <i>Textile Research Journal</i>, 2008, Vol 78(1): 60–72 DOI: 10.1177/0040517507082332 12. Gupta, D, 2014, Softening treatments for technical textiles in Gulrajani, ML, <i>Advances in the Dyeing and Finishing of Technical Textiles</i>, 2013, Woodhead Publishing, 154-176.
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20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	
20.2	Hardware	
20.3	Teaching aides (videos, etc.)	
20.4	Laboratory	yes
20.5	Equipment	yes
20.6	Classroom infrastructure	yes
20.7	Site visits	yes

21. Design content of the course (Percent of student time with examples, if possible)

21.1	Design-type problems	
21.2	Open-ended problems	
21.3	Project-type activity	10%
21.4	Open-ended laboratory work	20%
21.5	Others (please specify)	

Date: 26.02.2015

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	The Department / Centre is proposing the course	TEXTILE TECHNOLOGY
2.	Course Title (<i>< 45 characters</i>)	Principles of Colour Measurement and Communication
3.	L-T-P structure	2-0-2
4.	Credits	3
5.	Course number	TXL743
6.	Status (<i>Category for program</i>)	P. E. for M. Tech. (Fibre Science and Technology) students

7.	Prerequisites (Course no. /title)	N.A.
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8	Status vi's-à-vis other courses (<i>give the course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supersedes any existing course	TTL743

9.	Not allowed for (Indicate program names)	UG students of any discipline
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☒ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course S. Mukhopadhyay, B S Butola, Wazed Ali
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12.	Will the course require any visiting faculty?	No
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13.	Course objective (<i>about 50 words</i>): To communicate the concept of colour physics and techniques for colour specification and measurement. Understanding different colour order systems, their limitations and use of colour physics in working of human eye, recipe prediction and visual colour displays.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Light and light interactions. Physical, physiological and psychophysical aspects of colour, colour perception, colour specification, colour measurement. Basis of modern techniques for colour specification, measurement and communication, Applications of colour science to textiles, colour reproduction, computer-based imaging and display systems, Basic concepts of computer colour graphics.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Light, Light sources and interactions, concept of spectral power distribution, Planckian and non Planckian radiators, sources of artificial light, interaction of light with matter, color matching booth and visual colour matching	3
2	Measurement of colour – colorimeter, spectrophotometer – variants and principles, Concept of dual beam, spectral analyser and instrument geometry, analyses of spectrophotometer data	3
3	Colour order systems – different systems, colour difference evaluation, depth and relative depth, evaluation of whiteness and yellowness	2
4	Colorimetry and CIE system – concept of additive and subtractive mixing, standard observer experiments – color matching functions, Real and imaginary primaries, Tristimulus values, relationship of tristimulus values with color appearance and correlation with other colour order systems, Chromaticity diagrams, Usefulness and limitations of CIE system	4
5	Colour constancy and chromatic adaptation, Metamerism – various classes of metamerism, Colour rendering of light sources	2
6	Recipe prediction for textiles	2
7	Colour in visual displays – computer based imaging and concepts of computer colour graphics.	2
8	How we see colour - Mechanism of vision, attributes of colour as perceived by the human eye, differences and defects in colour vision	2
9	Student seminar presentations	8
Total		28

16.	Brief description of tutorial activities: Not applicable
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17.	Brief description of laboratory activities: Details in table
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Exp No.	Experiment	Time (hours)
Exp No. 1	To find day to day variation and man to man variation of non-reduction cleared and reduction cleared polyester samples.	4
Exp No. 2	Shade sorting of polyester dyed samples	2
Exp No. 3	Bleaching of cotton samples and measurement of whiteness index.	2
Exp No. 4	Setting up of a database in computer colour matching software using different dyes of different shade percentage.	4
Exp No. 5	To check the validity of the database created in experiment no. 4 by dyeing with same shade percentage and checking for recipe prediction	4

Exp No. 6	Recipe prediction using spectrophotometer and corresponding dyeing and correction dyeing to match the recipe	4
Exp No. 7	Development of shade of a given color for cotton	2
Exp No. 8	Study on metamerism	2
Exp. No. 9	Design your own experiment	4
	Total	28 hours

18. Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)

Model no.	Description	No. of hours
1	Basics of light and light interactions, studying on sources of light and detailed light interaction with matter	4
2	Designing a new spectrophotometer from scratch – component level analyses and discussion of incorporation of new elements in design	3
3	Design your own experiment to demonstrate additive and subtractive colour mixing and their difference. Give the practical usage of these two mixings and discuss them in terms of models of colour.	3
4	Design your own standard observer – define your own light sources and justify the reason behind your choice. Complete the standard observer experiment and define the primaries.	3
5	Draw chromaticity diagram from the basics. Create your own software to draw the chromaticity diagram and discuss the various practical issues which can be inferred.	4
6	Study on different colour order systems – their limitations	4
7	Metamerism – various types, colour constancy and colour rendering, relation to CIE systems and practical use.	3
8	Study on practical issues of recipe prediction	3
9	Colour in visual displays, colour management systems	3
10	The working of vision – modelling of colour process, differences in colour vision and defective colour vision	4
13	Visual and instrumental evaluation of whiteness and yellowness	3
14	Literature search, choosing a topic and preparation for presentation	5
		42

19.	Suggested texts and reference materials: - George Klein, Industrial Color Physics, Springer - J Roderick, Colour Physics for Industry, SDC, London
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	3. Ed. M L Gulrajani, Colour measurement – Principles, advances and industrial applications, Woodhead Publications
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20. Resources required for the course (*itemized & student access requirements, if any*)

20.1	Software	Match my colour, X-rite software
20.2	Hardware	Spectrophotometer, Colorimeter, Computer
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	Described in detail
20.5	Equipment	Spectrophotometer, Basic laboratory dyeing equipment
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	20%
21.2	Open-ended problems	15%
21.3	Project-type activity	10%
21.4	Open-ended laboratory work	20%
21.5	Others (please specify)	0%

Date: 23.02.2015

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	The Department / Centre is proposing the course	TEXTILE TECHNOLOGY
2.	Course Title (<i>< 45 characters</i>)	Coloration of Textiles
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TXL 744
6.	Status (<i>Category for program</i>)	Core for M. Tech. (Fibre Science and Technology) students

7.	Prerequisites (Course no. /title)	N.A.
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8	Status vi's-à-vis other courses (<i>give the course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supersedes any existing course	TTL741

9.	Not allowed for (Indicate program names)	UG students of any discipline
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course S. Mukhopadhyay, K Sen, B S Butola, Wazed Ali, Deepti Gupta
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12.	Will the course require any visiting faculty?	No
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13.	Course objective (<i>about 50 words</i>): To introduce the modern concepts of coloration of textiles by way of dyeing, printing. Also to familiarize the students of the new principles, mechanisms and technologies
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Developments in dyes and dyeing processes for the dyeing of various textile substrates with various dye classes; Dyeing of blends; Mass coloration of man-made fibres; Advances in dyeing machinery, Development in printing methods and machines; Direct, resist and discharge styles of printing; Printing of blends; Transfer printing; Physicochemical theories of the application of dyestuffs to textile and
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	related materials, including the thermodynamics and kinetic principles involved; Dye-polymer interactions; Role of fibre structure in dyeing.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Developments in dyes and dyeing process, Fluorescent and near IR dyes, developments in mass colouration and synthetic fibre dyeing, natural dyes	4
2	Dyeing of blends	3
3	Advances in dyeing machinery	3
4	Mass coloration	3
5	Developments in printing methods and machineries	3
6	Printing of blends, transfer printing	3
7	Digital printing and recent developments	3
8	Role of polymer and fibre structure in dyeing – dye polymer interactions, chemical and physical structure of fibres affecting dyeing, concept of orientation and crystallinity – effect on dyeing, case studies.	5
9	Physiochemical theories in application of dyestuffs, Thermodynamics and kinetics of dyeing	3
10	Environmental issues in dyeing, environmental friendly dyes and techniques, toxicology of dyes	3
11	Seminar presentations on selected topics	10
		42

16.	Brief description of tutorial activities: Not applicable
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17.	Brief description of laboratory activities: Not Applicable
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18. Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)

Model no.	Description	No. of hours
1	Developments in dyes and dyeing process, natural dyes	5
2	Advances in techniques of dyeing, low liquor techniques, foam dyeing, supercritical fluid dyeing,	6
3	Dyeing of wool, Dyeing of silk	6
4	Microfibre dyeing – issues and case studies	3
5	Use of ultra-sonication in dyeing, Effect of plasma on dyeability of different fibres	6
6	Environmental issues in dyeing – case studies, Use of biotechnology in effluent treatments, ozone treatments	6

8	Preparation for seminar on selected topic on advancement in dyeing/printing	10
		42

19.	Suggested texts and reference materials: 1. Ed. M Clark, Handbook of Textile Dyeing – principles, processes and types of dyes, part – I and II, Woodhead Publishing 2. Arthur Broadbent, Basic Principles of Textile Coloration, Society of Dyers and Colorists, London, 3. Ed. M Christie, Environmental aspects of textile dyeing, Woodhead Publishing John Shore Blends dyeing, 4. H Ujiye Digital Printing of Textiles, Woodhead Publishing
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20. Resources required for the course (*itemized & student access requirements, if any*)

20.1	Software	NIL
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	Nil
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	20%
21.2	Open-ended problems	10%
21.3	Project-type activity	0%
21.4	Open-ended laboratory work	0%
21.5	Others (please specify)	0%

Date: 23.02.2015

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Green processing techniques and certification
3.	L-T-P structure	2-1-0
4.	Credits	3
5.	Course number	TXL745
6.	Status (<i>category for program</i>)	DE for M. Tech. students (Textile) Open also for B. Tech. and Research students

7.	Pre-requisites (course no./title)	None
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	No

9.	Not allowed for (indicate program names)	
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10.	Frequency of offering	☐ Every sem ☐ 1stsem ☐ 2 nd sem ☒ Either sem -
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11.	Faculty who will teach the course Dr Samrat Mukhopadhyay
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): The increasing focus on the well-being of our planet has reinforced our concerns about Detrimental effects of many products as well as creating new expectations with regard to what goes into the making of those products. Green processing techniques have assumed real significance in today's world. This course would aim to explore the knitty gritty of
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	green technologies – which go to create textile products without deleterious effects on the environment, in their making, their use or their disposal.
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14.	Course contents (about 100 words) (Include laboratory/design activities): The course would highlight the processing technologies for organic fibers and eco-friendly lignocellulosic natural fibers. The further focus would be on new dyeing and finishing technologies which require fewer chemicals and consume less energy and water while also releasing cleaner effluent. Process technologies highlighted would include new enzymes and ozone technologies that replace harsh chemicals in fabric finishing, very low-moisture foam dyeing technologies, waste and solvent-eliminating digital printing technologies, low-salt reactive dyes, bleaching processes that reduce water and energy use, and technologies that combine dyeing and finishing in one step, among other technologies. Cleaner Effluent technologies would be discussed. Biocomposites and their manufacturing techniques would be detailed out. Effective recycling techniques would be discussed at length and the laws related to environmental protection would be explained specially with reference to textile industry
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1.	Natural fibers - classification and strengths with a focus on processing of Organic fibers – (a) cotton, (b) linen and (c) hemp	4
2.	Processing of bast fibers for industrial applications (a) Physical and (b) Chemical	4
3.	Physical modification of natural fibers	3
4.	Biodegradable polymers (a) Natural biopolymers – availability and applications (b) Synthetic biopolymers– synthesis and applications	5
5.	Environmental friendly (a) Dyes (b) Processing technology	4
6.	Waste and solvent-eliminating digital printing technologies	2
7.	Cleaner effluent treatments – using (a) electrocoagulation,	5

	(b) membrane technologies, (c) reusing textile effluents	
8.	Biocomposites (a) Biocomposites –preparation techniques (b) Cellulose, PLA, Bacterial polyester based (c) Case studies and future – sustainability issues	5
9.	Natural fibers for (a)Automotive applications (b)Building applications	3
10.	(a) Recycling of textile materials (b) Useful products using recycling and case studies – stress on unipolymer composites.	4
11.	(a) Laws of environmental protection (b) Special reference to textile industries	3
COURSE TOTAL		42 Lectures

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
1.	Debate, discussion on existing green technologies	
2.	Thoughts on alternative green technologies in textile processing	
3.	Students would submit a term paper on ‘alternative technologies’ highlighting the strength and weaknesses of the proposed technologies.	
4.	Laboratory demonstration on processing of bast fibers, clean technologies and biocomposites would be arranged.	

17. Brief description of laboratory activities: NA

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

[illegible]

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1. **Organic Cotton: From Field to Final Product**, By Dorothy Myers, Sue Stolton, Intermediate Technology, USA
2. **Biodegradable polymers for Industrial applications**, edited by Ray Smith, Woodhead Publications
3. **Natural fibers, polymers and biocomposites**, edited by Mohanty et. Al, CRC Press, http://www.crcpress.com/shopping_cart/products/product_detail.asp?sku=1741&af=W1129
4. **An Introduction to Biocomposites, Ramakrishna et.al.**, Imperial college press <http://www.worldscibooks.com/engineering/p311.html>
5. **Green chemistry**, by Mike Lancaster, <http://www.rsc.org/shop/books/2002/9780854046201.asp>
6. Research Papers

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	
20.2	Hardware	
20.3	Teaching aides (videos, etc.)	
20.4	Laboratory	
20.5	Equipment	
20.6	Classroom infrastructure	
20.7	Site visits	
20.8	Others (please specify)	

21. Design content of the course(Percent of student time with examples, if possible)

21.1	Design-type problems	
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	TEXTILE TECHNOLOGY
2.	Course Title (<i>< 45 characters</i>)	Bio-processing of Textiles
3.	L-T-P structure	3 – 0 - 0
4.	Credits	3
5.	Course number	TXL 746
6.	Status (<i>category for program</i>)	DE for B. Tech. (TT), M. Tech. (TF) students

7.	Pre-requisites (course no./title)	None
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	No

9.	Not allowed for (indicate program names)	UG students of non-textile disciplines
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem -
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11.	Faculty who will teach the course S. Mukhopadhyay, B.S. Butola, Wazed Ali, Deepti Gupta, Kushal Sen along with invited lectures from other departments.
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): The objective is to familiarize the students with scientific principles underlying the basis of the biotechnology and its use in textile industry and to provide the skills to use and locate information relating to biotechnology and its use from textbooks, scientific journals and reliable sources on the Internet
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14.	Course contents (about 100 words) (Include laboratory/design activities): Basics of Biotechnology. Bio-modified Plant Fibres and Fibres from Biopolymers. Bio dyes. Bio surfactants. Enzymes in Chemical Processing – cotton, wool, silk, jute and other bast
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	fibres, polyester. Bio effluent treatment. Enzyme based detergents. Bio-tagging.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
1.	Basics of Biotechnology Definition, origin and historical development, concepts of biotechnology in general and that of White Biotechnology in particular. Definition of molecular biotechnology and its emergence. The basic biological and chemical processes of cells, tissues, and organisms and their significance in biotechnology research and product development. Different types of enzymes, their mechanism of action as bio-catalysts and in fermentation.	4
2.	Bio-modified Plant Fibres and Fibres from Biopolymers Bt cotton; Naturally coloured cotton; Coloured silk; Spider silk; Biosteal™; Chitin fibre.	7
3.	Bio dyes Use of Cells for Dye Production; Microbial production of indigo; Dyes produced in Bioreactor; Fungal dyes - Mushroom and lichen dyes; Insect dyes – Lac and cochineal.	7
4.	Bio surfactants	2
5.	Enzymes in Chemical Processing Cotton – Desizing; Scouring; Bleaching; Finishing – Bio-polishing; Bio-washing.	5
	Wool – Bio-clipping of Wool; Carbonisation of wool; Reduction of wool-fibre stiffness and prickly; De-scaling; Anti-shrink	4
	Silk – Degumming; Bio-finishing	2
	Jute and other Bast Fibres – Jute Retting; Degumming of bast fibrous plants; Enzymatic Treatment of bast fibres; Bio-preparation of Linen Fabric	3
	Polyester - Bio catalytic modification of polyester	1
6.	Bio effluent treatment Dye removal by immobilized fungi; Biodegradation of dyes	5
7.	Enzyme based detergents	1
8.	Bio-tagging	1
COURSE TOTAL (14 times 'L')		42

16. Brief description of tutorial activities: Not applicable

Module no.	Description	No. of hours

17. Brief description of laboratory activities: Not applicable

Module no.	Description	No. of hours

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1.	Bioprocessing for sustainable production of coloured textiles	4
2.	Interface of Biotechnology and Textiles	4
3.	Enzyme technology and it's industrial use	4
4.	Environment, health and safety in enzyme handling	3
5.	Enzyme in treatment of textile effluents	4
6.	Application of microbiology in textile effluent treatment	4
7.	Biotechnology and Biopolymer in health and hygiene care textiles	5
8.	Textile waste bioprocessing to biofuel	4
9.	Current trend and future challenge in textile bioprocessing	4
10.	Topic selection and preparation for the presentation	6
	Total:	42

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

1.Georg M. Guebitz, Artur Cavaco-Paulo, Ryszard Kozlowski Biotechnology in Textile Processing
Haworth Press, 2006

2.Artur Cavaco-Paulo, Georg M. Gübitz, Textile Processing with Enzymes CRC, 2003

3.Helmut Uhlig, Elfriede M. Linsmaier-Bednar Industrial Enzymes and Their Applications
Wiley-IEEE, 1998

Recent Review papers to be given at the time of the lecture

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility

20.7	Site visits	None
20.8	Others (please specify)	-

21. Design content of the course*(Percent of student time with examples, if possible)*

21.1	Design-type problems	-
21.2	Open-ended problems	-
21.3	Project-type activity	-
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	20% (Term paper and presentation)

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	TEXTILE TECHNOLOGY
2.	Course Title (<i>< 45 characters</i>)	Medical Textiles
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TXL773
6.	Status (<i>category for program</i>)	DE for B. Tech. and PE (Programme Elective) for M. Tech. (TE and TF) for Textile department's students

7.	Pre-requisites (course no./title)	None
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Yes Functional and Smart Textiles (TTL719) <10%
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	TTL746

9.	Not allowed for (indicate program names)	No restriction
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem
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11.	Faculty who will teach the course- Dr. Sourabh Ghosh	
12.	Will the course require any visiting faculty?	Not necessary (Special lecture may be organized during visit of Internationally renowned scientists)

13.	Course objective. The objective of the course is to familiarize the students with various Medical textile products commercially available in healthcare field, their limitations, general understanding of structure-function correlation, cell-polymer interaction, and about the challenging Tissue engineering applications. Students will learn how to apply Textile technology, Material Science and Tissue engineering principles to develop solution for existing medical problems. Fabrication method of recently reported/patented novel bio-engineered products will be critically reviewed. Students will exercise this knowledge in a Term Report requiring them to identify existing specific clinical problem, and propose novel solutions using 'innovative'	
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	Medical Textiles. By attending the course students will come to appreciate the real-world challenges encountered in translational research.
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14.	Course contents (about 100 words) (Include laboratory/design activities): Natural and synthetic polymers and Textile-based techniques used for medical application, Fibrous extracellular matrix of human body and their characteristic features, Cell-Polymer interaction, Non-implantable materials (Wound-dressing, related hydrogel and composite products, Bandages, Gauges), Implantable biomedical devices (Vascular grafts, Sutures, Heart valves), Extra-corporeal materials (Scaffolds for Tissue engineering, Rapid prototyping, Cartilage, Liver, Blood Vessel, Kidney, Urinary bladder, Tendons, Ligaments, Cornea), Healthcare and hygiene products (Surgical Gowns, Face masks, wipes, Antibacterial Textiles, Super absorbent polymers, Dialysis, Soluble factor release), Safety, Legal and ethical issues involved in the medical textile materials.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No of lectures
1.	Introduction to healthcare and medical textile devices.	1
2	(a) Polymers used in Medical applications (Alginate, Chitosan, Silk, PLA, PGA, Carboxymethyl cellulose, Cellulose acetate etc)	3
	(b) Textile-based techniques for making Scaffolds for Tissue engineering	2
	(c) Rapid prototyping, Electrospinning	2
	(d) Design criteria & fabrication of Medical textile products: with special focus on Knitting, Braiding, 3D weaving, nonwoven techniques, spacer fabric, composites	2
3	Fibrous extracellular matrix of human body and their characteristic features; how these features can be replicated by using textile strategies	3
4	Interaction of cells on Polymeric textile structures (integrin recognition, cellular signaling process, gene expression, cytocompatibility, immune rejection)	4
5	Non-implantable materials (existing products, limitations, future direction): (a) Wound-dressing, related hydrogel and composite products (b) embroidered dressing, (c) Bandages: Simple, Light support, Compression, Orthopedic bandages (d) Gauges, (e) Healthcare and Hygiene Products, (f) International test methods and standards	4
6	Implantable biomedical devices (existing products, limitations, future direction): (a) Vascular grafts (knitting, nonwoven, electrospinning) (b) Sutures (mono / multifilament, braided, smart filaments) (c) Heart valves (knitting), (d) Hernia mesh (knitting, nonwoven, composite)	4
7	Extra-corporeal materials (existing products, limitations, future direction): (a) Cartilage (nonwoven, 3D weaving), (b) Skin (nonwoven, weaving), (c) Liver (rapid prototyping), (d) Kidney, Urinary bladder (nonwoven, 3D weaving), (e) Tendons, Ligaments (Silk filaments, braiding), (f) Cornea (Electrospinning, hydrogel composite)	5

8	Healthcare and hygiene products: (a) Surgical Gowns, masks, wipes, (b) Antibacterial Textiles, (c) Super absorbent polymers, (d) Dialysis membrane, (e) Soluble factor release (Drug, Growth factor Delivery), Enzyme (Matrix metalloprotease, proteases etc) attachment on fibrous materials, (f) Adhesive, anti-adhesive patches for Surgical application, (g) Phase change polymers & their healthcare applications (h) Coating & finishing technologies	6
9	Characterizing tests, Evaluation of commercial medical textiles products, Standards.	4
10	Fundamental aspects of safety issues for Biomedical application of textile products	1
11	Legal and ethical issues involved in the medical textiles materials	1
	Total lecture	42

16. Brief description of tutorial activities

Not Applicable

17. Brief description of laboratory activities

Module no.	Description	No. of hours
1	Some hands-on-activities will be conducted in class during lectures (design aspect of sutures; saline water absorption by different layers of incontinence products, role of textile composites and super absorbent layers)	-

18. Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1-6	Recent advancements in medical textiles, biomedical devices, use of nanofibrous membranes for topical drug delivery, implantable and non-implantable medical products and devices	21
7-11	Modern developments and recent trends in healthcare and hygiene products, testing of medical devices and products, ethical and legal issues	21

19. Suggested texts and reference materials :

1. Ed. Prof Apurba Das and Prof Alagirusamy (Technical Yarns), Dr Dipayan Das Selected chapters from books (Composite Nonwoven Materials), Woodhead Publishing
2. Robert Lanza, Robert Langer, Joseph P. Vacanti Principles of Tissue Engineering, Second Edition,
3. Mark Saltzman Tissue Engineering: Engineering Principles for the Design of Replacement Organs and Tissues, , Oxford University Press
4. Subhash Anand Medical Textiles, , Woodhead Publishing Ltd

5. JF Kennedy, SC Anand, M Miraftab, S Rajendran Medical textiles 2007: Proceedings of the fourth international conference on healthcare and medical textiles, CRC Press
6. Mary Ann Liebert Tissue Engineering Journal, Inc. Publications
7. Medical Textile monthly newsletters, Technical Textiles Net Publications
8. Ed. S.C. Anand, M Miraftab, JF Kennedy Medical Textiles and Biomaterials for Healthcare, , Woodhead Publishing Ltd, 2005
9. Various research papers to discuss about new developments

20. Resources required for the course (*itemized & student access requirements, if any*)

20.1	Software	None
20.2	Hardware	None
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	None
20.5	Equipment	None
20.6	Classroom infrastructure	Lecture room with AV facility
20.7	Site visits	None

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	-
21.2	Open-ended problems	10
21.3	Project-type activity	10
21.4	Open-ended laboratory work	-
21.5	Others (please specify)	-

Date:

(Signature of the Head of the Department)

18. Suggested texts and reference materials :

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19. Resources required for the course (*itemized & student access requirements, if any*)

19.1	Software	None
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	None (We need to buy some Medical Textile products (biomaterials) for demonstration in class (Sutures, wound dressings, surgical masks, wipes, gauges, incontinence products)

19.5	Equipment	None
19.6	Classroom infrastructure	Lecture room with AV facility
19.7	Site visits	None

20. Design content of the course (*Percent of student time with examples, if possible*)

20.1	Design-type problems	20% (term paper)
20.2	Open-ended problems	10%
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	-

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Major Project Part 1 (TXF)
3.	L-T-P structure	0-0-12
4.	Credits	6
5.	Course number	TXD802
6.	Status (<i>category for program</i>)	Core for M. Tech. (Fibre Science and Technology)

7.	Pre-requisites (<i>course no./title</i>)	None
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	TTD891

9.	Not allowed for (<i>indicate program names</i>)	Allowed only for M. Tech. (Fibre Science and Technology) students
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10.	Frequency of offering	☐ Every sem ☒ 1 st sem ☐ 2 nd sem ☐ Either sem -
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11.	Faculty who will teach the course Prof. B L Deopura, Prof. Kushal Sen, Dr. AK Agarwal, Dr. B. Gupta, Dr. D. Gupta, Dr. M.Jassal, Dr. M. Joshi, Dr. B S Butola, Dr. Sourabh Ghosh, Dr.S.Mukhopadhyay, Dr Bhanu Nandan, Dr Rajiv Srivastav, Dr. Wazed Ali
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): To learn about preparation of research plan and systematically carry out research project.
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14.	Course contents (about 100 words) (Include laboratory/design activities): Preparation of research plan, Completion of targeted research work for the semester, Presentation of research work for award of grade.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
	N A	
COURSE TOTAL (14 times 'L')		

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	N A	

17. Brief description of laboratory activities

Module no.	Description	No. of hours
	Experimental work	168
	COURSE TOTAL (14 times 'P')	168

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
	N A	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Research articles published in literature

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	Existing products from labs
20.2	Hardware	Existing products in labs or would be procured
20.3	Teaching aides (videos,	PPT

	etc.)	
20.4	Laboratory	All textile labs
20.5	Equipment	All existing equipments
20.6	Classroom infrastructure	Lecture room with AV facility for regular interaction
20.7	Site visits	Not in particular
20.8	Others (please specify)	

21. Design content of the course*(Percent of student time with examples, if possible)*

21.1	Design-type problems	
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	100%
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Major Project Part 2 (TXF)
3.	L-T-P structure	0-0-24
4.	Credits	12
5.	Course number	TXD804
6.	Status (<i>category for program</i>)	Core for M. Tech. (Fibre Science and Technology)

7.	Pre-requisites (<i>course no./title</i>)	None
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8.	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	No
8.2	Overlap with any UG/PG course of other Dept./Centre	No
8.3	Supersedes any existing course	TTD892

9.	Not allowed for (<i>indicate program names</i>)	Allowed only for M. Tech. (Fibre Science and Technology) students
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☒ 2 nd sem ☐ Either sem -
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11.	Faculty who will teach the course Prof. B L Deopura, Prof. Kushal Sen, Dr. AK Agarwal, Dr. B. Gupta, Dr. D. Gupta, Dr. M.Jassal, Dr. M. Joshi, Dr. B S Butola, Dr. Sourabh Ghosh, Dr.S.Mukhopadhyay, Dr Bhanu Nandan, Dr Rajiv Srivastav, Dr. Wazed Ali
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12.	Will the course require any visiting faculty? (yes/no)	No
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13.	Course objectives (<i>about 50 words</i>): To learn about preparation of research plan and systematically carry out research project.
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14.	Course contents (about 100 words) (Include laboratory/design activities): Continuation of planned tasks started in TXD802: Major Project Part 1 (TXF), to completion, thesis writing and presentation of complete work for award of grade.
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15. Lecture Outline(with topics and number of lectures)

Module no.	Topic	No. of hours
	N A	
COURSE TOTAL (14 times 'L')		

16. Brief description of tutorial activities:

Module no.	Description	No. of hours
	N A	

17. Brief description of laboratory activities

Module no.	Description	No. of hours
	Experimental work	168
	COURSE TOTAL (14 times 'P')	168

18. Brief description of module-wise activities pertaining to self-study component
(mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
	N A	

19. Suggested texts and reference materials

STYLE: Author name and initials, Title, Edition, Publisher, Year.

Research articles published in literature

20. Resources required for the course (itemized & student access requirements, if any)

20.1	Software	Existing products from labs
20.2	Hardware	Existing products in labs or would be procured
20.3	Teaching aides (videos, etc.)	PPT
20.4	Laboratory	All textile labs
20.5	Equipment	All existing equipments

20.6	Classroom infrastructure	Lecture room with AV facility for regular interaction
20.7	Site visits	Not in particular
20.8	Others (please specify)	

21. Design content of the course*(Percent of student time with examples, if possible)*

21.1	Design-type problems	
21.2	Open-ended problems	
21.3	Project-type activity	
21.4	Open-ended laboratory work	100%
21.5	Others (please specify)	

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Independent Study (Fibre Science and Technology)
3.	L-T-P structure	0-3-0
4.	Credits	3
5.	Course number	TXS806
6.	Status (<i>category for program</i>)	PE for M. Tech. (Fibre Science and Technology) students

7.	Pre-requisites (course no./title)	N.A.
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	Status vis-à-vis other courses (<i>give course number/title</i>)	
8.1	Overlap with any UG/PG course of the Dept./Centre	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supersedes any existing course	TTS890

9.	Not allowed for (indicate program names)	Only allowed for M. Tech. (Fibre Science and Technology) students
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☒ Either sem
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11.	Faculty who will teach the course Prof. B L Deopura, Prof. Kushal Sen, Dr. AK Agarwal, Dr. B. Gupta, Dr. D. Gupta, Dr. M.Jassal, Dr. M. Joshi, Dr. B S Butola, Dr. Sourabh Ghosh, Dr.S.Mukhopadhyay, Dr Bhanu Nandan, Dr Rajiv Srivastav, Dr. Wazed Ali	
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12.	Will the course require any visiting faculty?	No
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13.	Course objective (<i>about 50 words</i>):	
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	To undertake research oriented activity on machine design, development of software, product, process and instrumentation or in-depth study of a subject that is outside the scope of regular courses offered in the program.
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14.	Course contents <i>(about 100 words) (Include laboratory/design activities):</i> Student should undertake a research oriented activity including software development, machine design and development, product & process development, instrumentation and in-depth study of a subject which is outside the regular courses offered in the program. This study should be carried out under the guidance of a faculty member. The subject area chosen by the student should be sufficiently different from the area of major project being pursued by the student. The student should submit a detailed plan of work to the program coordinator before approval of registration for the course. The student registered for this course should give one mid-term presentation followed by a final presentation before a committee constituted by the program coordinator.
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15. Lecture Outline *(with topics and number of lectures)*- **Not applicable**

Module no.	Topic	No. of hours
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16.	Brief description of tutorial activities: Not applicable
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17.	Brief description of laboratory activities: Not Applicable
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18. Brief description of module-wise activities pertaining to self-study component (mandatory for 700 / 800 level courses)

Module no.	Description	No. of hours
1	All the activities are of self-study nature under the supervision of a faculty	42
	TOTAL	42

19.	Suggested texts and reference materials: Not Applicable.
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20. Resources required for the course (*itemized & student access requirements, if any*)

20.1	Software	Crystal ball software for simulation, Matlab etc.
20.2	Hardware	Machines and equipment
20.3	Teaching aides (videos, etc.)	None
20.4	Laboratory	All the laboratories
20.5	Equipment	Necessary machines and instruments
20.6	Classroom infrastructure	None
20.7	Site visits	Industry, if the work is undertaken outside the department.

21. Design content of the course (*Percent of student time with examples, if possible*)

21.1	Design-type problems	100% (machine design and software development)
21.2	Open-ended problems	15%
21.3	Project-type activity	70%
21.4	Open-ended laboratory work	15%
21.5	Others (please specify)	0%

Date:

(Signature of the Head of the Department)