

**Curriculum Revision
for
B. Tech.
(Textile Technology)
Programme**

**Dept. of Textile Technology
Indian Institute of Technology
Delhi
2013-2014**

Tentative Schedule of Undergraduate Courses

(The courses in red colour are the Institute core and programme linked core courses. These slots are fixed by The Institute.)

Sem	Lecture	lecture	lecture	lecture	Lecture/ Other	Other	Other	Other	L	T	P	TOTAL
I	Maths-1 / 2 (3-1-0)4	EE / CS (3-0-2)4	PH / CY (3-0-4)5	Mechanics / NONE (3-0-2)4	Intro. to Engg / Prog (0-0-2)1	Graphics / Prod. Real. (0-0-4)2	Language / None (0-0-4)2					
II	Maths-2 / 1 (3-1-0)4	CS / EE (3-0-2)4	CY / PH (3-0-4)5	NONE / Mechanics (3-0-2)4	Intro to Engg/ Prog (0-0-2)1	Prod Real./ Graphics (0-0-4)2	Language / None (0-0-4)2					
III	PL EA/EA AML120 (3-0-2)4	PL EA/ES AML130 / (3-1-2)5	Poly. Chem. (3-0-0)3	PL EA/ES AML150 / (3-1-2)5	Text. fibres (2-0-2)3	HUL ??						
IV	Yarn Manf.-I (3-0-0)3	Fabric Manf. I (3-0-0)3	Tech. TP &F (3-0-0)3	Biology (3-0-2)4/ Env. (2-0-0)2	Structure Property (3-0-0)3	Yarn Manf. Lab -I (0-0-2)1	Fabric Manf. Lab I (0-0-2)1	Prep. & Finishing Lab (0-0-3)1.5				
V	Yarn Manf.-II (3-0-0)3	Fabric Manf. II (3-0-0)3	Tech. Tex. Col. (3-0-0)3	Env. (2-0-0)2/ Biology (3-0-2)4	Mfd. Fibre Tech. (3-0-0)3	Yarn Manf. Lab -II (0-0-2)1	Fabric Manf. Lab II (0-0-2)1	Tech. Tex. Col. Lab (0-0-3)1.5				
VI	Eval. of Text. (3-0-0)3	Theory of Textile Structures (3-1-0)4	Spl. Yarns & Fabric (2-0-0)2	DE/OC/HUL	DE/OC	Mfd. Fibre Tech\ Lab (0-0-2)1	Evaluation of Textile Lab (0-0-2)1					
VII	DE/OC	DE/OC	DE/OC/HUL	DE/OC	DE/OC	Project Part I (0-0-8) 4						
VIII	DE/OC	DE/OC	DE/OC/HUL	DE/OC	DE/OC	Project Part II (0-0-12)6						

Sl. No.	Category	Symbol	B.Tech. requirement	Textile B.Tech.	Remarks	
1	Institute Core	IC	55 credits	55	Common to all disciplines	
2	Programme Linked EAS/BS	PL	0-15	66	Discipline specific as decided by the Department	
3	Departmental core	DC	65-80 with minimum 10 as DE		14	Discipline specific
4	Departmental Elective	DE				
5	Open Category	OC	10 credits	10	Open to student's choice	
6	Nongraded Core	NG	15 units	15		
			145-155 Credits + 15 nongraded units	145 +15 Nongraded		

$$55 + 66 + 14(\text{DE}) + 10 = 145$$

INSTITUTE CORE COURSES REQUIREMENT: TOTAL- 55 CREDITS**a) Basic sciences: 22 credits**

Maths	Physics	Chem.	Bio	Total
2X4=8	5	5	4	22

b) EA and ES courses: 18 credits

Elect. Eng.	Comp. Sci	Eng. Mech	Eng drawg/ Communication	Manufacturing/ product realization	Env. Studies	Total
4	4	4	2	2	2	18

c) Humanities and social Sciences: 15 credits**PROGRAMME LINKED BS/EA/ES COURSES: 14 CREDITS**

AML 120 Material Science	AML130 Experimental Methods & Analysis	AML150 Solid And Fluid Mechanics	AML 120 Material Science	Total
4(3-0-2)	5(3-1-2)	5(3-1-2)	4(3-0-2)	14

NON GRADE CORE REQUIREMENT: 15 CREDITS

Introduction to the Engg & Prog	Language and writing skills	NCC/ NSO/ NSS	Prof. ethics & social responsibilities	Communication skill /seminar	Design/ Practical experience	Total
2	2	2	2	2	2	15

DEPARTMENT CORE: 66

Sl. No.	Course No.	Course Title	L-T-P	Total Credits
1	TTL210	Textile Fibres	2-0-2	3
2	TTL211	Structure and Physical Properties of Fibres	3-0-0	3
3	TTL212	Manufactured Fibre Technology	3-0-0	3
4	TTL221	Yarn Manufacture – I	3-0-0	3
5	TTL222	Yarn Manufacture – II	3-0-0	3
6	TTL230	Polymer Chemistry	3-0-0	3
7	TTL231	Fabric Manufacture – I	3-0-0	3
8	TTL232	Fabric Manufacture – II	3-0-0	3
9	TTL241	Technology of Textile Preparation & Finishing	3-0-0	3
10	TTL242	Technology of Textile Coloration	3-0-0	3
11	TTL361	Evaluation of Textile Materials	3-0-0	3
12	TTL362	Theory of Textile Structures	3-1-0	4
13	TTL363	Speciality Yarns and Fabrics	2-0-0	2
14	TTP212	Manufactured Fibre Technology Lab	0-0-2	1
15	TTP221	Yarn Manufacture Laboratory – I	0-0-2	1
16	TTP222	Yarn Manufacture Laboratory – II	0-0-2	1
17	TTP231	Fabric Manufacture Laboratory – I	0-0-2	1
18	TTP232	Fabric Manufacture Laboratory – II	0-0-2	1
19	TTP241	Tech. of Text. Preparation & Finishing Lab	0-0-3	1.5
20	TTP242	Technology of Textile Coloration Lab	0-0-3	1.5
21	TTP361	Evaluation of Textiles Lab	0-0-2	1
22	TTD411	Major Project Part I	0-0-8	4
23	AML120	Material Science	3-0-2	4
24	AML130	Experimental Methods & Analysis	3-1-2	5
25	AML150	Solid And Fluid Mechanics	3-1-2	5
TOTAL				66

DEPARTMENT ELECTIVES: MINIMUM 14

Sl. No.	Course No.	Course Title	L-T-P	Total Credits	Spl. Cat.
1	TTL324	Multi and Long Fibre Spinning	3-0-0	3	
2	TTL331	Woven Textile Design	3-0-0	3	
3	TTL342	Colour Science	2-0-0	2	
4	TTL365	Costing and its Application in Textiles	3-1-0	4	2
5	TTL700	Modelling and Simulation in Fibrous Assemblies	2-0-2	3	
6	TTL710	High Performance and Specialty Fibres	3-0-0	3	1
7	TTL719	Functional and Smart Textiles	3-0-0	3	1
8	TTL722	Mechanics of Spinning Processes	3-0-0	3	
9	TTL724	Textured Yarn Technology	3-0-0	3	
10	TTL725	Mechanics of Spinning Machines	3-0-0	3	
11	TTL740	Science & App. of Nanotechnology in Textiles	3-0-0	3	1
12	TTL744	Env. Manag. in Textile and Allied Industries	3-0-0	3	
13	TTL746	Medical Textiles	3-0-0	3	1
14	TTL750	Science of Clothing Comfort	3-0-0	3	
15	TTL752	Design of Functional Clothing	3-0-0	3	1
16	TTL761	Costing, Project Formulation and Appraisal	2-1-0		2
17	TTL762	Prod & Operations Management in Textile Industry	3-0-0	3	2
18	TTL763	Technical Textiles	3-0-0	3	
19	TTL764	Process Control in Yarn & Fabric Manufacturing	3-0-0	3	1
20	TTL766	Design & Manuf. of Text. Reinforced Composites	3-0-0	3	1
21	TTL773	Design of Experiments and Statistical Techniques	3-0-0	3	
22	TTL782	Nonwoven Science and Engineering	3-0-0	3	1
23	TTD412	Major Project Part II	0-0-16	8	1 or 2
24	TTV701	Process Cont. and Econ. in manmade Fibre Prod.	1-0-0	1	
25	TTV702	Management of Textile Business	1-0-0	1	2
26	TTV703	Special Module in Textile Technology	1-0-0	1	
27	TTV704	Special Module in Yarn Manufacture	1-0-0	1	
28	TTV705	Special Module in Fabric Manufacture	1-0-0	1	
29	TTV706	Special Module in Fibre Science	1-0-0	1	
30	TTV707	Special Module in Textile Chemical Processing	1-0-0	1	
31	MEL754	Operations Planning & Control	3-0-2	4	2
32	MEL756	Supply Chain Management	3-0-2	4	2

33	SML304	Introduction to Marketing Management	3-1-0	4	2
34	SML780	Managerial Economics	2-0-2	3	2
35	SML760	Marketing Management	2-0-2	3	2

TENTATIVE DEPARTMENT SPECIALIZATION BASKETS OF 20 CREDITS

Spl. 1. Technical and Innovative Textiles

Spl. 2 Textile Business & Management

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Major Project Part I
3.	L-T-P structure	0-0-8
4.	Credits	4
5.	Course number	TTD411
6.	Status (<i>category for program</i>)	Department Core for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	EC120
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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	TTD411

9.	Not allowed for (indicate program names)	Only for B. Tech. (Textile 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 All textile faculty can coordinate.	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To prepare a research plan and systematically carry out research project.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Formation of project team (up to two students and up to two faculty guides); formulation of work plan completing targeted work for the semester and presentation of complete work of progress for award of grade.
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15. **Lecture Outline** (*with topics and number of lectures*): **Not Applicable**

16. **Brief description of tutorial activities:** **Not Applicable**

17. Brief description of laboratory activities:

Module no.	Experiment description	No. of hours
1	Experimental work	112
COURSE TOTAL (14 times 'P')		112

18. Suggested texts and reference materials :

Research articles published in literature.

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

19.1	Software	Existing products from labs
19.2	Hardware	Existing products in labs or would be procured
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	All textile labs
19.5	Equipment	All existing equipments
19.6	Classroom infrastructure	Lecture room with AV facility for regular interaction
19.7	Site visits	Not in particular

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

20.1	Design-type problems	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	100%
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 II
3.	L-T-P structure	0-0-12
4.	Credits	6
5.	Course number	TTD412
6.	Status (<i>category for program</i>)	Department Core for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	EC120
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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	TTD412

9.	Not allowed for (indicate program names)	Only for B. Tech. (Textile 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 All textile faculty can coordinate.	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To prepare a research plan and systematically carry out research project.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Continuation of planned tasks started in Major Project Part I, TTD411, to completion, thesis writing and presentation of complete work of progress for award of grade.
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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:

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

18. Suggested texts and reference materials :

Research articles published in literature.
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19. Resources required for the course (itemized & student access requirements, if any)

19.1	Software	Existing products from labs
19.2	Hardware	Existing products in labs or would be procured
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	All textile labs
19.5	Equipment	All existing equipments
19.6	Classroom infrastructure	Lecture room with AV facility for regular interaction
19.7	Site visits	Not in particular

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

20.1	Design-type problems	100%
20.2	Open-ended problems	-
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>)	Textile Fibres
3.	L-T-P structure	2-0-2
4.	Credits	3
5.	Course number	TTL210
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	PHL110 / MAL110 / CYL120
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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	TTP211

9.	Not allowed for (indicate program names)	No such restriction
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10.	Frequency of offering	☐ Every sem X1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Bhanu Nandan, Rajiv Srivastava, Sourabh Ghosh, Manjeet Jassal, Mangala Joshi, Ashwini K. Agrawal, Bhuvanesh Gupta, Samrat Mukhopadhyay	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To introduce the essential properties of fibre forming polymers and the natural fibres to the students. This knowledge will enable the students to develop basic understanding of various textile fibres.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Classification of fibres. Basic structure of a fibre. General properties of a fibre such as moisture absorption, tenacity, elongation, initial modulus, yield point, toughness, elastic recovery. Relationship between polymer structure and fiber properties. Detailed chemical and physical structure of natural fibres: cotton, wool and silk, their basic properties. Introduction to important bast and leaf fibres. Basic introduction to Fibre spinning. Introduction Manmade and synthetic fibres: Viscose, Acetate, Acrylic, Nylon, polyester. High Performance Fibres.	
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	Laboratory exercises would include experiments on fibre identification through physical appearance, microscopic (optical, SEM), and burning behaviour. Chemical identification through solvent treatment and elemental analysis.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Classification of fibres based on origin and chemical structure	1
2	Basic structure of a fibre	1
3	General properties of a fibre such as moisture absorption, tenacity, elongation, initial modulus, yield point, toughness and elastic recovery	2
4	Essential requirements of fibre forming polymers, Relationship between polymer structure and fiber properties	2
5	Cotton Fibre : Production of cotton, Detailed chemical and physical structure and properties	4
6	Structure and properties of important bast and leaf fibres: Jute, Kenaf, Flax, Coir, Sisal	4
7	Silk Fibre: Types of Silk, production of silk, Detailed chemical and physical structure and properties of silk fibre	3
8	Wool fibre : Detailed chemical and physical structure and properties, comparison with silk fibre	4
9	Introduction to Fibre Spinning	1
10	Regenerated and modified cellulose fibres: Acetate, Viscose	2
11	Synthetic Fibres: Acrylic, Nylon, Polyester	3
12	High Performance Fibres	1
COURSE TOTAL (28 times 'L')		28

16. Brief description of tutorial activities: NOT APPLICABLE

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17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	Fibre identification through optical and scanning electron microscopy	8
2	Moisture absorption and swelling properties of fibres	4
3	Measurement of linear density	2
4	Fibre identification through heat and flame test	2
5	Fibre identification through elemental analysis	2
6	Fibre identification through solubility tests	2
7	Identification of fibres in blend of fibres	2
8	Identification of unknown fibres in the fabric sample	2
9	Quantitative analysis of fibres in blend of fibres	2
10	Differentiation of POY and FDY polyester yarn based on extension and shrinkage behavior	2
COURSE TOTAL (14 times 'P')		28

18. Suggested texts and reference materials:

1. S.J. Eichhorn, J.W.S. Hearle et al., *Handbook of Textile Fibre Structure*, Vol. 2, Woodhead Publishing Limited, 2009.
2. M. Lewin, E. M. Pearce, *Handbook of Fibre Chemistry*, 2nd Ed., Marcel Dekker, 1998.
3. W.E. Morton and J.W.S. Hearle, *Physical properties of textile fibres*, 4th Ed. CRC Press, 2008.
4. J.E. McIntyre, *Synthetic fibres: Nylon, polyester, acrylic, polyolefin*, Woodhead Publishing Limited, 2004

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	Fibre Science Lab
19.5	Equipment	Optical and Scanning Electron Microscope, Basic labwares
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	-
20.2	Open-ended problems	-
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>)	Structure and physical properties of fibres
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 211
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	TTP211/ TTL230
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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	Supercedes any existing course	

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 Sourabh Ghosh, Bhanu Nandan, Rajiv Srivastava, Manjeet Jassal, Mangala Joshi, Ashwin K. Agrawal	
12.	Will the course require any visiting faculty?	Not required

13.	Course objective. The objective of the course is to familiarize the students with polymer composition, backbone chain configuration, tacticity, molecular motion and how those parameters determine material properties. Students will learn to appreciate role of hierarchical structures in polymers, in the context of both natural and synthetic origin polymers. After completing this course, students should be able to explain how polymer structure determines material properties, such as viscoelastic behaviour, 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. Amorphous and crystalline phases. Glass transition. Crystallization. Melting. Structures in natural and synthetic fibres. Characterization techniques. Fibre properties. Moisture absorption properties. Mechanical properties. Fibre friction. Optical properties. Thermal properties
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No of lectures
1	Basic structures of polymers, Types of polymers Homo and Copolymers, Molecular architecture, configuration, conformation, Tacticity and Stereoregularity Bondings in polymers: Primary and secondary bonding, Polymers as plastics, fibres and rubbers. Introduction to fibre structure, Requirements of fibre forming polymers, Semicrystalline nature	3
2	Physical states and transitions in polymers, Amorphous and crystalline phases, glass transition, plasticization, crystallization, melting, Factors affecting glass transition temperature (T_g) and melting temperature (T_m), T_g and T_m of fibre forming polymers	2
3	Crystallization in Polymers: Importance, Factors affecting Crystallization, Mechanism- Nucleation and Growth, Lamellar and Spherulitic Structures ; Rate of Crystallization, Crystallization in Fibers forming polymers	3
4	Basic structure of a fiber, structure of fibrils, Fiber Structure models, Fine structure of fibres in particular man-made fibres. Fine -structure of Cellulosic fibres (Cotton, viscose), PET, Nylon, PP, Acrylic	6
5	Methods of investigating physical structure of fibres : , Wide Angle X Ray Diffraction (WAXD), Differential scanning calorimetry (DSC), Thermogravimetric Analysis (TGA), Thermomechanical Analysis (TMA) / Dynamic Mechanical analysis (DMA), Fourier Transform Infrared Spectroscopy (FTIR), sonic modulus and birefringence as methods of investigating structure of fibers	7
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	Principles of Elasticity and viscoelasticity, Viscoelastic Models : Maxwell model, Kelvin Model, Eyring Model, Theories of Mechanical Properties.	3
8	Time dependent properties: creep and stress relaxation	2
9	Fibre Friction: Nature of friction in fibres, Friction in wool	1
10	Moisture absorption -and Desorption in fibres, Rate of moisture absorption and desorption, Heat of sorption, water retention and swelling. Theories of moisture absorption- general view, absorption in crystalline and amorphous regions, quantitative theories.	6
11	Electrical Properties: Dielectric properties, effect of frequency and temperature on dielectric constant. Electrical resistance and its measurement, static electricity and measurement of static charge in	2

	fibres	
12	Optical properties: Polarizability and refractive index, -Birefringence and its measurement, Hermantz Orientation Factor, Absorption and Dichroism , Reflecion and Lustre	1
13	Thermal Properties: Thermal expansion. Specific Heat, Thermal conductivity	1
14	Total lecture	42

16. Brief description of tutorial activities: NOT APPLICABLE

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17. Brief description of laboratory activities: NOT APPLICABLE

18. Suggested texts and reference materials :

1. Physical properties of Textile Fibres- WE Morton, JWS Hearle, Woodhead Publishing
2. Introduction to Polymers-Robert J. Young & P A Lovell.
3. Hand book of Textile Fibres – James Gordon Cook, Vol-1,2, Merrow
4. Handbook of Fibre Chemistry- Lewin, Pearce , CRC Press
5. Structure Formation in Polymeric Fibres, David R. Salem, Hanser Publishers.
6. Polymer Viscoelasticity,Evaristo Riande,Ricardo Diaz-Calleja, Margarita Prolongo and Rosa Masegosa, Marcel Dekker

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
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	10%
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>)	Manufactured Fibre Technology
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL212
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	TTL210/TTL211
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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	Nil

9.	Not allowed for (indicate program)	No such restriction
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10.	Frequency of offering	☐ Every sem X1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Bhanu Nandan, Sourabh Ghosh, Manjeet Jassal, Mangala Joshi, Ashwini K. Agarwal, Bhuvanesh Gupta, Rajiv Srivastava	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): The objective of the course is to introduce fundamentals of fibre formation processes including the basic understanding of polymer rheology.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Polymer rheology in shear as well as extension. Polymer entanglements. Flow instabilities in polymer fluids. Principles of solidification. Heat and mass transfer. Melt spinning. Force and momentum balance in spinline. Stress induced crystallization. Experimental observations from melt spinning of polyamides and polyesters. Solution spinning. Dry and wet spinning. Transport phenomena. Kinetic and thermodynamic effects in solution spinning. Solution spinning of viscose and acrylic fibres. Dry jet wet spinning. Post spinning processes. Drawing and heat setting. Stress-strain-structure relationship. Effect of post spinning operations on fibre structure and properties. Spin
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	finish applications. Introduction to electrospinning.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Fundamentals of Spinning	
	Spinnability of fluids and hydrodynamic stability	1
	Principles of solidification: Heat and mass transfer, phase transitions	3
2	Rheological properties of fibre-forming materials	
	Introduction to polymer viscoelasticity, stress relaxation, creep, models of viscoelastic behavior, time-temperature correspondence, polymer entanglements	2
	Shear flow in a capillary, factors affecting shear viscosity of polymer fluids	3
	Elongational flow: Elongational viscosity, Theoretical considerations, Experimental methods and results.	3
	Flow instabilities in polymer fluids	2
3	Melt Spinning	
	Engineering analysis of the process, force and momentum balance	3
	Crystallization in the spinline, Stress induced crystallization	2
	Experimental observations from melt spinning of Polyesters, polyamides, PP	3
4	Solution Spinning	
	Introduction to solution spinning, dry, wet and dry-jet wet spinning	2
	Fundamentals of solution spinning- transport phenomena, kinetics and thermodynamics including the effect of parameters on fibre structure, Solution spinning of acrylic fibres	5
	Manufacture of viscose and acetate fibres	3
5	Drawing	
	Introduction to drawing, stress-strain-structure relationship, neck drawing	2
	Thermal effects in drawing	1
	Effect of drawing on properties of fibres	1
6	Heat-Setting	
	Introduction to heat setting, internal stresses in fibres, structure development during heat-setting	2
	Effect of heat-setting on properties of fibres	2
7	Spin finish application	1
8	Introduction to Electrospinning	1
Total hours of lecture (42 times 'L')		42

16. Brief description of tutorial activities: NOT APPLICABLE

17. Brief description of laboratory activities: NOT APPLICABLE

18. Suggested texts and reference materials:

1. Fundamentals of Fibre Formation, A. Ziabicki, John Wiley & Sons.
2. Structure Formation in Polymeric Fibres, David R. Salem, Hanser Publishers.
3. Manufactured Fibre Technology, V.B. Gupta and V.K. Kothari, Springer.
4. Dynamics of Fibre formation and Processing, R. Beyreuther and H. Brunig, Springer.
5. Introduction to Polymer Viscoelasticity, M. T. Shaw, Wiley.
6. Introduction to Polymer Rheology, M. T. Shaw, Wiley.

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

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

20.1	Design-type problems	-
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>)	YARN MANUFACTURE – I
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL221
6.	Status (<i>category for program</i>)	DC for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110
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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	Supercedes any existing course	TTL221

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 R. Alagirusamy, R. Chattopadhyay, S. M. Ishtiaque, R. S. Rengasamy, Apurba Das, Dipayan Das	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): It is a foundation course in the area of staple yarn manufacture. After completing this course the students will have knowledge about the followings: • Technological processes involved in pre-spinning operations • Various machines used and their working principle • Importance of critical parameters on yarn quality	
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14.	Course contents (about 100 words) (Include laboratory/design activities): Impurities in natural fibres. Separation of trash and lint. Pre-baling operations for staple fibres. Purpose of opening, cleaning, mixing and blending of fibres. Blow room machinery and operating elements. Principles of fibre opening and cleaning in blow room. Transportation of fibre mass. Influence of process parameters on opening and cleaning. Analysis of opening and cleaning processes. Principles and methods of fibre mixing and blending. Principles of carding. Machine elements and operations in card. Sliver formation, packing and fibre configurations in sliver. Objectives, principles and methods of roller drafting. Purpose and principle of condensation of fibres. Causes of mass variation of fibrous assembly and control. Automation and recent developments in blowroom, card and draw frames. Fibre opening, carding and drawing for wool, jute and other fibres. Modification in process parameters for processing blended fibres in blowroom, card and drawframe.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Impurities in raw cotton and their origin, Pre-ginning operations, Various ginning methods and baling, Pre-baling operations for wool, jute and other fibres	2
2	Purpose of opening, cleaning, mixing and blending of fibres, Average fineness and length of mixed fibre population	2
3	Sequence of machinery and operating elements in blow room	2
4	Principles of fibre mixing and blending, Methods of mixing: Sandwich mixing and mixing of bales by automatic bale openers, Intensive mixer using multi-chutes and concept of blending delay time	3
5	Principles of fibre opening in blow room (gripped & free beating), buoyancy principles and feeding of fibrous assembly in blow room	2
6	Principles of cleaning at blow room and influence of process parameters on opening and cleaning	2
7	Analysis of opening and cleaning of fibres: Waste extraction, cleaning efficiency, fibre loss, fibre damage and fibre rupture and their control	2
8	Transportation of fibre within and between machines, Synchronization of feeding of various machines, Material flow regulation, Aerofeed system to cards	3
9	Processing of synthetic fibres and their blends in blowroom	1
10	Principles & operations of pre-carding fibre preparation for wool, jute and other fibres	2
11	Card geometry and its role on opening and cleaning	1
12	Principles of fibre opening in card (fibre opening by lickerin, carding, stripping, brushing and combing actions)	2
13	Principles of cleaning at card viz. licker-in and carding and cylinder under casing regions, Sliver formation	2
14	Formation of operational layer, Mixing action of card and fibre configurations in the sliver, Principle of autolevelling, Autolevellers in	4

	card, Modern developments in cards	
15	Carding of synthetic fibres and their blends with cotton	1
16	Principles of operation of cards for processing wool, jute and other fibres	1
17	Objectives of drafting, Principles of drafting. Roller configurations and fibre control devices	2
18	Mass variation in slivers, Periodic and non-periodic faults, Influence of doubling and drafting on mass variation in slivers	3
19	Principles of auto-levellers used in drawframes and modern developments in drawframes	2
20	Blending in drawframe, Processing of synthetic fibres and their blends with cotton in drawframes	2
21	Principles of drafting for wool, jute and other fibres	1
COURSE TOTAL (42 times 'L')		42

16. Brief description of tutorial activities: Not applicable

17. Brief description of laboratory activities: Not Applicable

18. Suggested texts and reference materials:

Fundamentals of spun yarn Technology, C. A. Lawrence, CRC Press, 2003.

Manual of Textile Technology, Volumes 1-3, W. Klein, The Textile Institute, Manchester, 1993.

The Economics, Science and Technology of Yarn Production, P. R. Lord, School of Textiles, NC State University, USA, 1981.

The Institute Series on Textile Processing. Volume 1: Opening, Cleaning, and Picking, Zoltan S. Szaloki, Institute of Textile Technology, Charlottesville, Virginia, 1976.

Technology of carding, R. Chattopadhyay, NCUTE Publication, Ministry of Textiles, Govt. Of India, 2003.

Spun Yarn Technology, E. Oxtoby, Butterworths, London, 1987.

Jute Fibre to Yarn, R. R. Atkinson, B. I. Publication, 1965.

Woolen & Worsted Spinning, Miles Collins, Abhishek Publications, 2002

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

19.1	Software	NPTEL web site
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	Yarn manufacturing laboratory
19.5	Equipment	None
19.6	Classroom infrastructure	Lecture room with AV facility

19.7	Site visits	None
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20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	10%
20.2	Open-ended problems	20%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	0%

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>)	YARN MANUFACTURE – II
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL222
6.	Status (<i>category for program</i>)	DC for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110
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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	TTL222

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 R. Alagirusamy, R. Chattopadhyay, S. M. Ishtiaque, R. S. Rengasamy, Apurba Das, Dipayan Das	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): This course is a continuation of the course Yarn Manufacture-I. On completion of the course, one will have knowledge about following: • Concepts involved in fibre fractionation, twisting, wrapping and package formation in speed frame, ring, rotor, air-jet and friction spinning machinery • Various machines used in spinning and their working principles • Importance of critical parameters on yarn quality	
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	Automations and developments in various spinning machinery.

14.	Course contents (about 100 words) (Include laboratory/design activities): Fibre fractionation and combing. Preparation of fibre assembly for combing. Principle of operations in a rectilinear comber. Combing machine elements. Theory of fibre fractionation. Roving formation: Elements of roving frame, drafting, twisting and winding in speed frame, principle and mechanism of builder motion in speed frame. Yarn formation: Elements of ring frame, drafting, twisting and winding in ring frame, design aspects of spindles, rings and travelers, builder motion in ring frame. Spinning geometry. Twist and yarn strength. Yarn doubling : Purpose of doubling and plying of yarns, ring doubling, two-for-one and three for one twisting. New spinning methods: Principles of yarn formation in rotors, friction, airjet, vortex and electrostatic spinning. Yarn structure and property comparison.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Purpose of fibre fractionation and combing	1
2	Types of combers and sequence of operations in a rectilinear comber	1
3	Combing machine elements: nipper assembly, cylinder comb, top comb, detaching rollers and their movements, Comber timing diagram, waste removal	3
4	Preparation of fibre assembly: lap doubling and sliver doubling methods; comber lap preparatory equipments	1
5	Theory of fibre fractionation. Fibre fractionation and yarn quality. Automation and modern developments in cotton comber	3
6	Principle of woolen combing and jute hackling	2
7	Working principle of speed frame: drafting, twisting and winding	2
8	Principle of flyer twisting, types and design aspects of flyers, modifications and attachments, Principle and design aspects of builder motion in speed frame, Flyer lead and bobbin lead frames	3
9	Automation and modern developments in speed frame	1
10	Ring frame: Working principle, drafting, twisting and winding	2
11	Principles of ring twisting, design aspects of spindles, rings and travellers	2
12	Builder motion in ring frame, Twist variation during cop-build	1
13	Yarn tension and balloon formation in ring spinning, spinning geometry and its impact	2
14	Automation and modern developments in ring spinning machines. Principle of compact spinning and different methods of compact spinning	2
15	Processing of synthetic fibres and their blends in roving and ring frames: processing issues and selection of process parameters	2
16	Principles of woolen and worsted spinning, mule spinning, flyer spinning	2
17	Yarn Doubling: Up-twisting, down-twisting and fancy doubling, TFO and Three for one twisting: principle of twist insertion, design aspects	2

	of twisting elements, Concept of yarn reserve on reserve disc	
18	Rotor Spinning: Mechanism of twist insertion using rotors, design aspects of rotor grooves, novel and doffing tubes and their influence on yarn properties	3
19	Airjet spinning: Yarn formation using air-jets, raw material requirements, design aspects of the air-jet nozzles, twist distribution. Air vortex spinning	2
20	Friction spinning: Twisting by friction drums, principle of twist insertion, design aspects of friction drums	2
21	Processing of synthetic fibres and their blends in new spinning systems	1
22	Other new spinning systems. Structure and property comparison for yarns from different spinning systems	2
COURSE TOTAL (42 times 'L')		42

16. Brief description of tutorial activities: Not applicable

17. Brief description of laboratory activities: NOT APPLICABLE

18. Suggested texts and reference materials:

Manual of Textile Technology, Volume 1, 3, 4, 5, W. Klein, The Textile Institute, Manchester, 1993.

The Economics, Science and Technology of Yarn Production, P. R. Lord, School of Textiles, NC State University, USA, 1981.

Manual of Cotton Spinning: The Principles and Theory of Ring Spinning, A. E De Barr and H. Catling, The Textile Institute, Butterworths, 1965..

Spun Yarn Technology, E. Oxtoby, Butterworths, London, 1987.

Open End Spinning, V. Rohlena, Elsevier Scientific Publishing Company, 1975.

Open End Spinning, R. Nield, The Textile Institute, Manchester, 1975.

Advances in Yarn Spinning Technology, Edited by C A Lawrence, University of Leeds, UK, Woodhead Publishing Series in Textiles No. 99

Jute Fibre to Yarn, R. R. Atkinson, B. I. Publication, 1965.

Woolen & Worsted Spinning, Miles Collins, Abhishek Publications, 2002

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

19.1	Software	NPTEL web site
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	Yarn manufacturing laboratory
19.5	Equipment	None
19.6	Classroom infrastructure	Lecture room with AV facility

19.7	Site visits	None
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20. Design content of the course *(Percent of student time with examples, if possible)*

20.1	Design-type problems	20%
20.2	Open-ended problems	10%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	0%

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 Chemistry
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL230
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120
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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	

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- Rajiv Srivastava, Manjeet Jassal, Bhuvanesh Gupta, Mangala Joshi, Bhanu Nandan	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): The course is about polymerization processes, structure property relationship of polymers and fiber forming polymers.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The course will deal with chain and step growth polymerization methods, polymer's macromolecular architecture, molecular weight of polymers, copolymerization, cross-linked polymers, general structure and characteristics 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	Topics	No of lectures
1	Polymers and polymerization, natural and synthetic polymers, organic reactions and mechanisms– Introduction, Basic concepts	3
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	Copolymerization	2
6	Advanced methods of chain growth polymerization – ZN, Metallocene catalysis, ATRP, RAFT, CRP	3
7	Polymerization processes – Bulk, solution, suspension and emulsion polymerizations, batch and continuous processes	4
8	Production of PE, PP and acrylics – Chemistry aspects	4
9	Polymerization – Step growth polymerization, features and reaction kinetics	5
10	Production of Nylons and Polyesters – Chemistry aspects	4
11	Polymeric networks – cross-linked polymers	2
12	Structure-property relationship- transitions in polymers, polymer solution properties	3
13	Fiber forming polymers – structural requirements and applications	2
	Total	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.	Suggested texts and reference materials : 1. Principles of Polymerization – George Odian 2. Polymer Chemistry - Carraher 3. Manufactured Fiber Technology – Gupta and Kothari 4. Handbook of Fiber Chemistry – M. Lewin, E. M. Pearce, 2nd Ed., Marcel Dekker, 1998.
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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.)	None
19.4	Laboratory	-
19.5	Equipment	-
19.6	Classroom infrastructure	Lecture room with AV facility for regular interaction,

		LCD projector, screen and white/black board
19.7	Site visits	-

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

20.1	Design-type problems	-
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>)	FABRIC MANUFACTURE – I
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL231
6.	Status (<i>category for program</i>)	DC for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110
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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	TTL231

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 V. K. Kothari, B. K. Behera, Abhijit Majumdar, Amit Rawal	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): Understanding the sequences of fabric manufacturing process. The need of yarn preparation and machines used for this purpose. Analysis of primary, secondary and auxiliary motions of the shuttle loom. Understanding the design aspects of various loom components.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Introduction to various fabric forming principles: weaving, knitting, nonwoven and	
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	braiding. Stages of woven fabric manufacturing: winding, warping, drawing and tying in and weaving. Winding: principles, precision and random winding, digicone winding, yarn tensioning and clearing. Warping: direct and sectional warping. Sizing: size materials, sizing machines, process and quality control, modern trends. Drawing and tying in. Basic fabric designs: plain, matt, rib, twill and satin, drafting and lifting plans. Primary motions of shuttle looms: cam shedding, cam designs, dobby and jacquard systems, picking systems, loom timing, beat up, sley eccentricity. Secondary and auxiliary motions: take up, let off, warp and weft stop and warp protecting motions.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Introduction to various fabric manufacturing methods like weaving, knitting, nonwoven and braiding, product range and applications, sequence of woven fabric manufacture, Warp, weft, crimp, cover, areal density and related calculations	2
2	Winding, Objectives of winding, types of packages, yarn withdrawal from different packages, wind, wind per double traverse, angle of wind. Types of winders, drum driven and spindle driven winders, expression for winding speeds, cone winding. Package density, problems in winding, patterning, gain, step precision winder, Conditions for uniform building of cheese and cones, accelerated grooved drums	4
3	Yarn tensioning, objectives, additive and multiplicative tensioners, optimization of winding tension. Yarn clearing, principles of mechanical and electronic clearers, classimat faults, winding cuts, splicing and knotting. Pirn winding, shape and build of the pirn, consistency of pirn diameter, Calculations related to winding process.	4
4	Warping, Objectives of warping, passage of warp, warping creels, efficiency of warping. Beam warping or direct warping, machines, Yarn tension in warping, leasing and beaming, control systems in warping. Sectional warping, objectives, passage of warp, machine drive Calculations related to beam and sectional warping.	4
5	Sizing, Objectives of sizing, sizing-weaving curve. Sizing ingredients, starch, modified starch, synthetic size materials, PVA, Acrylic size, CMC, Polyester resin, recipe for different yarns. Sizing machine elements, creel designs, size box, 1 dip and 1 nip, 2 dip and 2 nip, squeeze rollers, factors influencing the pick-up of size.	4
6	Drying methods and systems, head stock, stretch in sizing, tension control mechanisms. Modern trends in sizing, single end sizing, prewetting, control of sizing parameters. Quality evaluation of sized yarns, criteria for assessment, tensile and abrasion properties, loom action abraders. Calculations related to production, size add-on, size pick up and water evaporation.	4
7	Fabric structure, classification, notation of weave, draft and peg plan. Plain weave and its derivatives, warp rib, weft rib and matt weaves. Twill weaves, warp and weft faced twills, angle of twill, pointed twill, broken twill. Satin and sateen weaves, honey comb, mock-leno weaves	4
8	Weaving, classification of looms, primary motions, Introduction of	4

	shedding mechanisms, distinct and indistinct shed, cam or tappet shedding system, expression of lift of the tappets and warp strain. Dobby and jacquard shedding, limitations of tappet shedding, rotary dobby, different types of jacquards, electronic jacquard. Designing of cam, linear and SHM cam. Reversing mechanisms, roller and spring mechanisms, geometry of the shed, bending factor and effect of shed timing on bending factor.	
9	Picking systems, shuttle picking, cone over pick, cone under pick systems. Motion of shuttle, catapult effect, nominal and actual displacement, shuttle checking. Loom timing, relation between shuttle velocity and loom speed, loom width and rate of weft insertion Parallel pick and link pick, expression for power required for picking, shuttle checking	4
10	Movement of sley, beat up, sley eccentricity and the factors influencing it. Expressions related to sley displacement, velocity and acceleration. Effects of sley eccentricity on beat up force and timing available for shuttle flight. Beat up force, weaving resistance, bumping conditions, temples.	4
11	Take up motions, objectives, negative and positive take up systems, design principles of take up systems. Let off motions, negative and positive let off motions, tension variations. Auxiliary motions, weft stop motions, warp protector motions, loose reed and fast reed mechanisms, warp stop motions. Automatic looms, weft feelers, bobbin change systems, weft mixing, drop box motions.	4
COURSE TOTAL (42 times 'L')		42

16. Brief description of tutorial activities: Not applicable

17. Brief description of laboratory activities: Not Applicable

18. Suggested texts and reference materials:

- 1) Weaving mechanism by Marks and Robinson, Textile Institute
- 2) Weaving: Conversion of Yarn to Fabric by Lord and Mohamed
- 3) Woven cloth construction by Robinson, Textile Institute
- 4) Textile Mathematics by J. E. Booth (Volume III), Textile Institute.
- 5) Textile Sizing by Goswami, Anandjiwala and Hall, Woodhead Publisher
- 6) Yarn winding by Banerjee and Alagirusamy (NCUTE publication)
- 7) NPTEL lectures on Fabric Manufacturing I

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

19.1	Software	NCUTE CBTs
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	Fabric manufacturing laboratory
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%
20.2	Open-ended problems	10%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	0%

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>)	FABRIC MANUFACTURE – II
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL232
6.	Status (<i>category for program</i>)	DC for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	TTL231
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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	TTL232

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 V. K. Kothari, B. K. Behera, Abhijit Majumdar, Amit Rawal	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To understand the principles fabric manufacturing in shuttle-less looms, knitting, nonwoven and braiding systems.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Shuttleless looms: Principles of weft insertion in projectile, rapier, air-jet and water-jet looms, comparison of various weft insertion systems, principles of two phase, multiphase, circular and narrow fabric weaving. Leno weaving, Triaxial weaving. Knitting: Basic weft and warp knitted constructions, cams and needles, different weft and warp knitted structures and their properties, weft and warp knitting machines. Nonwovens: Definitions and classifications, production technology, selection criteria	
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	and important properties of fibres used, different types of webs and bonding techniques, production and properties of needle punched, adhesive bonded, thermally bonded, hydroentangled, spun bonded and meltblown fabrics. Braided structures: Types of braiding processes, classification of braids, braid geometry, structure-property relationship, over braiding.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Limitations of shuttle looms, Principles of weft insertion in shuttle-less looms	1
2	Principle of picking in projectile loom, sequence of weft insertion, types of projectile, projectile guides, matched cam shedding, cam beat-up, power required for picking in torsion bar picking system, timing of different operations.	3
3	Rapier picking system, flexible and rigid rapier, rapier heads and weft transfer, loop transfer and tip transfer, rapier drives, movement pattern of weft in rapier picking system	2
4	Fluid jet looms, Air jet and water jet weft insertion system, streamline and turbulent flows, fluid drag, nozzle design, velocity of jet and weft, air guiding devices, guide plates, confuser, profile reed, relay nozzles and their types, timing of relay nozzles, weft accumulators, timing of air-jet and water-jet loom operations, tension profile in weft, factors influencing the weft insertion in air-jet loom.	4
5	Principles of fabric formation on two phase, multiphase, circular and narrow fabric weaving. Leno weaving, Triaxial weaving.	2
6	Basic elements of weft and warp knitted constructions: loop, float, tuck. Course, wale and stitch density. Weft knitted structures: single jersey, rib, purl, double jersey and interlock, graphical and needle notations. Primary and secondary knitting elements: different types of needles, knitting cams and their functions, sequence of loop formation on warp and weft knitting machines	4
7	Geometry of a loop in plain knitted fabric, spirality and curling, control of loop length and fabric weight. Dimensions and properties of knitted fabrics: tightness factor, porosity, areal density of knitted fabrics, course, wale and stitch density constants, loop shape factor. Weft knitting machines: flat bed and circular machines, needle arrangement and cam tracks in single jersey, double jersey and interlock machines, robbing back, productivity of knitting machines, Calculations related to knitting.	4
8	Warp knitting: Tricot and Raschel warp knitting machine, needle bar, sinker bar and guide bars and their movements, shogging and swinging, lapping diagrams, open and closed lapping. Warp knit structures: lockknit, sharkskin, queenscord etc., Double bed warp knitting machines.	4
9	Nonwovens: Introduction and classification, dry, wet and polymer laid nonwovens, mechanical, thermal, and chemical bonding of nonwovens	1
10	Raw material for nonwovens: natural, synthetic fibres and their properties, selection of fibres according to application.	2
11	Web preparation: Principles of dry laying techniques, carding, cross laying, parallel laying, airlaying, and fiber orientation distributions	1
12	Needlepunched nonwovens : Needlepunching process, barbed needles and their selection, depth of needle penetration, punch density, structure-property relationships and their applications	3

13	Hydroentangled nonwovens: Hydroentangling process, high pressure water-jets and calculations of specific energy and impact force, structure, properties and their applications.	2
14	Spundonded and meltblown nonwovens: Principles of polymer laying techniques, operating variables, bonding techniques, structure, properties and their applications.	2
15	Thermally bonded nonwovens: Principle of thermal bonding, raw materials, calendar bonding, through-air bonding, thermal radiation and ultrasonic bonding, structure, properties and their applications.	3
16	Braids: Introduction and classification, circular braids, flat braids, triaxial braids, diamond, regular and hercules braids, complex shape and 3D braids, maypole braiding machine and its working principle.	1
17	Geometry of braided structures: braid angle, helical length, braid diameter, pitch, cover factor, fibre volume fraction.	1
18	Braided structures: Braid kinematics and tensile mechanics, basics of over-braiding, structure, properties and their applications.	2
COURSE TOTAL (42 times 'L')		42

16. Brief description of tutorial activities: Not applicable

17. Brief description of laboratory activities: Not Applicable

18. Suggested texts and reference materials:

1. Weaving Technology and Operations by Ormerod
2. Handbook of Weaving by S. Adanur
3. Flat knitting by Samuel Raj, Bamberg Publisher
4. Circular Knitting by Iyer, Mammel & Schach, Bamberg Publisher
5. Knitting technology by Spenser
6. Fundamentals and advances in knitting technology by Sadhan Ray, Woodhead.
7. NPTEL lectures on Knitting Technology
8. S. J. Russell, Handbook of nonwovens (2007), Woodhead publishing.
9. W. Albrecht, H Fuchs, W. Kittelmann, Nonwoven fabrics (2003), Wiley-VCH Verlag.
10. W.A. Douglass, Braiding and Braiding Machinery (1964), Centrex Publishing Company

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
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	40%
20.2	Open-ended problems	-
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>)	Technology of Textile Preparation and Finishing
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL241
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	
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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	TTL241

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 B S Butola, Samrat Mukhopadhyay, Kushal Sen, Deepti Gupta	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To introduce the aspects of textile pretreatment and finishing to the students.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Natural and added impurities in textiles. Singeing, desizing, scouring, bleaching, mercerisation and optical whitening of cotton. Combined preparatory processes Carbonisation, scouring and bleaching of wool, degumming of silk. Preparation of synthetic fibres and blends, heat setting. Machinery for preparation of textiles. Surfactants and their application. Introduction to chemical and mechanical finishes. Chemical finishes for hand modification. Biopolishing, easy care, oil, water and soil repellent finishes. Fire retardancy, antimicrobial finishes. Finishes for wool. Mechanical finishes like shrinkproofing and calendering; Raising, sueding and emerising. Low liquor application techniques and machinery; Stenters and dryers.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Natural and added impurities in textiles. Natural impurities in cotton, wool and silk. Oils and lubricants. Chemistry of sizing agents. Natural and synthetic sizes. Process sequence in chemical wet processing, Singeing, desizing, scouring, bleaching, mercerisation and optical whitening of cotton.	3
2	Singeing of different kind of fabrics. Hydrolytic and oxidative desizing, Enzymatic desizing	3
3	Mechanism of hydrophobic soil removal, Surfactants and their application. Conventional and solvent scouring of cotton, enzymatic scouring, Assessment of scouring efficiency	3
4	Bleaching with oxidative bleaching agents. Use of sod. Hypochlorite, hydrogen peroxide, sod. Chlorite, peracetic acid. Assessment of bleaching efficiency	3
5	Mercerization of cotton with sodium hydroxide and liquid ammonia, process parameters, effect on fibre structure and properties, discussion on recent developments	3
6	Chemistry and application of Optical whitening agents, Mechanism of action	2
7	Introduction. Physics of heat-setting. Heat-setting and structural parameters. Mechanisms of heat-setting. Heat setting behaviour synthetic fibres, Methods of heat-setting, Effect of heat-setting on properties of synthetic fibres, settability and the measurement of the degree of set.	3
8	Machinery for batch, semi-continuous and continuous processes	1
9	Introduction to finishing methods - concepts	1
10	Dry and wet methods of finishing - low liquor methods, advances in these technologies and water saving techniques in modern finishing.	3
11	Easy care finishing, Easy care properties and application, Formaldehyde free finishing	2
12	Anti- microbial finishing, Mode of action, treatment, Biocides – developments, testing of anti-microbial finishes	2
13	Flame retardant finishing, burning and flame retardancy, current flame retardant finish, mechanism of action, application methods, use on apparels and technical textiles, evaluation	3
14	Mechanical finishing – calendaring, emerising, raising and compressive shrinkage	2
15	Water repellency – theory, fabric construction, water repellent finishes, test methods for water repellency	3
16	Anti-static finishes	1
17	Wool finishing – control of shrinkage, processing – issues and options, commercial routes	2
18	Coating, lamination, bonding	2
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 APLICABLE

Module no.	Experiment description	No. of hours
1		
2		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials:

1. Chemical Technology in the pre-treatment process of textiles, S R Karmakar, 1999, Elsevier Science
2. Textile Scouring & Bleaching by E.R.Trotman, B.I. Publications, New Delhi.
3. Handbook of Fibre Science and Technology- Volume I: Chemical Properties of fibers and fabrics fundamentals and preparation Part-A and B. ed. Mena Chem Lewin and Stephen B-Sello. Marcel Dekker Inc. New York.
4. Textile Finishing, (Ed.) Derek Heywood, 2003, Society of Dyers and Colorists
5. Chemical Finishing of Textiles, W D Schindler and P J Hauser, Woodhead Publishing, 2004

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
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
20.2	Open-ended problems	10
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	70% (Lectures and interactions)

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>)	Technology of Textile Coloration
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL242
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (<i>course no./title</i>)	TTL241
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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	TTL242

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 B S Butola, Samrat Mukhopadhyay, Kushal Sen, Deepti Gupta	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To introduce the aspects of textile coloration to the students.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The principles of dyeing and printing of textile materials. Basic characteristics of dyes, chemical structure of dyes, and classification of dyes. Dyeing equipment and the specific dyes and procedures used to dye textiles. Evaluation of Fastness. Methods of printing namely, roller, screen, transfer, ink jet and the preparation of printing paste. Direct, discharge and resist printing styles. Physical chemistry of fibre/fabric dyeing. Physicochemical theories of the application of dyestuffs to textile and related materials, including the thermodynamics and kinetic principles involved.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Introduction to physical basis of colour, chemical constitution of coloured organic compounds, chromophores, auxochromes, UV-Visible spectrophotometry, Beer Lambert's law, classification of dyes	3
2	Direct dyes, constitution, physical and chemical characteristics, classification, application on cellulosic textiles, reactant fixable direct dyes, after treatment to improve washing fastness	3
3	Reactive dyes, constitution, physical and chemical characteristics, reactive group types and reactivity, mono and bifunctional reactive dyes with emphasis on chloro-triazine and vinyl sulphone dyes, mechanism of dye reaction with cellulose, application on cellulosic textiles, batch, semi and continuous methods, washing- off	3
4	Vat dyes, constitution, physical and chemical characteristics, role of auxiliaries in dyeing, application on cellulose, indigo dye, application on cellulosic yarns for denim manufacture,	3
5	Acid dyes, constitution, physical and chemical characteristics, classification, application on wool, silk and nylon, role of pH in dyeing, leveling agents, syntan process for improving wash fastness, chrome dyeing process	3
6	Basic dyes, constitution, physical and chemical characteristics, acrylic fibre characterization for dyeing purpose, application on acrylic textiles, leveling agents, dyeing thermodynamics and kinetics	3
7	Disperse dyes, constitution, physical and chemical characteristics, application on polyester, dyeing thermodynamics and kinetics, dyeing theories, carrier dyeing, application on polyester by exhaust and continuous dyeing methods, rapid dyeing of polyester	3
8	Physicochemical theories of the application of dyestuffs to textiles, blends dyeing	1
9	Dyeing equipments and machinery, evaluation of fastness	2
10	Production and properties of printing paste – thickeners and print paste rheology, print paste production	2
11	Screen printing – semi-automatic, automatic screen and rotary printing	4
12	Styles of printing – direct, transfer – sublimation, melt and film release, resist, discharge, fixation and after treatment process,	4
13	Carpet printing	2
14	Digital Printing	2
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

18. Suggested texts and reference materials:

1. **Cellulosics Dyeing**, Edited by John Shore, 1995 Society of Dyers and Colorists
2. **Synthetic Fibre Dyeing**, Edited by Chris Hawkyard, 2004, Society of Dyers and Colorists
3. **Textile Printing**, Revised Second Edition Edited by Leslie W C Miles, 2003, Society of Dyers and Colorists

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
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	-
20.2	Open-ended problems	-
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>)	Multi and Long Fibre Spinning
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL324
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	TTL 221/ TTL 222/ TTL 231/ TTL 232
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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	TTL324

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 Apurba Das, R. Alagirusamy, R. Chattopadhyay, S. M. Ishtiaque, R. S. Rengasamy, Dipayan Das	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): On completion of the course, the student will have knowledge about the following: • Challenges involved in multi-fibre spinning. • Various machines used in long and hard fibre spinning and their working principles • Importance of critical parameters on blended and long fibre spun-yarn quality • Quality and process control related knowledge of all the above yarn spinning systems.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Blending of fibres during staple fiber spinning , Characteristics of manmade fibres and their spinnability. Blending at draw frame. Fundamentals of strictly similar yarns. Processing of manmade fibres and blends on staple fibre spinning system. Properties of blended yarns. Spinning of dyed fibres. Mélange yarns. Worsted /semi-worsted/Woolen spinning. Jute and Flax Spinning. Tow to top Conversion. Bulk yarn. Spun silk yarn
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15. Lecture Outline (*with topics and number of lectures*)

Module no.	Topic	No. of hours
1	Blending of fibres during staple fiber spinning	3
	Objectives, Tinting, Selection of blend constituents, Mechanics of blending, Merits and demerits of different blending methods	
2	Blending at draw frame and other places	2
	Number of fibres in the cross section of a blended yarn, Selection of number and hank of draw frame sliver, Index of blend irregularity	
3	Fundamentals of strictly similar yarns	3
	Linear density of strictly similar yarns, Twist factor of strictly similar yarns, Proportion area of cross section of blend components in strictly similar yarns, Derivations, calculations and problems related to strictly similar yarn	
4	Man made fibre quality requirements	4
	Physical, mechanical and structural properties of the manmade fibres, particularly with reference to the staple spinning, Physiochemical properties (moisture effect, thermal behaviour, impact of light and weather) of the manmade fibres, Spin finish application on staple manmade fibres,	
5	Processing of manmade fibres	5
	Requirements of various processing parameters (speeds, settings etc.) during processing of manmade fibres and their blends in blow room, carding, drawframe, roving frame, ring frame, rotor & vortex spinning, Specific changes required in the process while shifting from cotton to spinning of manmade fibres and their blends. Problems and their remedies in spinning of manmade fibres and their blend	
6	Properties of blended yarns	3
	Mechanical properties, prediction of tenacity based on Hamburger's model	
7	Dyeds fibre spinning	1
	Need of spinning of dyed fibres, Methods followed in the industry	
8	Mélange yarn	1
	Uses of mélange yarn, Methods of manufacturing of mélange yarn	
9	Woollen, semi-worsted, and worsted spinning	10
	Details of process flow of woollen, semi-worsted and worsted spinning systems, Principles of opening, & cleaning, carding, gill-drawing, combing, roving frame and spinning, Basic difference with cotton	

	system, Calculations: Card production, delay factor, fiber load on swift (cylinder), & worker & stripper, transfer factor	
10	Flax and jute spinning Process sequence of flax and jute spinning, opening (hackling), carding, gill drawing, spinning of jute and flax yarns	4
11	Tow to top conversion Requirements, Process sequence of tow to top conversion, methods of tow to top conversion	3
12	Bulked yarns Methods of manufacturing bulked yarns, impact of different process parameters (temperature, stretch ratio etc) on bulk development	2
13	Spun silk yarn Principles of production of spun silk yarn	1
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

18.	Suggested texts and reference materials: Spinning of manmades and blends on cotton system, K. R. Salhotra, The Textile Association, India, 2004 Short-staple spinning series – “Man-made fibres and their processing (Vol. – 6), W. Klein, The Textile Institute, Manchester, 1984 Textile yarns, technology, structure, & applications, B. C. Goswami, J. G. Martindale & F. L. Scardino, John Wiley & Sons Inc, 1977 Textile Progress:- “Woolen-yarn manufacture”, (Vol. 15, No. ½), D. A. Ross, G. A. Carnaby & J. Lappage Spun yarn technology, E. Oxtoby, Butterworth-Heinemann, Boston, MA, 1987 Wool science and technology, W. S. Simpson & G. H. Crawshaw, Woodhead Publishing Ltd., 2002 Jute: Fibre to Yarn, R. R. Atkinson, Chemical Publishing Company, 1965 The structure of yarn, W. Zurek, National Center for Scientific, Technical, and Economic Information, Warsaw, 1975.
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	Fundamentals of Spun yarn technology, C. A. Lawrence, CRC Press, 2003
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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.)	Blackboard, PPT
19.4	Laboratory	None
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	15%
20.2	Open-ended problems	15%
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	20% (Group Discussion)

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>)	Woven Textile Design
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL331
6.	Status (<i>category for program</i>)	DE for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	TTL231
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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	Supercedes any existing course	TTL331

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 B. K. Behera, Abhijit Majumdar, Amit Rawal	
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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 impart knowledge on - weave design, construction particulars, manufacturing techniques and applications of various standard woven textile structures and - weaving requirements and calculations related to production of various woven constructions.	
14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>):	

	Elements of woven design. Construction of elementary weaves; plain, twill, satin weaves and their derivatives. Rib and cord structures. Construction of standard woven fabrics; poplin, sheeting, denim, drill and jean, gabardine, granite, diamond and diaper weaves, Honey comb, Huckaback and Mockleno weaves. Colour effect on woven design. Dobby design, stripes and checks. Construction of jacquard design. Figuring with extra threads. Damasks and Brocades. Double cloths. Multilayer fabrics. Tapestry structures. Gauze and Leno structures. Whip cord and Bedford cord. Pique and Wadded structures. Terry pile structures. Velvet and velveteen. Axminster carpet structures. Indian traditional designs. Introduction to CAD for woven designs.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Elements of woven design, method of fabric representation, weave repeat unit, draft and peg plan, weavability calculation	2
2	Construction of elementary weaves; plain, twill, satin weaves and their derivatives	2
3	Rib and cord structures, Fancy rib and cord weaves	1
4	Construction of standard woven fabrics; poplin, sheeting, denim, drill and jean, gabardine, granite, diamond and diaper weaves	4
5	Honey comb, Huckaback and Mockleno weaves, properties and applications	2
6	Colour effect on woven design, Dobby design, stripes and checks, simple colour and weave effect and compound colour and weave effects, Figured colour and weave	4
7	Construction of jacquard design, Harness and design calculation, Development of figures, Composition of design, Geometrical ornamentation	4
8	Figuring with extra threads, Extra warp figuring and extra weft figuring, Imitation extra thread effects	2
9	Damasks and Brocades, Multi warp brocade and multiweft brocade	2
10	Double cloths, self stitched double cloths, wadded double cloths centre- stitched double cloths	2
11	Multilayer fabrics, treble cloth and belting structure	2
12	Tapestry structures, simple weft face tapestry and combined warp and weft face tapestry structures	2
13	Gauze and Leno structures	1
14	Whip cord and Bedford cord, Pique and Wadded structures	2
15	Terry pile structures, warp pile and weft pile structures, single face and double face, cut pile structures	2
16	Velvet and velveteen, Construction principle and applications	2
17	Axminster carpet structures, Spool Axminster and Gripper Axminster system, Spool-Gripper combined system	2
18	Indian traditional designs, Ekat, phulkari, potola, himroo, kani jamawar	2
19	Introduction to CAD for woven designs.	1
20	Construction / specifications of some standard fabrics	1
		42

16.	Brief description of tutorial activities: Not applicable
17.	Brief description of laboratory activities: Not Applicable
18.	Suggested texts and reference materials: 1. Watson's Textile Design and colour by Z Grosicki, Universal Publishing Corporation 2. Watson's Advanced Textile Design, by Z Grosicki, Universal Publishing Corporation 3. Hand book of Textile design by Jacquie Wilson, Woodhead Publication

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	Nil
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	100%
20.2	Open-ended problems	0%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	0%

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>)	Colour Science
3.	L-T-P structure	2-0-0
4.	Credits	2
5.	Course number	TTL342
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students and OC for others

7.	Pre-requisites (course no./title)	PHL110/CYL120
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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	

9.	Not allowed for (indicate program names)	Only for textile B. Tech.
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem ☐ 2 nd sem ☐ Either sem Once in a year, any semester
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11.	Faculty who will teach the course- Dr Samrat Mukhopadhyay/Dr B S Butola	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): The subject would deal with the physics and application of color science in Textile industry, Techniques for colour measurement and colour recipe formulation
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The course will deal with aspects of colour science that are important to the colour technologist in the day-to-day manufacture and control of coloured products in textile applications.
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15. **Lecture Outline** (*with topics and number of lectures*)

Module no	Topics	No of lectures
1	Light – the visible spectrum, discussion Sources – Planckian radiators, Concept of illuminants and sources, Standardization and light interaction	4
2	The measurement of colour – Colorimeter and spectrophotometer, Developments in spectrophotometry Application of spectrophotometry to dyes	3
3	Colorimetry and CIE system- additive and subtractive mixing, Inadequacy of primaries, Concept of standard observer functions, Tristimulus values, Chromaticity diagrams Metamerism - types	4
4	Colour-order systems – Munsell colour system xyY colour space, Hunter Lab colour space Concept of uniform colour spaces, Colour difference and colour scales	4
5	Perception of colour – spectral responses of the eye, sensitivities of eye Herrings color theory and opponent colour theory, Composite model of color vision Photometry, Photopic and scotopic vision	3
6	Colour measurement in textile industry On line colour measurement Colour of dry and wet fabrics, colour of finished fabrics, Grading of cotton by colour measurement	3
7	Visual and instrumental evaluation of whiteness	2
8	Colour shade sorting	1
9	Camera based colour measurement, colour management	2
10	Determining color uncertainty	2
	Total (28 times 'L')	28

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.	Suggested texts and reference materials : 1. Color - A Multidisciplinary Approach, Heinrich Zollinger, Wiley 2. Colour Measurement - Principles, Advances and Industrial Applications, ed. M L Gulrajani, Woodhead 3. Colorimetry - Fundamentals and Applications, Noboru Ohta, John Wiley and Sons 4. Colour Physics for Industry, McDonald, Society of Dyers and Colorists, London
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19.	Resources required for the course (itemized & student access requirements, if any)	
19.1	Software	Color matching software.
19.2	Hardware	Color matching system

19.3	Teaching aides (videos, etc.)	-
19.4	Laboratory	-
19.5	Equipment	-
19.6	Classroom infrastructure	Lecture room with AV facility for regular interaction, LCD projector, screen,
19.7	Site visits	-

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

20.1	Design-type problems	10%
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>)	Evaluation of Textile Materials
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL361
6.	Status (<i>category for program</i>)	DC for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110
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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	Supercedes any existing course	Nil

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 Apurba Das, Dipayan Das, B. K. Behra, R. Chattopadhyay, B. S. Butola, R. Alagirusamy, S. M. Ishtiaque, R. S. Rengasamy, Abhijit Majumdar, Amit Rawal, Samrat Mukhopadhyay	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): After completing this course the students will have knowledge about following: • Sampling techniques & analysis of test results • Principles of instrument used for evaluation of fibres , yarns and fabric characteristics • Test procedures & influence of test parameters on results	
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14.	Course contents (about 100 words) (Include laboratory/design activities): <i>Introduction to textile testing</i> <i>Sampling and basic statistics:</i> Selection of samples for testing; Random and biased samples; Different types of sampling of textile materials; The estimation of population characteristics from samples and the use of confidence intervals; Determination of number of tests to be carried out to give chosen degree of accuracy; Test of significance of means and variance; Related numerical; Quality control charts and their interpretation; Standard tests, analysis of data and test reports, Correlation and coefficient of determination; Analysis of variance (ANOVA). <i>Testing methods:</i> Measurement of length, fineness and crimp of fibres; Determination of maturity, foreign matter, and moisture content of cotton; Principles of AFIS, HVI etc.; Measurement of twist, linear density and hairiness of yarn; Evenness testing of silvers, rovings and yarns; Analysis of periodic variations in mass per unit length; Uster classimat; Spectrogram and V-L curve analysis; Tensile testing of fibres, yarns and fabrics; Automation in tensile testers; Tearing, bursting and abrasion resistance tests for fabrics; Pilling resistance of fabrics; Bending, shear and compressional properties of fabrics, fabric drape and handle (KESF, FAST etc); Crease and wrinkle behavior; Fastness characteristics of textiles; Matching of shade; Air, water and water-vapour transmission through fabrics; Thermal resistance of fabrics; Testing of interlaced and textured yarns; Special tests for carpets and nonwoven fabrics. Testing of special yarns (textured yarns, core yarn, ropes, braids etc). Testing of special fabrics (different types of nonwovens, carpets, different types of technical textiles like bullet proof fabrics, UV protective fabrics, EMS fabrics etc.)
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Introduction to textile testing	1
2	Selection of samples for testing; Random and biased samples; Different types of sampling of textile materials	2
3	The estimation of population characteristics from samples and the use of confidence intervals; Related numerical	2
4	Determination of number of tests to be carried out to give chosen degree of accuracy; Related numerical	2
5	Test of significance of means and variance; Related numerical	2
6	Quality control charts and their interpretation; Standard tests, analysis of data and test reports	1
7	Correlation and coefficient of determination; Analysis of variance (ANOVA).	2
8	Measurement of fibre length	2
9	Measurement of fibre fineness	2

10	Evenness testing of laps, slivers, roving and yarns & numerical on evenness, index of irregularity, limit irregularity of fibrous strands	4
11	Analysis of periodic variations in mass per unit length; Uster classimat; Spectrogram and V-L curve analysis	2
12	Measurement of yarn hairiness	1
13	Tensile testing of fibres, yarns and fabrics; Automation in tensile testers	4
14	Tearing, bursting and abrasion resistance tests for fabrics; Pilling resistance of fabrics	3
15	Bending, shear and compressional properties of fabrics; Fabric drape and handle	2
16	Fastness characteristics of textiles (light fastness, wash fastness, crock fastness etc.); Matching of shade	3
17	Testing of air, water and water-vapour transmission through fabrics; thermal resistance of fabrics	2
18	Testing of special yarns (textured yarns, core yarn, ropes, braids etc).	1
19	Testing of special fabrics (nonwovens, carpets, technical textiles such as bullet proof fabrics, UV protective fabrics, EMS fabrics etc.)	4
COURSE TOTAL (42 times 'L')		42

16. Brief description of tutorial activities: Not applicable

17. Brief description of laboratory activities: NOT APPLICABLE

18. Suggested texts and reference materials:

3. Text/References

- i) Physical Testing of Textiles by B. P. Saville, 1999, Woodhead Publishing Ltd., U. K.
- ii) Principles of Textile Testing by J. E. Booth, 1961, Heywood Books, London
- iii) Testing and Quality Management – Edited by V. K. Kothari, IAFL Publications, New Delhi
- iv) Handbook of Textile Testing and Quality Control by E. B. Grover and D. S. Hamby
- v) Any basic book on applied statistics

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

19.1	Software	NPTEL web site
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT, Animations, Videos
19.4	Laboratory	Textile testing and textile chemistry laboratories
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	10%
20.2	Open-ended problems	20%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	0%

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>)	Theory of Textile Structures
3.	L-T-P structure	3-1-0
4.	Credits	4
5.	Course number	TTL362
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	TTL 221/ TTL 222/ TTL 231/ TTL 232
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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	TTL362

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 V. K. Kothari, S.M. Ishtiaque, R. Chattopadhyay, B. K. Behera Abhijit Majumdar, Dipayan Das, Amit Rawal	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): This course is designed to provide the students with an in-depth understanding of the theoretical analysis of textile structures (yarns and fabrics) and their responses to mechanical deformations.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Basic characteristics of yarn structure. Köchlin's theory of relations among yarn count, twist, packing density, and diameter. Helical model of fibres in yarns. Radial migration of fibres in yarns. Tensile behavior of yarns. Theory of yarn mass variation. Theory	
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	of plied yarn. Basic characteristics of fabric structure. Flexible and rigid thread models of woven fabric geometry. Tensile, bending, and shear deformation of woven fabric. Geometry of knitted and nonwoven fabrics.
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15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Basic characteristics of yarn structure Yarn count, Fibre orientation in yarn, Number of fibres in yarn cross-section, Fibre packing density in yarn, Spinning-in coefficient, Yarn diameter, Diameter multipliers, Yarn twist, Twist coefficients, and Twist intensity	2
2	Relations among yarn count, twist, packing density, and diameter Köchlin's theory: Assumptions, Consequences, Limitations, and Corrections	2
3	Helical model of fibres in yarns Assumptions of helical model, Theoretical determination of number of fibers in yarn cross-section, Yarn retraction based on helical model, Limits of yarn twist	3
4	Radial fibre migration in yarns General description of fibres in yarn, Treloar's theory of fibre migration, Characteristics of fibre migration, Neckár's model of equidistant migration, Experimental validation	3
5	Tensile behaviour of yarns Strength of fibre bundle, Hamburger's theory of strength of blended fibre assembly, Gegauff's theory of relation between fibre strain and yarn strain, Poisson's ratio, Tensile force utilization, Twist-tenacity relation, Peirce's model of yarn strength as a function of gauge length, Experimental verifications, Failure mechanisms of different technological yarns	5
6	Theory of yarn mass variation Martindale's theory, Determination of coefficient of variation of yarn count, Limitations and corrections of Martindale's theory	3
7	Theory of plied yarn Plied yarn geometry, strength of plied yarns.	3
8	Basic characteristics of fabric structure Fabric sett, Fractional cover, Cover factor, Crimp, Areal density, Porosity	1
9	Flexible thread models of woven fabric geometry Description of woven fabric geometry, Peirce's geometrical model, Theory of jamming, Crimp interchange phenomenon, Limitations of Peirce's model, Geometrical models based on non-circular cross-section	5

18. Suggested texts and reference materials:

B. Neckář and D. Das, Theory of structure and mechanics of fibrous assemblies, Woodhead Publishing India Pvt. Ltd., 2012

J. W. S. Hearle, P. Grosberg, S. Backer,: Structural mechanics of fibers, yarns, and fabrics. Wiley-Interscience, New York – London – Sydney – Toronto, 1969

P. Schwartz, Structure and Mechanics of textile fibrous assemblies, Woodhead Publishing Ltd., Ltd., UK, 2008

B. K. Behera and P. K. Hari, Woven Textile Structure: Theory and Applications, Woodhead Publishing Ltd. UK, 2010

J. Hu, Structure and Mechanics of woven fabrics, Woodhead Publishing Ltd., UK, 2004

S. J. Russel, Handbook of Nonwovens, Woodhead Publishing Limited, UK, 2007

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.)	Blackboard, PPT
19.4	Laboratory	None
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	60%
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	20% (Group Discussion)

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>)	Specialty Yarns and Fabrics
3.	L-T-P structure	2-0-0
4.	Credits	2
5.	Course number	TTL363
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	TTL 221/ TTL 222/ TTL 231/ TTL 232
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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	No

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 S.M. Ishtiaque, R. Chattopadhyay, R. Alagirusamy, R. S. Rengasamy, Apurba Das, Dipayan Das, B. K. Behera, A. Majumdar, Amit Rawal	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): After completion of the course, the student will have knowledge on the design, manufacturing, characteristics and applications of innovative nonconventional yarns and fabrics in view of emerging trends in modern textile industries.	
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14.	Course contents: Design, manufacture, characterization and applications of specialty yarns. Hybrid yarns. High bulk yarns. Electro-conductive yarns. Technical sewing threads. Coated yarns. Reflective yarns. Elastomeric yarns. Yarn quality requirement.	
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	Yarn preparation & production technology. Structural design, properties-Performance and applications of specialty fabrics. Denim. Pile fabrics. Narrow fabrics. 3D fabrics. Spacer fabrics. Profiled fabrics. Contour fabrics. Polar fabrics. Spiral fabrics. Multi-functional fabrics.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Hybrid yarns for composites: Types of hybrid yarns. Characterization of hybrid yarns, Compaction and consolidation of hybrid yarns, Hybrid yarn structure-composite property relations	2
2	High bulk yarns, Principles of bulked yarn production, Yarns with micropores. Twistless and hollow yarns	2
3	Electro-conductive yarns: Manufacturing methods through friction spinning, ring spinning and hollow-spindle spinning, Inherently conductive polymer yarns, Characterization methods, Applications	2
4	Technical sewing threads: Industrial sewing threads-types and structures of industrial sewing threads, Thread finishing, Thread numbering, Properties of fibres used for sewing threads, Threads for high temperature applications, Out-door applications, airbags, geotextiles, etc. Surgical threads, Classifications, Manufacturing processes, Characterization	2
5	Coated yarns: Coating formulations for technical textile yarns, Principles of yarn coating, Solvent coating, Aqueous coating, Hot-melt coating, Metal coating, Vacuum coating, Electroplating, Electroless plating, Plasma treatment and Lamination, Machinery for yarn coating, Applications and properties of coated yarns	2
6	Reflective yarns: Types and manufacturing techniques, UV protected yarns, Metallic and metaplastic yarns, Manufacturing techniques, Yarns for specific purposes: Antimicrobial yarns, Shape memory yarns, Anti-static yarns, Soluble yarns, Biodegradable yarns, etc.	2
7	Elastomeric yarns and their manufacturing techniques, properties and applications, Fancy yarns, Types of fancy yarns, Manufacturing techniques, properties and applications of fancy yarns	2
8	Denim Manufacturing: Classification, Yarn preparation, Rope dyeing process, Sheet Dyeing process, Construction of denim, Selection of weave and special effect, Washing and Finishing, Applications	2
9	Manufacturing of Pile fabrics: Classification of pile structure, Woven and Knitted pile structure, Yarn preparation for terry weaving, Terry mechanism, Construction of towel Fabric, Dobby and Jacquard towel, Properties and performance of pile fabrics	2
10	Narrow weaving: Classification, Yarn preparation, Weave construction, Weaving mechanism for narrow fabric, Mechanism of Needle loom, CAD for narrow fabrics, Properties of narrow fabrics, Applications: Tape, label, seat belt, elastic band	2
11	3D Weaving, Classification of 3D structures, Mechanism of 3D weaving Development of orthogonal, warp interlock and angle interlock structures 3D nodal and cell structures, Properties and	2

	applications of 3D fabrics	
12	Spacer fabrics: Classification of spacer geometry, Production of spacer by weaving and knitting, Design of spacer architecture for various applications, Characterization and applications of spacer fabrics	2
13	Profiled fabrics: Profiled structures, T, L, I, U, H and Pi structures, Polar fabric, Spiral fabric, Contour fabric, Properties and applications of profiled structures	2
14	Multifunctional Woven Fabrics, Woven fabric structures for electro-conductive sensors and heating elements, Smart woven fabrics in renewable energy generation, Woven fabrics used for outdoor performance clothing, Functional design of the woven filters	2
COURSE TOTAL (28 times 'L')		28

16. Brief description of tutorial activities: Not Applicable

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17. Brief description of laboratory activities: Not Applicable

18. Suggested texts and reference materials:

Technical textile yarns: Industrial and medical applications, R. Alagirusamy and A. Das, Woodhead Publishing Limited, UK, 2010

Specialty yarn and their fabric structures, R. H. Gong, Woodhead Publishing Limited, UK, 2011

Fancy Yarns, R. H. Gong and R. M. Wright, Woodhead Publishing Limited, UK, 2002

Hand Book of Weaving, S. Adanur, CRC Press, 2000

Wellington Series Handbook of Industrial Textiles, S. Adanur, CRC Press, 1995

Advances in Modern Woven Fabric Technology, S. Vassiliadis, InTech, 2011

Textile Structural Composites, T.-W. Chou and F. K. Ko, Elsevier Science Pub. Co., 1989.

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.)	Blackboard, PPT
19.4	Laboratory	None
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	60%
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	20% (Group discussion)

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>)	Costing and its Application in Textiles
3.	L-T-P structure	3-1-0
4.	Credits	4
5.	Course number	TTL365
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students and OC for others

7.	Pre-requisites (<i>course no./title</i>)	EC 90 Exclusion: TTL761, SML303, SML401
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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	40% with TTL761
8.2	Overlap with any UG/PG course of other Dept./Centre	30% with SML303, 30% with SML401
8.3	Supersedes any existing course	

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 R. S. Rengasamy, R. Alagirusamy, S. M. Ishtiaque, B. K. Behera, Abhijit Majumdar	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To provide exposure to the students to the fundamentals of costing and its application to textile and garment industry.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Importance of costing. Material costing in textile industry. Methods of inventory costing. Economic order quantity, price discount, safety stock, lead time. Allocation	
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	of labour cost-shift premium, overtime, idle time, rush orders in garment industry. Allocation of overheads in composite mills. Job order costing in garment industry. Economic batch quantity. Process costing in mill. Unit cost of yarns, fabric and processing. Joint and by-product costing. Absorption costing. Variable costing for decision making. Profit planning in textile industry, variation of price, costs etc., breakeven capacity. Standard costs of fibres, yarns, labour etc. HOK, OHS, UKG etc. Cost variance analysis-iteration of actual costs of fibre, labour and overhead with respect to standard costs. Work allocation to spinner. Balancing of machine for optimizing product mix in a spinning mill. Financial information-balance sheet, profit/loss account, balance sheet. Ratio analysis.
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15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Introduction to costing. Costing and control of materials in textile industry- FIFO, LIFO & average cost methods, Organizational set up for purchase, Inventory control techniques-ABC analysis, EOQ based on discount on price, ordering cost, carrying cost, Reorder point, Safety stock and stock-out cost of bales.	5
2	Direct and indirect labour in textile industry, Accounting of labour cost-shift & overtime premiums, idle time, rush order, poor workmanship, Labour attrition and incentive schemes in garment industry.	1
3	Factory overheads- cost allocation to production departments and products, Overhead application rate for yarns, fabrics and garments, Methods of charging of service costs, Over and under absorption.	2
4	Job costing in garment industry- cost assignment to completed and ongoing jobs, FOH control and applied accounts, Batch costing.	2
5	Cost concepts in textile industry-income measurement, profit planning, cost control	2
6	Process costing in textile industry-Allocation of material, labour and overhead costs, equivalent units of material, labour and overhead, Cost of product - FIFO and average methods, Wastages-normal and abnormal	3
7	Joint costs in textile industry- allocation by different methods	1
8	Absorption costing, Variable costing for decision making-optimal sales mix of yarns, fabrics & garments, fixing price on special order in garment industry, buy/make decisions in textile machinery manufacture, adding and dropping a product line, sales mix to be arrived with or without constraints.	3
9	Planning for profits and capacity in textile industry based on changes in fixed and variable costs, selling price and tax rates, Sales turnover, profit/loss, breakeven capacity, PV ratio, contribution margin.	3
10	Budgeting-budgets for operation, finance, production, manufacturing, budgeted income statement, cash budget, Performa balance sheet for a	1

	spinning mill producing multiple yarn counts.	
11	Capital budgeting-ARR, PB, NPV and IRR techniques for capacity planning in textile industry involved in modernization or capacity expansion or replacement of machines.	2
12	Standard costs in spinning mills- price and usage of fibres, standard costs per kg of yarn, norms for power and labour costs- UKG, OHS, HOK.	2
13	Cost variance analysis- iteration of material, labour and overhead costs for cost control, MCV, MPV, MUV, MMSV, MYSV for fibres, LCV, LRV, LEV, idle hours, revised LEV in spinning mills, LMSV, LYSV in garment industry, Fixed and variable overhead variance in textile industry	3
14	Work allocation to spinner in mill based on end breakage rate	1
15	Balancing of machines based on optimum sales mix in spinning mills	1
16	Financial statement analysis-Balance sheet, components of liabilities and assets, P/L account	2
17	Generally Accepted Accounting Practices (GAPP)	1
18	Preparation of balance sheet based on GAAP and changes in equity capital, fixed assets, cash, profit/loss, purchase of materials, long and short-term loans, distribution of profit to share holders, issue of equity shares, shares at premium and bonus shares.	2
19	Financial statement analysis- Net working capital, Ratio analysis-current ratio, turnover ratios-inventory, credit, debtor, debt-equity ratio, return on equity, Profit ratios-gross, operating and net, Overall rate of return, Return on investment-based an assets, capital, equity; Price earning ratios.	5
	COURSE TOTAL (42 times 'L')	42

16. Brief description of tutorial activities

Twelve to fourteen tutorials having numerical problems covering 14 hrs of duration. The areas to be covered are: Identification of right supplier and EOQ when price and quantity discounts offered by the suppliers are different, Inventory costing of bales/yarns/fabrics- FIFO, LIFO and average cost methods, Setting of inventory levels- reorder and minimum levels based on consumption rate, lead time and stock out costs, Allocation of labour costs- shift premium, overtime, idle time, rush order in garment industry, Allocation of service department costs in composite mills, Allocation of over- and under absorption overheads in mills, Price bidding in garment industry, Economic batch quantity in wet processing house, Preparation of process accounts in wet process house- FIFO and average cost methods, Preparation of income statements based on absorption and variable costing, Decision to close down a textile unit, Optimizing the product mix in spinning mill, CVP analysis for a weaving mill, Profit planning for merged units, Preparation of budgets for textile industry having product portfolio, Investment decision for textile industry based on ARR, PB, NPV methods- acquiring of new machines and replacement of machines, Material cost variance for a

spinning mill, Labour cost variance for garment industry.

17. Brief description of laboratory activities Not Applicable
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18.	Suggested texts and reference materials: 1. Management Accounting by M. Y. Khan and P. K. Jain Tata McGraw Hills, New Delhi. 2. Accounting Principles by Robert N. Anthony and James S. Reece, A.I.T.B.S Publishers and Distributors, New Delhi. 3. Norms for spinning mills, SITRA, Coimbatore.
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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.)	Blackboard and PPT
19.4	Laboratory	None
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	
20.2	Open-ended problems	20%
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>)	Modelling and simulation in fibrous assemblies
3.	L-T-P structure	2-0-2
4.	Credits	3
5.	Course number	TTL700
6.	Status (<i>category for program</i>)	DE for B.Tech. (Textile Technology) students and PE for M.Tech. (Textile Engineering & Fibre Science) students

7.	Pre-requisites (course no./title)	90 Earned Credits for UG students
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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	TTL830

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 Amit Rawal, Abhijit Majumdar and Prabal Talukdar (Department of Mechanical Engineering)	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): The objective of the course is to familiarise the students with general understanding of various modelling and simulation techniques that are currently used for fibrous assemblies. The students will be able to develop fundamental and empirical models based on the techniques covered in this course. They will also be able to optimise the structural and construction parameters of the fibrous assemblies for attaining the	
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	targeted properties.
14.	Course contents (about 100 words) (Include laboratory/design activities): Introduction to Textile Modelling and Simulation, types of model. Curve Fitting Techniques: Prediction of mechanical properties of fibrous assemblies. Artificial Neural Network (ANN): Mathematical models of artificial neurons, ANN architecture, Learning rules, Back propagation algorithm, Applications of ANN. Fuzzy Logic: Crisp and fuzzy sets, Operations of fuzzy sets, Fuzzy rule generation, Defuzzification, Applications of fuzzy logic. Genetic Algorithm (G.A.): Basics of G.A., G. A. in fabric engineering. Stochastic and Stereological Methods: Random fibrous assemblies, anisotropy characteristics, two and three-dimensional fibrous assemblies. Statistical Mechanics: Monte Carlo simulation of random fibrous assemblies, Multiscale Modelling: Geometrical modelling of textile structures, modelling of properties of fibrous assemblies Computational Fluid Dynamics: Newtonian and Non-Newtonian Fluids and their applications in extrusion processes, Computer simulation of fluid flows through porous materials, heat and mass transfer in fibrous assemblies. .

15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Introduction to model development. Curve Fitting Techniques: Linear and nonlinear curve fitting techniques, Prediction of mechanical properties of fibrous assemblies, process- structure-property relationship of fibrous structures.	3
2	Neural Networks: Biological neural system, Mathematical models of artificial neurons, ANN architecture, Single and multi-layer perceptrons, Learning rules, Back propagation algorithm, Kohonen self organizing network, Applications of artificial neural networks in fibre, yarn and fabric modelling.	4
3	Fuzzy Logic: Introduction to crisp and fuzzy sets, Concepts of uncertainty and imprecision, Operations of classical and fuzzy sets, Introduction to Fuzzy logic, Membership functions, Fuzzification, Fuzzy rule generation, Defuzzification, Hybrid systems, ANFIS, Applications of fuzzy logic in yarn and fabric modelling.	4
4	Genetic Algorithm: Overview, GA vs traditional optimisation, Multi-objective optimisation, Implementation of GA in yarn and fabric engineering.	2
5	Stochastic and Stereological Methods: Random fibrous assemblies, anisotropy characteristics in fibrous assemblies, two and three-dimensional fibrous assemblies.	5
6	Statistical Mechanics: Monte Carlo simulation of random fibrous assemblies	3
7	Multiscale Modelling: Geometrical modelling of textile structures, Prediction of properties of fibrous assemblies using Matlab®	2
8	Computational Fluid Dynamics: Introduction to Finite Difference, Finite	5

	Element and Finite Volume Techniques, Newtonian and Non-Newtonian Fluids and their applications in extrusion processes, Computer simulation of fluid flows through porous materials, heat and mass transfer in fibrous assemblies.	
Total		28
16.	Brief description of tutorial activities: Not applicable	
17.	Brief description of laboratory activities: (7 sessions × 4 hours) - Developing ANN models for simple logic gates. - Studying the effect of leaning parameters and network structure on the prediction accuracy of ANN. - Developing a practical model for strength prediction of yarn/ woven fabric/ nonwoven fabric. - Developing a simple fuzzy inference system and understanding the processes of fuzzification, fuzzy rules, aggregation and defuzzification using MATLAB. - Developing a fuzzy expert system for fibrous assemblies. - Optimization using Genetic algorithm - To solve heat and mass transfer & revealing anisotropic characteristics of fibrous assemblies. - To simulate random fibrous assemblies using Monte Carlo simulation techniques. - To develop and simulate geometrical models of various textile structures using Matlab®. - To predict the mechanical properties of fibrous assemblies using curve fitting techniques.	
18.	Suggested texts and reference materials: - Bird, Byron, R. (1977), <u>Dynamics of Polymeric liquids</u>, John Wiley & Sons, New York, 214. - Hirsch, C. (1988), <u>Numerical Computation of External and Internal Flows</u>, Vol.1, John Wiley & Sons, New York. - Chung, T.J. (1978), <u>Finite Element Analysis in Fluid Dynamics</u>, Mc Graw-Hill, New York. L.Ames, Andrea (1997), <u>VRML 2.0 Sourcebook</u>, 2nd edition, John Wiley & Sons, New York. - Kendall, M.G. and Moran, P.A.P (1963), <u>Geometrical Probability</u>, Charles and Griffin Co. Ltd., London. - Hilliard, J.E. (2003), <u>Stereology and Stochastic Geometry</u>, Kluwer Academic Publishers, Boston. - Binder, K. and Heermenn, D.W. (1997), <u>Monte Carlo Simulation in Statistical Physics: An Introduction</u>, Springer Verlag, Berlin. - Rajasekaran and Pai, <u>Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications</u>, Prentice-Hall of India Pvt. Ltd. - Haykin, <u>Neural Networks: A Comprehensive Foundation</u>, Second Edition, Pearson Education. - Zimmerman, <u>Fuzzy Set Theory and its Applications</u>, 2nd Edition, Allied	

	Publishers Limited. 10) Berkan, and Trubatch, Fuzzy Systems Design Principles, Standard Publishers Distributors. 11) Bector, and Chandra, Fuzzy Mathematical Programming and Fuzzy Matrix Games, Springer publisher. 12) Kartalopoulos, Understanding Neural Networks and Fuzzy Logic: Basic Concepts and Applications, Prentice-Hall of India Pvt. Ltd.	
19.	Resources required for the course (<i>itemized & student access requirements, if any</i>)	
19.1	Software	Matlab 7, Statistica neural network, GAMBIT (Computer Aided Design software package), FLUENT (Computational Fluid Dynamics software), ANSYS (Finite Element Package),
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	Nil
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%
20.2	Open-ended problems	
20.3	Project-type activity	20%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	0%

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	TTL710
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)	TTL212 and 90 credits for B. Tech. (TT) 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% TTL715
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supersedes any existing course	No

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 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:
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	profile fibres, optical fibres, bicomponent fibres and hybrid fibres, Superabsorbent 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 speciality 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 copolyesters.	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	Speciality fibres from new polymers, hybrid fibres, nanocomposite fibres	4
13	Other specialty fibres: absorbent fibres , hollow fibres and profile fibres, bicomponent 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.	Suggested texts and reference materials:
• High Performance fibres J W S Hearle • Textile fibres: Developments and Innovations, V. K. Kothari • Physical properties of fibres J W S Hearle and W E Morton • David R. Salem. (Eds). Structure Formation in Polymeric Fibres. Carl Hanser Verlag, Germany. 2001	

- Yang H H, *Kevlar aramid fiber*, John Wiley & Sons, Chichester, 1993.
- Manufactured fibre Technology, V. B. Gupta and V.K. Kothari
- Mukhopadhyay S K, 'High-performance fibres', *Textile Progress*, 1993, 25, 1–85.
- Ozawa S and Matsuda K, *High Technology Fibers Part B*, edited by Lewin M and Preston J, Marcel Dekker, New York, 1989.
- Some review and research papers

19.	Resources required for the course (<i>itemized & student access requirements, if any</i>)	
19.1	Software	None
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	None
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	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	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>)	Functional and Smart Textiles
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 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)	EC 90 and TTL212/TTL221/TTL231 for UG students None for PG 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 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	Supercedes any existing course	

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, Deepti Gupta	
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	
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	and Classification of Functional and Smart textiles ; Introduction to Composites : Theory, Types, Properties ; High Performance fibers, thermoplastic and thermosetting 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: NOT APPLICABLE

17. Brief description of laboratory activities: NOT APPLICABLE

18. 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

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
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	-
20.2	Open-ended problems	10
20.3	Project-type activity	10
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>)	Mechanics of Spinning Processes
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 722
6.	Status (<i>category for program</i>)	DE for B.Tech. (Textile Technology) students and PC for M.Tech. (Textile Engineering) students

7.	Pre-requisites (course no./title)	EC 90 and TTL221/TTL222 for B.Tech. (Textile 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	TTL722

9.	Not allowed for (indicate program names)	None
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10.	Frequency of offering	☐ Every sem X 1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course R. Chattopadhyay, S. M.Ishtiaque, R. S. Rengasamy, R. Alagirusamy, A. Das, and Dipayan Das	
12.	Will the course require any visiting faculty?	NIL

13.	Course objective (<i>about 50 words</i>): After attending the course the student will learn – complex interaction between fibre and process parameters and its implications – significance of developments made in spinning machines and – technological limitations of various processes	
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14.	Course contents (about 100 words) (Include laboratory/design activities): Cotton fibre selection. Forces on fibres during opening and cleaning and their significance. Analysis of cylinder load and transfer efficiency. Technological considerations in design of high production card. Card wire geometry. Fibre configuration in card and drawn slivers. Fibre hook removal. Sliver irregularity. Fibre movement in drafting field. Drafting wave. Drafting force. Roller slip & roller eccentricity. Roller vibration. Fibre fractionation in comber. Combing performance. Principle of autolevelling. Blending of fibres. Analysis of forces on yarn and traveller. Spinning geometry. Spinning tension in ring and rotor spinning. Twist flow in ring and rotor spinning. End breaks during spinning. Dynamics of false twisting.

15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Fibre opening, cleaning, and mixing processes	8
	Bale management: Theory and practice of cotton fibre selection, Fundamental forces acting on tufts and it's role on opening and cleaning processes, Developments in blowroom and its significance, Characteristics of impurities and contaminants in cotton and their removal strategy, Blend parameters, Index of blend irregularity (IBI), Influence of blending technique on blend parameters and IBI	
2	Carding process	8
	Analysis of carding process, Theoretical analysis of transfer efficiency, Design aspect of high performance card and it's significance, Card wire geometry and it's influence, Principles of auto-levellers in card	
3	Drawing process	8
	Mechanism of generation of drafting drafting wave, periodic variation and it's location, Roller & apron slippage and their effects, Suppression of drafting faults, Fibre straightening and hook removal through drafting operation, Principles of auto-levellers in drawframe	
4	Combing process	4
	Theory of fibre fractionation in combing, Factors affecting combing performance, Developments in combing and it's technological significance	
5	Spinning processes	14
	Mechanism of ring, rotor, air jet and friction yarn formation, High performance ring, traveller and spindles, ring traveller interaction, Theory of formation of yarn balloon, balloon stability, Yarn tension in ring and rotor spinning, Spinning geometry, Twist flow in ring and rotor and air jet spinning; false twisting, Interaction of twist and tension	

	in spinning zone and it's influence on end breakage	
	COURSE TOTAL (42 times 'L')	42

16. Brief description of tutorial activities: Not Applicable

17. Brief description of laboratory activities: Not Applicable

18.	Suggested texts and reference materials: Advances in Technology of Yarn Production 1, R. Chattopadhyay, NCUTE Publication, Ministry of Textiles, Govt. of India, 2001 Yarn Production: Theoretical aspects, P. Grosberg and C. Iype, The Textile Institute, 1999 Technology of carding, R. Chattopadhyay, NCUTE Publication, Ministry of Textiles, Govt. Of India, 2003 The Principles and Theory of Ring Spinning, A. E. De Barr, and H. Catling, Manual of Cotton Spinning, Vol. 5, The Textile Institute, Manchester 1965 End Breaks in Ring Spinning, T.A. Subramaniam, ATIRA, Ahemedabad Carding, Bombay Textile Research Association, BTRA Monograph Series Bombay 1994 Evenness Testing in Yarn Production, Part – I and II, R. Furter, Quality control and assessment series, The Textile Institute, Manchester Lecture Notes on Carding, R. Chattopadhyay, CD Cell, IIT Delhi, 1992 Textile Yarns: Technology, Structure and Applications, B. C. Goswami, J.G.Martindale and F.L. Scardino, Wiley, 1977 Fundamentals of spun yarn Technology, Carl A Lawrence, CRC Press, 2003
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 & Blackboard
19.4	Laboratory	None
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	10%
20.2	Open-ended problems	20%
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>)	Textured Yarn Technology
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL724
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students, PE for M. Tech. (Textile Engineering/Fibre Science & technology) students, OC for other students

7.	Pre-requisites (course no./title)	No pre-requisites for M.Tech. Students 90 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	No

9.	Not allowed for (indicate program names)	No such restriction
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10.	Frequency of offering	☐ Every sem ☒ X1 st sem ☐ 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Kushal Sen , V K Kothari	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): This is an advance level course in Texturing, designed for masters 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. Bulked 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	Bulked 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: NOT APLICABLE

17. Brief description of laboratory activities

18. Suggested texts and reference materials :

STYLE: Sonntag, R. E., Borgnakke, C., and Van Wylen, G. J., *Fundamentals of Thermodynamics*, 5th Ed., John Wiley, 2000.

1. Yarn texturing technology, J W S Hearle, L Hollick and D K Wilson, Woodhead Publishing, 2001
2. Draw-Textured Yarn Technology, G.D, Wilkinson; Published by Monsanto Textiles Company, 1974
3. Synthetic Filament Yarn: Texturing Technology, Ali Demir, Hassan M. Behery, Prentice Hall, 1997
4. Bulkied yarns: production, processing and applications; Bohumil Piller 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.

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, video films
19.4	Laboratory	None
19.5	Equipment	None
19.6	Classroom infrastructure	Lecture room with AV facility
19.7	Site visits	Lab demo

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

20.1	Design-type problems	15
20.2	Open-ended problems	15
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	Discussion (20%)

Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title (< 45 characters)	Mechanics of Spinning Machines
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL725
6.	Status (category for program)	DE for B.Tech. (Textile Technology) students and PC for M.Tech. (Textile Engineering) students

7.	Pre-requisites (course no./title)	EC 90 and TTL221/TTL222/ for UG students
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8.	Status vis-à-vis other courses (give course number/title)	
8.1	Overlap with any UG/PG course of the Dept./Centre	5% with TTL222
8.2	Overlap with any UG/PG course of other Dept./Centre	20% with MEL311; 10% with MEL417
8.3	Supersedes any existing course	TTL321, TTL722

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 R. S. Rengasamy, R. Alagirusamy, S. M. Ishtiaque, R. Chattopadhyaya	
12.	Will the course require any visiting faculty?	No

13.	Course objective (about 50 words): Students will learn about spinning machine elements and their design aspects, drive and issues related to their selection	
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14.	Course contents (about 100 words) (Include laboratory/design activities): Drive systems, belt drives, belt tensions, power transmission, variable, PIV and reversing drives. Polygonal effect in chain drives. Gear types, design aspects,	
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	interference and periodic faults, thrust loads and elimination, gear selection, planetary gear trains in spinning machines. Design of cone pulleys, design of transmission shafts and drafting rollers-materials, design against torsional & lateral rigidity. Clutches and brakes – design, torque transmission capacity, applications in textile machines, bush bearings-theory of lubrication, Rolling contact bearings in textile machines. Machine balancing – static, couple, dynamic unbalance, balancing of cylinder-plane transposition, practical aspects of balancing. Cams in roving and ring spinning machines.
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15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Introduction to drives and machine elements, Characteristics & selection of drives.	1
2	Flat belt- belt tensions, maximizing power transmission, V belt-force analysis, Round belt drive in friction spinning machine; Reversing, variable speed and special purpose drives in spinning machines- clutching action; PIV drive, cone and stepped pulleys; Methods of adjustment of belt tensions; Toothed belt drives-characteristics; Tapes, Comparison, selection and applications of belt drives in spinning machines.	4
3	Chain drives:- types, construction, lubrication, chain tension and bending force on shaft, polygonal effect, Selection and applications of chain drives in spinning machines.	2
4	Spur gears:- Design aspects, conjugate action; involute tooth; Interference & - periodic faults in fibre assemblies in roller drafting, Elimination of interference; Internal gears & rack and pinion gears; Force analysis- position of idler gears in headstock of spinning machines, torque and power transmission; Lubrication.	3
5	Parallel helical gears- geometry, hand notation, force analysis; thrust loads, Crossed helical gears- elimination of thrust loads for driving bobbins and flyers; Various bevel gears, Worm gears- terminology, single and double envelop worms; Characteristics, selection & applications of gears in textile machines.	3
6	Planetary gear trains:- methods of speed calculation; Degrees of freedom; Planetary gear trains in roving machine- bobbin diameter and speeds of bobbin, roving stretch & slackness, relation between the speeds of bobbin and bottom cone pulley, Planetary gear train in combing machine- motion of detaching roller, control of web movement.	4
7	Cone pulleys in roving machine- design aspects, hyperbolic and straight cone pulleys, shifting of belt, belt slippage and corrections	2

	for belt position, belt shifting mechanism for straight cone pulleys, finer adjustment of belt shifting; Cone pulleys for piano-feed regulation in lap former.	
8	Transmission shafts and drafting rollers: material properties; factor of safety and allowable stress; tensile, shear, bending and torsional stresses; Design of transmission shaft- against static load, maximum shear stress theory of failure,, design for torsional and lateral rigidity; Design of bottom drafting rollers- design and processing perspectives, design against torsional and lateral rigidity.	4
9	Clutches:- Mechanical lockup clutches- characteristics, applications in card, sliver doubling, roving and ring spinning machines; Friction clutches- single disk, torque transmitting capacity- theory of uniform pressure and wear, delayed start of drafting in ring spinning; Multi disk friction clutch- bale opener, Cone clutches- bobbin carriage; Centrifugal clutches- principle, applications.	3
10	Brakes:- Mechanical brakes- block brake with short shoe, analysis of forces acting on drum, Block brake in lap former; pivoted block brake with long shoe, spindle brake; differential band brake; disk brakes; Non-friction brakes; disc clutch and disc brakes, hysteresis clutch and brake, applications.	3
11	Bearings:- Sliding contact bearings-types, theory of lubrication, friction in bearings, Rolling contact bearings- ball, needle and roller bearings, Self-aligning, thrust bearings, bearing selection for various drives, static load and dynamic capacity, equivalent bearing load, load-life relationship, Applications of bearings in spinning machines.	4
12	Balancing of machines:- Unbalance, imaginary heavy spot and centrifugal force, relating unbalance to vibrations; static balancing; types of unbalance, dynamic unbalance- opening and cleaning roller, winding drum, balancing of card cylinder; trial weights; run out; unbalance due to eccentricity in mounting shaft and non-uniform mass distribution of rotor; dynamic balancing of single and multi-plane rotors; practical aspects of balancing during maintenance.	4
13	Cams:- Design of cams for yarn winding in ring spinning and belt shifting in roving machines	2
14	Air drag forces-fibre opening & transportation, Curved path of fibres & roller offset in roller drafting, mechanism of nipper movement & intermittent motion to planetary gears in comber	3
	COURSE TOTAL (42 times 'L')	42

16. Brief description of tutorial activities

Numerical problems on design aspects of machine elements in spinning machines will be given to students during lecture hours. The total duration of tutorials will be about 7 h.

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
	There will be laboratory visits during lecture hours to demonstrate the design aspects of drives and machine elements at yarn manufacture laboratory.	5

18.	Suggested texts and reference materials: Mechanics of Spinning Machines, R. S. Rengasamy, NCUTE, New Delhi, 2002. Manual of Textile Technology: A Practical Guide to Combing and Drawing, Vol. 3, W. E. Klein, The Textile Institute, Manchester, 1987. Design of machine Elements, V. B. Bhandari, Tata McGraw-Hill, New Delhi, 1994. Machine Design, Mubeen, Khanna Publishers, Delhi, 1998. Machinery Vibration: Balancing, Victor Wowk, McGraw-Hill, Inc. New York, 1995. Machine Design: An Integrated Approach, Robert L. Norton, Prentice-Hall, New Jersey, 1996. NPTEL Course material.
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19. Resources required for the course (itemized & student access requirements, if any)

19.1	Software	NPTEL web site
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	Blackboard, PPT, Animation, videos
19.4	Laboratory	Yarn manufacture Laboratory
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	50%
20.2	Open-ended problems	10%
20.3	Project-type activity	10%
20.4	Open-ended laboratory work	10%
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>)	Science and Applications of Nanotechnology in Textiles Structure and physical properties of fibres
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 740
6.	Status (<i>category for program</i>)	DE for B. tech. (TT), M. Tech. (TE/TF) students, OC for others

7.	Pre-requisites (course no./title)	TTL 230 and EC 90 for UG students None for PG 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	No
8.2	Overlap with any UG/PG course of other Dept./Centre	Yes 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	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
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11.	Faculty who will teach the course- Mangala Joshi, Manjeet Jassal, Bhanu Nandan, Ashwini K. Agrawal	
12.	Will the course require any visiting faculty?	Not necessary

13.	Course objective The objective of the course is to acquaint the students with the fundamentals of nanoscience
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	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 Polymerisation, 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 lectures
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	3
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	2
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 zeta potential, particle size and particle size distribution: Dynamic light scattering (DLS) and Transmission electron microscopy (TEM) etc.	4
7.	Techniques for dispersion of nanomaterials in solvents or polymeric	3

	solutions: mechanical, ultrasonication, surfactant, surface functionalization	
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

16. Brief description of tutorial activities: NOT APPLICABLE

17. Brief description of laboratory activities: NOT APPLICABLE

18. Suggested texts and reference materials :

a) Introduction to Nanoscience and Nanotechnology Charles P Poole, Jr and Frank J Owens; Wiley India -Student Edition(2006) b) Nanoscale Science and Technology Robert W. Kelsall, Ian W. Hamley, Mark Geoghegan, John Wiley and Sons (2005) c) Nanofibres and Nanotechnology in Textiles Ed. P Brown and K Stevens, Woodhead Publishing Co. UK (2007) d) ‘The Impact of Nanotechnology on Polyesters and Polyamides’ M Joshi, A chapter in the book titled “Advances in Polyesters and Polyamides”, Woodhead Publishing Co. UK (2008) e) Polymer Clay Nanocomposites Ed. T J Pinnavia & G W Beall, John Wiley and Sons Ltd. England (2000) f) An Introduction to Electrospinning and Nanofibres, Seeram Ramakrishna, K Fujihira, W Teo and TL Zumie Ma, World Scientific Publishing Co. Ltd. (2005) g) Fundamentals and Applications of Nanomaterials, Zhen Guo, Li Tan, (Artech House) London (2009) h) Encyclopedia Of Nanoscience and Nanotechnology, Hari Singh Nalwa American Scientific Publishers, 10 Volumes Set (2004)
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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.)	LCD projector (PPT /Video)
19.4	Laboratory	None
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	-
20.2	Open-ended problems	10%
20.3	Project-type activity	20% (Assignments)
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>)	Environment Management in Textile and Allied Industries
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL744
6.	Status (<i>category for program</i>)	DE for B. Tech. (TT), M. Tech. (TE/TF) students, , OC for others

7.	Pre-requisites (course no./title)	EC-90
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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	

9.	Not allowed for (indicate program names)	Only for textile B. Tech.
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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 – Kushal Sen, Bhuvanesh Gupta, Mangala Joshi, Deepti Gupta, Samrat Mukhopadhyay, B S Butola	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): The subject would deal with aspects of various types of pollutions caused by textile industry, its impact on the environment, its assessment, management and alternative green practices. The course would create awareness about the environmental impact of various industrial practices in Textile industry, its assessment and management.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Introduction, Definition, Pollutant categories and types; International and Indian legislation, Environmental impact along the textile chain, Toxicity of intermediates, dyes and auxiliaries, Pollution load from wet processing operations,
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	Textile effluents and their characterization, Technology and principles of effluent treatment; Advanced color removal technologies, Recovery and reuse of water and chemicals; Air and noise pollution, Eco labeling schemes, Analytical testing of environmental parameters, Eco friendly textile processing: waste minimization, standardization and optimization, process modification; safe and eco-friendly dyes and auxiliaries; Industrial hygiene and safe working practices; Solid waste recycling and modification; Waste management approaches; Environmental management systems: ISO 14000; Certification criteria
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15. Lecture Outline *(with topics and number of lectures)*

Module no	Topics	No of lectures
1	Introduction; Importance of ecological balance and environmental protection; Definition of waste and pollutant; Pollutant categories and types	3
2	Environmental impact along the textile chain from fibre production to disposal, Sequential and integrated waste management approaches- at source reduction, reclamation , recycle, energy recovery, and disposal	3
3	Toxicity of intermediates, dyes and other auxiliaries; Pollution load from different wet processing operations	3
4	Textile effluents and their characterization	2
	Technology and principles of effluent treatment; Advanced color removal technologies	5
5	Recovery and reuse of water and chemicals	2
6	Air and noise pollution and its control	2
7	Analytical testing of eco and environmental parameters	3
8	Industrial hygiene and safe working practices	2
9	Eco-friendly textile processing: waste minimization, standardization and optimization, process modification; low liquor techniques, advanced textile processing techniques like Plasma, safe and eco-friendly dyes and auxiliaries, organic cotton , natural dyes, naturally coloured cotton	5
10	Eco labeling schemes	2
11	Solid waste (fibre and polymer) recycling; direct extrusion, densification, recovery of monomers, energy recovery and chemical modification of fibre waste	3
12	Waste management approaches; Environmental management systems: ISO 14000; Certification criteria	3
13	International and Indian legislation and enforcing agencies in pollution control	2
14	Case studies	2
	Total	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.	Suggested texts and reference materials : 1) Environmental Aspects of Textile Dyeing, Edited by R.M. Christie, Woodhead Publishing, Limited, Cambridge, England, 2007. 2) Chemical Technology in The Pre-treatment Processes of Textiles, Edited by S.R. Karmakar, Elsevier Publications. 3) Training Report on The Programme on Treatment and Reuse of Textile Industry Effluents, December 10th to 12th, 2008, Organized by Department of Textile Technology, IIT, Delhi. 4) Wastewater Management for Textile Industry – An Overview, A.S. Bal, Indian J. Environ. Hlth. 41(4), 264-290, 1990. 5) ISI Standards for Effluent Treatment in Textile Industries.
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19.	Resources required for the course (<i>itemized & student access requirements, if any</i>)	
19.1	Software	-
19.2	Hardware	-
19.3	Teaching aides (videos, etc.)	Blackboard, PPT
19.4	Laboratory	-
19.5	Equipment	-
19.6	Classroom infrastructure	Lecture room with AV facility for regular interaction, LCD projector, screen,
19.7	Site visits	-

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

20.1	Design-type problems	10%
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>)	Medical Textiles
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 746
6.	Status (<i>category for program</i>)	DE for B. tech. (TT), M. tech. (TE/TF) students, OC for others

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- Sourabh Ghosh, Bhuvanesh Gupta	
12.	Will the course require any visiting faculty?	Not necessary (Special lecture may be organized during visit of Internationally renowned scientists)

13.	Course objective. To familiarize the students with various Medical textile products commercially available in healthcare field, their limitations, general understanding of 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’ 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, 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	3
3	Fibrous extracellular matrix of human body and their characteristic features; how these features can be replicated by using textile strategies	2
4	Interaction of cells on Polymeric textile structures (integrin recognition, cellular signaling process, gene expression, immune rejection)	5
5	Non-implantable materials (existing products, limitations, future direction): (a) Wound-dressing, related hydrogel and composite products (b) Bandages: Simple, Light support, Compression, Orthopedic bandages (c) Gauges, (d) Healthcare and Hygiene Products	3
6	Implantable biomedical devices (existing products, limitations, future direction): (a) Vascular grafts (knitting, nonwoven, electrospinning) (b) Sutures (mono / multifilament, braided) (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 (e) Soluble factor release (Drug, Growth factor Delivery), Enzyme (Matrix metalloprotease, proteases etc) attachment on fibrous	6

	materials (f) Adhesive, anti-adhesive patches for Surgical application (g) Phase change polymers & their healthcare applications (h) Coating & finishing technologies	
9	Characterization and 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

- 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)
- 2) Analysis of mathematical problems related to Textile architectures, and their bio-engineering applications

18. Suggested texts and reference materials :

(a) Selected chapters from books edited by Prof Apurba Das and Prof Alagirusamy (Technical Yarns), Dr Dipayan Das (Composite Nonwoven Materials), Woodhead Publishing
(b) Principles of Tissue Engineering, Second Edition, by Robert Lanza, Robert Langer, Joseph P. Vacanti
(c) Tissue Engineering: Engineering Principles for the Design of Replacement Organs and Tissues, by Mark Saltzman, Oxford University Press
(d) Medical Textiles, by Subhash Anand, Woodhead Publishing Ltd
(e) Medical textiles 2007: Proceedings of the fourth international conference on healthcare and medical textiles, By JF Kennedy, SC Anand, M Miraftab, S Rajendran, CRC Press
(f) Tissue Engineering Journal, Mary Ann Liebert Inc. Publications
(g) Medical Textile monthly newsletters, Technical Textiles Net Publications
(h) Medical Textiles and Biomaterials for Healthcare, Ed by S.C. Anand, M Miraftab, JF Kennedy, Woodhead Publishing Ltd, 2005

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>)	Science of Clothing Comfort
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 750
6.	Status (<i>category for program</i>)	DE for B.Tech. (Textile Technology) students, PE for M.Tech. (Textile Technology) & M. Tech. (Fibre Science and Technology) students, and OC for others

7.	Pre-requisites (course no./title)	EC 90
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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	TTL750

9.	Not allowed for (indicate program names)	None
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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 Apurba Das and R. Alagirusamy	
12.	Will the course require any visiting faculty?	NIL

13.	Course objective (<i>about 50 words</i>): After attending the course the student will learn the followings: • Science of clothing comfort • various aspects (aesthetic, neuro-physiological , psychology, thermal, tactile etc.) related to clothing comfort • transmission behaviour of clothing	
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14.	Course contents (about 100 words) (Include laboratory/design activities): Clothing Comfort: Brief introduction to the various processes related to comfort, Application of science of clothing comfort. Psychology and comfort: basic concepts, Psychological research techniques, General aspects and measurement of aesthetic properties, changes in aesthetic behaviour. Neurophysiological Processes of Comfort: Neurophysiologic basis of sensory perceptions, Perceptions of sensations related to mechanical, thermal and moisture stimuli. Thermal transmission: Thermoregulatory mechanisms of human body, heat transfer theories, thermal conductivity of fibrous materials, steady state measurement techniques for heat transfer, transient heat transfer mechanism: warm-cool feeling. Moisture Transmission: transfer of liquid moisture and vapour transfer through fibrous materials. Dynamic Transmission of heat and moisture: Relationship of moisture and heat, multiphase flow through porous media, moisture exchange between fibre and air, temperature and moisture sensations: theories and objective measurement techniques, impact of microclimate. Tactile Aspects of Comfort: Fabric mechanical properties and tactile- pressure sensations like fabric prickliness, itchiness, stiffness, softness, smoothness, roughness and scratchiness, fabric hand value, clothing comfort aspects in relations with garment size and fit.

15. Lecture Outline (with topics and number of lectures)

Module no.	Lecture description	No. of hours
1	Definition of clothing comfort, importance of studying clothing comfort, Application of science of clothing comfort, basic consumer trends	1
2	Brief introduction to the various processes related to comfort: psychological, neurophysiological, physiological and physical: the human-clothing system	1
3	<i>Psychology and Comfort:</i> Perception of comfort, comfort sensory descriptors, psychophysics	1
4	<i>Psychological research techniques:</i> Psychological scaling, scales of measurement, wear trial technique	1
5	<i>Aesthetic Comfort:</i> General aspects, measurement of aesthetic properties, changes in aesthetic behaviour	1
6	<i>Neurophysiological basis of sensory perceptions:</i> Skin structure, vascular system, skin stimuli and skin sensory system, transduction, sensory receptors, neural pathways and responses	2
7	<i>Perceptions of skin sensations related to mechanical stimuli:</i> Dynamics of wear sensation, touch and pressure, prickle, itch and inflammation,	1

	roughness and scratchiness	
8	<i>Fabric mechanical properties and tactile- pressure sensations:</i> Fabric prickliness, fabric itchiness, fabric stiffness, fabric softness, fabric smoothness, fabric roughness and fabric scratchiness, fabric hand	2
9	<i>Perceptions of sensations related to thermal and moisture stimuli:</i> Thermoreceptors, sensible and insensible heat, thermoregulatory sweating mechanism, shivering, heat exchange at the skin surface, moisture exchange at the skin surface, typical skin temperatures, distribution of thermal sensitivity, thermal sensation and comfort, moisture effects on comfort, fabric thermal sensations, dampness sensations	3
10	<i>Revisiting the Thermoregulatory Mechanisms of human body:</i> The body core and skin temperature, hypothermia and hyperthermia, metabolic rate under different working conditions, thermoregulatory mechanism in humans: autonomic temperature regulation, two-node model of thermal regulation	2
11	<i>Heat Transfer Theories:</i> Basic modes of heat transfer, i.e. Conduction , Convection, Radiation and Evaporation; Steady state heat transfer, Fourier's law of thermal conduction, Newton's Law of cooling, Concept of a blackbody radiation, Stefan-Boltzmanns law of radiation, concept of transient state; Conductivity, resistance, emissivity, diffusivity, thermal absorptivity	3
12	<i>Thermal Conductivity of Fibrous Materials:</i> Various parameters and related factors that affect the thermal conduction through fibrous materials like fibre batts, nonwoven fabrics, woven and knitted fabrics, thickness, cover factor, fibre type, yarn structure, fibre morphology and shape, effect of fabric layers etc.	3
13	<i>Steady state measurement techniques for heat transfer:</i> Various techniques and methods	1
14	<i>Transient heat transfer mechanism (the warm-cool feeling):</i> Kawabata's theoretical proposition of thermal diffusivity as an objective parameter for evaluation of warm-cool feeling, Hess's proposition of thermal absorbtivity as a more suitable parameter for the same purpose, Kawabata's instrument, Alambeta	2
15	<i>Liquid Moisture Transfer through Fibrous Materials (Wicking and Water absorption):</i> Theory of surface tension, theory of capillary action, wetting and wicking, interaction between liquid and fibrous materials, liquid spreading dynamics on a solid surface, Rayleigh instability, Lucas-Washburn theory, various theories and models on vertical and horizontal wicking through yarns, nonwoven fabrics and woven fabrics, absorption of water by a fibrous mass, objective measurement of wicking and absorption: angle of contact, droplet absorption test, vertical wicking, horizontal or transverse wicking tests	3

16	<i>Transfer of moisture vapour through Fibrous Materials:</i> Diffusion of vapour through a porous medium, various modeling approaches, moisture vapour permeability of fabrics, influence of various fabric parameters such as thickness, cover factor, etc. on the moisture vapour permeability, measurement of moisture vapour permeability, International standards	3
17	<i>Relationship of moisture and heat (basic concepts):</i> Evaporation as a process of mass and heat transfer, evaporation and condensation, latent heat, sorption and desorption	1
18	<i>Multiphase flow through porous media:</i> Mass and energy transport equations, thermodynamic relations, convective transport in liquid and gas phase, modified transport equations	2
19	<i>Moisture exchange between fibre and air:</i> Moisture diffusion into the fibres, behaviour of fabrics made from different fibres, drying of fabrics	1
20	<i>Temperature and moisture sensations (theories and objective measurement techniques):</i> Coolness to touch, warmth, dampness, clamminess and moisture buffering, environmental buffering, sweating skin and manikin, Hess's proposal of moisture absorbtivity as an objective measurement parameter, use of Permatest and Alambeta to measure dynamic interaction of heat and moisture in fabrics	3
21	<i>Clothing comfort aspects in relations with garment size and fit:</i> General aspects, construction, dimensional change, ergonomics, garment fit and pressure comfort, Effect of clothing design on performance: Impact of tight and loose fit, Impact of microclimate	2
22	<i>Concept of designing of clothing assemblies for specific applications:</i> It is very important to understand and analyze the requirements of specific applications to engineer a clothing system. The students will be given exposures on various clothing requirements for specific applications, like <i>Neonate, Infants, Work clothing, Extreme cold weather, Foul weather clothing, Surgical apparel, Sports wear, Special purpose clothing (e.g. Space suit, Fire fighter) etc.</i>	3
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

Module no.	Experiment description	No. of hours

18. Suggested texts and reference materials:

Science in Clothing Comfort, Apurba Das & R. Alagirusamy, Woodhead Publishing India Pvt. Ltd., 2010

K. Slater, The Thermal Behaviour of Textiles, Textile Progress, Vol. 8, No. 3, 1976.
J. O. Ukponmwan, The Thermal Insulation Properties of Fabrics, Textile Progress, Vol. 24, No. 4, 1993

K. Slater, Comfort Properties of Textiles, Textile Progress, Vol. 9, No. 4, 1977

Y. Li, The Science of Clothing Comfort, Textile Progress, Vol. 31, No. 1 & 2, 2001

G. J. Morris, Thermal Properties of Textile Materials, J. Text. Inst., 44, 1953, T449

Patnaik et. al., Wetting and Wicking in Fibrous Materials, Textile Progress, Vol. 38, No. 1, 2006

Thermal and moisture transport in fibrous materials, edited by N. Pan and P. Gibson, The Textile Institute, Published by Woodhead Publishing Limited, Cambridge, England, 2006

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 & Blackboard
19.4	Laboratory	None
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	30%
20.2	Open-ended problems	15%

20.3	Project-type activity	15%
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>)	DESIGN OF FUNCTIONAL CLOTHING
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 752
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students, PE for M.Tech. (Textile Engineering) & M.Tech. (Fibre Science and Technology) students and OC for others

7.	Pre-requisites (course no./title)	EC 90 credits for UG students None for PG
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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	TTL752

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- Deepti Gupta, R. Chattopadhyay, A. Majumdar	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To familiarize students with the design and engineering of functional clothing; Principles of building specific functionalities into clothing while optimizing body comfort and movement; ergonomics and its application to design of technical clothing. Application of optimal design approach to engineering of functional clothing. Performance testing and evaluation.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Functional clothing - definition and classification. Techniques in design of functional
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	clothing - 3D body scanning, human motion analysis, 2D/3D CAD and 3D modelling. Design of patterns, garment assembling methods. Ergonomics in design of functional clothing. Principles and practice of Anthropometrics. Biomechanical considerations in design of clothing. Performance evaluation of performance clothing - subjective and objective methods, modeling and simulation. Human mechanics and operational performance. Modelling, optimization and decision making techniques in design of functional clothing. Certification and standardization. Case studies - swimwear, sportswear, pressure garments, space suit, military clothing with a view to study specific design and manufacturing considerations.
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15. Lecture Outline (with topics and number of lectures)

Module no	Topic	No of Lectures
1	Introduction and classification of Functional clothing Protection, sports, medical, aesthetic and special needs. Requirements from functional clothing	3
2	Introduction to Ergonomics Introduction to Ergonomics and Human factors engineering. Human Motion analysis, quantitative kinematic analysis of body in action.	3
3	Ergonomics and design of functional clothing Environmental mapping, reducing heat stress, requirements of human mechanics, kinematic analysis. Design for insulation, ventilation, ease of motion and protection.	3
4	Techniques of body measurement and principles of fit Techniques of body measurement- manual, photographic and 3D body scanning; Body shapes, sizing and fit.	3
5	Clothing for functionality Principles of providing support and compression, reducing air/water drag, impact protection through garment design.	3
6	Garment design, assembly and making up 2D and 3D Pattern making for functional design; principle of zoning and layering, Selection of seams, stitches, seam finishes, accessories and closures. Lamination, moulding and seamless technology.	4
7	Testing and performance evaluation Subjective and objective testing, modeling and simulation; Testing human mechanics and operational performance.	4
8	Anthropometrics Principles and practice of anthropometrics; Statistical description of human variability, diversity in human bodies, design limits, design constraints and criteria. Static and dynamic measures. Application of anthropometry in design.	3
11	Biomechanics Biomechanical characteristics of human body; dynamic mechanical interactions between the body and clothing. Distribution of garment pressure and shear, stress distribution between clothing and body. Physiological effects resulting from clothing pressure, Direct and indirect pressure sensing systems. Range of tolerable pressure.	3

12	Engineering design of Functional envelopes Principles of optimal design engineering- tools and techniques, their application to design for humans. Modelling, optimization and decision making techniques in design of functional clothing, regression and ANN, linear programming and genetic algorithm techniques for process optimization. Multicriteria decision making techniques.	5
13	Testing and certification Standards and certification for performance clothing.	2
14	Case studies Performance enhancing swimwear, sportswear, pressure garments, space suit, motorcyclists clothing, military clothing.	6
	COURSE TOTAL (42 times 'L')	42

16. Brief description of tutorial activities: Not Applicable

17. Brief description of laboratory activities: Not Applicable

18. Suggested texts and reference materials:

Books

1. Advances in apparel production, Ed. by C Fairhurst, CRC Press, 2008.
2. Biomechanical Engineering of Textiles & Clothing, Ed. Y. Li and X-Q.Dai, CRC Press, 2006.
3. Bodyspace: Anthropometry, Ergonomics and the design of work by S Pheasant and CM Haslegrave, 3rd Edn., Taylor and Francis, 2006.
4. Chemical finishing of textiles, by W D Schindler, CRC Press, 2004.
5. Clothing appearance and fit: Science and technology, by J. Fan, W. Yu, and L. Hunter, CRC Press, 2004
6. Clothing Biosensory Engineering, by Y. Li and A.S.W. Wong, CRC Press, 2006.
7. Coated and laminated textiles, by W Fung, CRC Press, 2002.
8. Fitting the task to the human: : a textbook of occupational ergonomics, by K. H. E. Kroemer and Etienne Grandjean, CRC Press, 1997
9. Innovation and technology of women's intimate apparel, by W Yu, J Fan, S-P Ng, CRC Press, 2006.
10. Intelligent textiles and clothing, Ed. by HR Mattila, CRC Press, Woodhead Publishing, 2006
11. Medical Textiles, Ed. by S C Anand, CRC Press, 2001.
12. Military Textiles, by E Wilusz, CRC Press, 2008
13. Quick Selection Guide to Chemical Protective Clothing, by Krister Forsberg, S. Z. Mansdorf, 2007
14. Sizing in Clothing, Ed. by SP Ashdown, CRC Press, 2007.
15. Smart fibres, fabrics and clothing: Fundamentals and applications, Ed. by X M Tao, CRC Press, 2001.
16. Structure and mechanics of woven fabrics, by J Hu, CRC Press, 2004.
17. Synthetic fibres: Nylon, polyester, acrylic, polyolefin, Ed. by J E McIntyre, CRC Press, 2004.
18. Textiles for Protection, Ed. By Richard A Scott, CRC Press, 2005.
19. Textiles in Sport, by Roshan Shishoo, CRC Press, 2005

20. Thermal and moisture transport in fibrous materials, Ed. by N Pan, CRC Press, 2006.
 21. Wearable electronics and photonics, Ed. by X M Tao, CRC Press, 2005

Journals/ magazines

International Journal of Clothing Science and Technology

Textile Research Journal

Applied Ergonomics

Company Clothing Magazine

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

19.1	Software	-
19.2	Hardware	-
19.3	Teaching aides (videos, etc.)	-
19.4	Laboratory	-
19.5	Equipment	-
19.6	Classroom infrastructure	Lecture room with AV facility for regular interaction
19.7	Site visits	-

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

20.1	Design-type problems	20%
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>)	COSTING AND PROJECT MANAGEMENT
3.	L-T-P structure	3-1-0
4.	Credits	4
5.	Course number	TTL761
6.	Status (<i>category for program</i>)	DE for B.Tech. (Textile Technology) students and PE for M. Tech. (Textile Engineering & Fibre Science)

7.	Pre-requisites (course no./title)	90 Earned Credits for UG students Exclusion: TTL365, SML303, SML401
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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	Supercedes any existing course	TTL 761

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 S. M.Ishtiaque, B K. Behera, R. Rengasamy, R, Alagirusam, Abhijeet Majumdar	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): After attending the course the student will learn • concepts, theories, techniques of cost ascertainment and their application for planning, performance evaluation and decision making • scientific way of planning, implementing, monitoring and controlling the various aspects of project such as identification of project, technical and financial appraisal of the textile projects.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Importance of costing for textile industry. Costing of materials, labour and factory overheads and their control; methods of inventory costing for textile industry, accounting of labour, factory over heads in a composite mill. Job order costing for garment industry. Batch costing. Process, Joint and by-product costing. Unit cost of textile products. Absorption and variable costing; short-term decision making. Profit planning; cost-volume-profit-analysis, break-even point, contribution margin. Capital budgeting. Cost control; standard cost, cost and revenue variance. Financial information; balance sheet and profit and loss account. Financial statement- Ratio analysis. Phases of project cycle, preparation, evaluation and supervision. Functions in project cycle. Appraisal- methodology, key financial indicators, investment decision, post-project appraisal. Choice of technology, operating constraint. Project utilities and environmental aspects. Project appraisals for modernisation, balancing equipment, expansion and diversification.

15. Lecture Outline (*with topics and number of lectures*)

Module no.	Topic	No. of hours
1	Costing as an aid to management.	1
2	Cost terms related to income measurement, profit planning and cost control for textile industry.	2
3	Costing of materials, labour and factory overheads and their control	2
4	Methods of inventory costing for textile industry	2
5	Accounting of labour, factory over heads absorption rate, overhead cost allocation in a composite mill.	2
6	Job order costing for garment industry. Batch costing	2
7	Process costing; waste cost and its control in textile mill.	1
8	Joint and by-product costing.	1
9	Unit cost; costs of yarns and fabrics, fabric processing cost.	2
10	Absorption and variable costing; short-term decision making.	2
11	Profit planning; cost-volume-profit-analysis, break-even point, contribution margin, margin of safety and capital budgeting. Profit planning; cost-volume-profit-analysis, break-even point, contribution margin, margin of safety and capital budgeting.	3
12	Cost control; standard cost, cost and revenue variance.	1
13	Financial information; balance sheet and profit and loss account. Statement of changes in financial position. Ratio analysis.	3
14	Phases of project cycle identification, preparation, evaluation, documentation and supervision.	3
15	Various functions in project cycle.	2
16	Appraisal concept, need for appraisal, methodology, key financial indicators in appraisal, investment decision from appraisal report, post-project appraisal.	4
17	Choice of technology and their assessment, operating constraint,	4

	appropriateness of technology, factor influencing selection.	
18	Project utilities and environmental aspects for textile projects.	2
19	Special appraisals: for modernisation, balancing equipment, expansion and diversification projects.	3
COURSE TOTAL (42 times 'L')		42

16.

Brief description of tutorial activities: Cost Sheets, Case studies, Preparation of Project Proposals (14 times 'T')

17.

Brief description of laboratory activities: Not Applicable

18.

Suggested texts and reference materials:

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	Nil
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	10%
20.2	Open-ended problems	20%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	0%

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>)	Production and Operations Management of Textile Industry
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL762
6.	Status (<i>category for program</i>)	DE for B.Tech. (Textile Technology) students and PE for M. Tech. (Textile Engineering & Fibre Science) students

7.	Pre-requisites (course no./title)	90 Earned Credits for UG students
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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	SML 745 Operations management (15%)
8.3	Supersedes any existing course	TTL762

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 S. M.Ishtiaque, B K. Behera, R. Rengasamy, R, Alagirusamy, Abhijit Majumdar	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): After attending the course the student will learn – Various operations management functions of textile industry such as operation strategy, facility location, capacity planning, aggregate planning ,production planning and control, , scheduling. Just in time concept, supply	
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	chain management, motion and time study, productivity, forecasting, financial and profit analysis, MIS.
14.	Course contents (about 100 words) (Include laboratory/design activities): Production and operations management function. Operation strategy. Facility location and capacity planning. Production planning and control, aggregate planning, scheduling, PERT and CPM, product mix linear programming concepts. Inventory models, optimal order quantity, economic manufacturing batch size, classification of materials, materials requirement planning, Just in time concept. Supply chain Management. Maintenance management. Plant modernisation. Motion and time study. Job evaluation and incentive scheme. Productivity, partial and total productivity, machine, labour and energy productivity, efficiency and effectiveness, benchmarking, measure to increase productivity. Forecasting, methods of forecasting. Total quality management and Six Sigma. Product pricing. Financial and profit analysis, investment decisions. Management information system.

15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Indian textile industry scenario, production and export, yarn, fabric and apparel sectors.	2
2	Textile Policy. Sickness in textile industry, analysis and options.	2
3	Production and operations management function.	1
4	Operation strategy, facility location and capacity planning	3
5	Production planning and control; aggregate planning, scheduling, PERT and CPM, product mix using linear programming concepts.	4
6	Inventory model and safety stock; optimal order quantity, economic manufacturing batch size.	3
7	Classification of materials, materials requirement planning, material store management and distribution management., Just in time concept.	2
8	Supply chain Management in textile industry	2
9	Maintenance management in textile industry	2
10	Plant modernisation	2
11	Motion and time study	1
12	Job evaluation and incentive scheme.	1
13	Productivity; partial and total productivity, machine, labour and energy productivity, efficiency and effectiveness, benchmarking, measure to increase productivity.	3
14	Forecasting; methods of forecasting, moving average, regression and exponential smoothing techniques, forecasting accuracy.	3
15	Total quality management and Six Sigma.	3
16	Product marketing and pricing for textile industry	2
17	Financial and profit analysis, investment decisions.	4
18	Management information system.	2
		42

16. Brief description of tutorial activities: Not applicable

17. Brief description of laboratory activities: Not Applicable

18.

Suggested texts and reference materials:

- i. Production & Operations management by R. Panneerselvam
- ii. Operations and supply management by Chase, Ravi Shankar, Jacob & Aquilano
- iii. Operations management: Theory and Practice by B. Mahadevan
- iv. Operations management by Krajewski, Ritzman and Malhotra
- v. Operations research: An introduction by H. A. Taha

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

19.1	Software	NPTEL web site, LINDO, MS PROJECT
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	Nil
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	10%
20.2	Open-ended problems	20%
20.3	Project-type activity	20%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	0%

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>)	Technical Textiles
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL763
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students, PE for M. Tech. (TE, TF) students, OC for others

7.	Pre-requisites (course no./title)	90 Earned Credits and TTL211/TTL221/TTL222/TTL231/TTL232 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	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	TTL363, TTL364, TTL717, TTL718, TTL866

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 x Either sem
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11.	Faculty who will teach the course V. K. Kothari, R. Alagirusamy, R. S. Rengasamy, R. Chattopadhyay, Apurba Das, Dipayan Das	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): The objectives of the course are - To familiarize the students with the manufacturing of technical textiles - To provide knowledge on material-structure-property relationship in technical textiles - To know the areas of applications of technical textiles
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Technical textile: definition, classification, and growth projection. Properties of fibres,
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	yarns and fabrics used in technical textiles. Sewing thread: type, characteristics & performance. Characteristics & properties of cords, ropes, braids and narrow fabrics. Textiles for dry and wet filtration. Mechanisms of separation. Fibre and fabric selection for filtration. Types and application of geosynthetics, Fibre and fabric selection for geotextiles. Application of textiles in automobiles. Requirement and design for tyres, airbags and belts. Clothing for thermal protection. Extreme winter clothing with low heat transmission and comfort properties. Mechanism of high velocity impact absorption. Materials used in bullet proof and cut resistant clothing. Design for soft and hard armours. Material, method of production and areas of application of agrotextiles. Design of temporary and permanent structures using fabrics. Different types of fabrics used for packaging. Methods of production and properties of textiles used in these applications.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Introduction, definition, classification, market and scope: Definition, classification, products, market overview and growth projections of technical textiles. Fibres, yarns and fabric structures in technical textiles and their relevant properties.	6
2	Sewing threads, cord, ropes, braids, narrow fabrics: Type and important characteristics of sewing threads. Definitions and major characteristics of cord, ropes, braids and narrow fabrics. Methods of their production and technical uses of these products.	6
3	Theory of filtration, types and concepts, filter fabrics: Textile and other filter media for dry and wet filtration. Mechanisms of separation. Requirements for good filter media and filtration. Fibre and fabric selection for filtration.	6
4	Geotextiles and other geosynthetics: Types and application of geosynthetics. Functions and application areas of geotextiles. Fibres and fabric selection criteria for geotextile applications. Mechanics of reinforcement, filtration and drainage by geotextiles. Soil characteristics. Methods of long term prediction of geotextile life and survivability in soil.	6
5	Automotive Textiles: Application of textiles in automobiles. Requirement and design for pneumatic tyres, airbags and belts. Methods of production and properties of textiles used in these applications.	6
6	Protective Textiles – Protection against cold, bullets, cuts: Clothing requirements for thermal protection, ballistic protection. Extreme winter clothing with low heat transmission and comfort properties. Mechanism of high velocity impact absorption. Materials used in bullet proof and cut resistant clothing. Design for soft and hard armour. Design principles and evaluation of these protective clothing in these applications.	6
7	Agrotextiles, Architectural Fabrics, Textiles for Packaging etc.: Type and properties of fabrics used in these applications. Raw material, method of production and areas of application of agrotextiles. Different types of architectural fabrics and their property requirements. Design of temporary and permanent structures using fabrics. Different types of fabrics used for packaging. Their production techniques and properties.	6
8		
9		
10		
11		
12		
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

Module no.	Experiment description	No. of hours
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials :

1. Handbook of Technical Textiles, Eds. A.R. Horrocks and S.C. Anand, Woodhead Publishing, U.K.
2. Wellington Sears Handbook of Industrial Textiles, Ed. S. Adanur, Alburn University, USA

Other reading material needed would be referred to and intimated to the students in the class.
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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
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	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	Group discussion (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>)	Process control in yarn and fabric manufacturing
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 764
6.	Status (<i>category for program</i>)	DE for B. Tech. (Textile Technology) students and PE for M. Tech. (Textile Engineering) students

7.	Pre-requisites (course no./title)	90 Earned Credits and TTL221/TTL222/TTL231/TTL232 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	Nil
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	TTL323, TTL333

9.	Not allowed for (indicate program names)	None
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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 S. M. Ishtiaque, R. Chattopadhyay, R. Alagirusamy, R. S. Rengasamy, B. K. Behera, Abhijit Majumdar, Amit Rawal, and Dipayan Das	
12.	Will the course require any visiting faculty?	NIL

13.	Course objective (<i>about 50 words</i>): This course is designed to provide the students with an understanding of the controlling of spinning and weaving processes. The students will learn about the principles of automatic control, types of controller action, controller mechanism, control strategies & techniques used for ensuring yarn and fabric quality, process efficiency, and minimizing process waste.	

14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Basics of automatic control, Statistical considerations in process control. Online and	
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	offline control measures in spinning. Control of yarn quality attributes. Spinning process performance. Post spinning problems. Control of winding, warping, sizing, weaving and knitting processes. Control of fabric defects and value loss. Yarn quality requirement and assessment for weaving

15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Basics of automatic control	4
	Principles of automatic control , Open loop , closed loop, Types of controller action (On/off control, proportional control, proportional & integral control, proportional plus integral plus derivative control)	
2	Statistical process control	3
	Steam-and-Leaf plot, Check sheet, Pareto chart, Cause-and-effect diagram, Defect concentration diagram, Scatter diagram, Shewhart control charts for variables and attributes, Cumulative sum control chart, Exponentially weighted moving average control charts	
3	On line & off line control measures in spinning	4
	Overview of process control activity in spinning, Contamination in cotton and control measures, Control of mixing quality and cost , Bale management, Blendomat (Truetszschler), Autolevellers in card and draw frame	
4	Control of yarn quality attributes	5
	Control of yarn unevenness, imperfections and periodic mass variation in yarn, Control of yarn count and count CV%, Control of strength (CSP and single yarn), elongation and their variation in cotton and blended yarn, Control of yarn hairiness	
5	Spinning process performance	4
	Process capability, Static charge, it's effect (roller lapping, web breakage, soiling etc.) and control, Control of waste and cleaning in blow room, card, comber, On line monitoring of end breaks ring and rotor spinning and it's control	
6	Post spinning problems	2
	Mixing and it's effect on shade variation and dyed specs, Barre: it's causes and control	
7	Process control in winding and warping	4
	Controls for quality, machine stoppage and productivity in winding , warping, and pirn winding, process control program in winding and warping, Controls in the process of high twist yarns, blended yarns, filament yarns in warp and weft. Controls in the winding for processing yarns for dyeing & knitting, Controlling sloughing off during winding, warping , Control of yarn tension and clearer setting in winding, evaluation of knots and splice, control of hairiness, Calculations pertaining to production, efficiency and machine allocation in winding, warping, pirn winding, assessment of package and beam quality.	
8	Process control in sizing	3
	Selection of size material, control of size add on, sizing-weaving curve,	

	Optimization of machine speed, squeeze pressure, drying temperature, size concentration and viscosity, size paste preparation, evaluation of size material and sized yarn, control of waste in sizing, Control of migration in sizing, size droppings, typical size mix for common fabric styles, preparation of filament yarns for weaving.	
9	Process control in loom shed Control of machine stop and yarn breakage, Controls for yarn quality, machine and energy audit, housekeeping and material handling, Care, selection and consumption norms of accessories. formulation of maintenance schedule, Loom allocation, Temperature and humidity control, Statistical interpretation of data on waste and quality, troubleshooting in weaving room, weft loading in shuttleless weaving, control of air quality and water quality in jet weaving.	3
10	Process control in shuttle less weaving systems Automation of functions, weft entry angle, trouble shooting message analysis and suggestion of action, various machine adjustments, electronic weft insertion control, automatic pick finder, auto-setting and opening of valve in air-jet loom, settings of weave colour & colour pattern, electronic let-off & take-up, automatic stop-mark preventer, weft selection, automatic control of weft density and warp tension, material handling and QSC system, warp tension control, control of weft waste.	3
11	Fabric defects and value loss Fabric defects and their control, automatic fabric inspection, estimation of value loss, Control of value loss in fabrics through evaluation & grading of fabric defects, Fabric defect analysis based on minor, major and point system grading. remedial measures to control weaving defects, Control and norms for waste.	2
12	Process control in knitting and nonwoven Control of yarn tension, areal density, loop length in knitting. Spiral and its control. Process control in needle punching, hydroentanglement, melt blowing and spun bending operations.	2
13	Yarn quality requirement and assessment for weaving Warp breakage phenomena in weaving, warp breakage mechanism, factors affecting warp breakage rate, Estimation of warp breakage rate, empirical, statistical and instrumental approach, Concept of weavability, Yarn quality and weavability, CSP as a measure of weavability, Classimat analysis, role of classimat faults in assessing weaving performance of warp yarn, yarn quality requirement for high speed weaving.	3
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

18. Suggested texts and reference materials:

1. Process control in textile manufacturing, edited by Majumdar, Das, Alagirusamy & Kothari, Woodhead
2. Seminar on Process Control in Spinning, Edited by R. Chattopadhyay, March 2001, IIT Delhi
3. Quality control in Spinning, 3rd Edition, T. V. Ratnam and K.P. Chellamani, South India Textile Research Association, Coimbatore, 1999
4. Process Control in Spinning, 2nd Edition, T. A. Subramaniam and A.R. Garde, ATIRA, Ahmedabad, 1978
5. Process control in weaving, M. C. Paliwal, P. D. Kimothi, Ahmedabad Textile Industry's Research Association, 1983
6. Uster Sliver data for the process prior to spinning, Uster News Bulletin No.33/1986, Zellweger Uster
7. Product Quality and assurances at automatic rotor spinning machines, Uster News Bulletin No.34/1987, Zellweger Uster
9. The detection of end breaks in ring spinning, Uster News Bulletin No.27/1979, Zellweger Uster
10. The Uster system of yarn fault control, Uster News Bulletin No.29/1981, Zellweger Uster
11. Uster polyguard Q-pack, Uster News Bulletin No.37/1990, Zellweger Uster
12. Quality management in spinning mill, Uster News Bulletin No.39/1993, Zellweger Uster
13. On line quality control in spinning and weaving, Textile progress, Vol 17, No.1/2
14. Computer Integrated Manufacturing and Total Quality management, D.M. Sigmon, P.L. Grady and S.C. Winchester Textile Progress, Vol 27, No.4, The Textile Institute, 1998
15. Evenness testing in yarn production, Part –I and II, R. Fruter, Quality control and assessment series. The Textile Institute, Manchester
16. Engineering in Textile coloration, Edited by C. Duckworth, Dyers company publication trust, England, 1983

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
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	-
20.2	Open-ended problems	40% case studies
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-

20.5	Others (please specify)	-
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Date:

(Signature of the Head of the Department)

COURSE TEMPLATE

1.	Department/Centre proposing the course	Department of Textile Technology
2.	Course Title	Design and Manufacturing of Textile Structural Composites
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL766
6.	Status (category for program)	DE for B. Tech. (Textile Technology) students, PE for M. Tech. (Textile Engineering/Fibre Science and Technology) students

7.	Pre-requisites (course no./title)	90 Earned Credits and TTL231/TTL232 for UG students
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8.	Status vis-à-vis other courses (give course number/title)	
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	TTL718

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 B. K. Behera, R. Alagirusamy, Amit Rawal	
12.	Will the course require any visiting faculty?	No

13.	Course objective (about 50 words): - To understand the formation of special textile structures and their usage for composite applications - To understand structure-property relationship of various textile structural composites - To know the design engineering principles of textile structural composites by computational method - To know the methods used to characterize various structural composites for different applications	
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14.	Course contents : Introduction to textile composite systems. Textile composites and textile structural composites. Advantages of textile composites. Classification of textile reinforcement structures. Manufacture of textile reinforcement structures. UD, 2D and 3D woven, braided, knitted structures. Manufacturing techniques of structural composites. Design of fabric reinforced composites. Mathematical analysis for yarn model, fabric model, processing model and models for composite laminates. Finite element modeling of textile composites. Design and manufacture of 3D fabrics and their composites, profiled structures, spacer fabric, polar fabric, spiral fabric, hollow fabric, contour fabric. Structure and properties of composites. Mechanical analysis, tensile, bending, shear and compression properties. Characterization of structural composites. Test methods. Applications of textile structural composites. Experiments in textile composites.
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15. Lecture Outline *(with topics and number of lectures)*

Module no.	Topic	No. of hours
1	Introduction to Textile Composite, Definition -Textile composites and Textile structural composites, Advanced composites, Flexible and Rigid composites, Fibres for composites, Specialty yarns for composites, Hybrid yarn, Types of matrices for composites , Description of matrix material, Matrix selection criterion, Components and classification of composites	4
2	Classification of Textile Reinforced Structures, Categorization according to the reinforcement geometry, particular, fibrillar, granular, lamellar, Classification based on axial orientation of component yarns, uniaxial, biaxial, triaxial and multiaxial structures, Classification based on dimensions, UD, 2D and 3D structures, Multilayer, Laminar and Hybrid structures, Belting , Composite Rope	4
3	Theory of composites, Design of composite structure, parallel arrangement and series arrangement of components, Mixing rules, general mixing and logarithmic mixing, Strength and modulus of structural composites, strength for continuous fibre, short fibre and randomly oriented fibre, Determination of fibre volume fraction	4
4	Textile Preforming, Manufacturing of textile reinforcement structures for composite applications, Weaving, Knitting, Nonwoven, Braiding, Stitching, Tufting, Embroidery, Robotic tow placement, Tape laying, Near-net preforming for thick fittings, Winding/wrapping	6
5	Design and manufacturing of 3D fabrics for composites, 3D weaving, 3D solid structures, cell structures, hollow structures, 3D Knitting-knitted spacer , 3D braiding, 3D nonwoven structures for structural composites, Extra-light 3D woven distant structures for composites	4
6	Development of Innovative structures to produce specialty structural composites, Profiled structures, Manufacturing of spacer fabric for composites, Production of Polar fabric, Spiral fabric, Hollow fabric, Contour fabric and their processing for structural composites, Nonwoven with particulates, Nonwoven with bicomponent fibres, Nonwoven produced with multi-card and multi-beam process,	4

	Combination process-SMS, Hydroknit and COFORM process nonwovens for structural composites	
7	Manufacturing techniques of structural Composites, Various composite processing, Hand lay up, Bag-molding, compression molding, pultrusion, and filament winding, Resin transfer molding, structural reaction injection molding, resin film infusion, tube-rolling technique	4
8	Design Engineering of fabric reinforced composites, Mathematical analysis for yarn model, fabric model, processing model and models for composite laminates, Finite element modeling of textile structural composites and comparison with real testing , multiscale modeling of structural Composites, meso-scale modeling of unbalanced woven composites, Mechanical modelling of different structures and prediction of mechanical behavior of selected structural composites.	4
9	Structure and properties of structural composites, Internal Geometry of reinforcement structures, Morphological characterization of composites reinforced by various textile structures, Mechanical Analysis, tensile, bending, shear and compression properties, Impact and fatigue analysis, Study of fibre-matrix behaviour at interface, Damage analysis, Delamination test, Analysis of thermal conductivity, Acoustic emission test , Environmental test	4
10	Applications of Textile structural composites, automotives, marine, aerospace, sports, civil engineering, machine components, wind energy, ballistic and other body armour applications, knife penetration protection, pressure vessel.	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

Module No.	Experiment description	No. of hours

18. Suggested texts and reference materials :

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1. Recent Advances in Textile Composites, edited by Suresh G. Advani
2. Design and manufacture of textile composites, Edited by A C Long, University of Nottingham, UK, Woodhead publication
3. 3-D Textile Reinforcements In Composite Materials , Editor(s): Antonio Miravete
4. Mechanics of Composite Materials, Second Edition, Autar K. Kaw, *University of South Florida, Tampa, USA*
5. Finite Element Analysis of Composite Materials, Ever J. Barbero, *West Virginia University, Morgantown, USA*
6. Introduction to Composite Materials Design, Second Editio, Ever J. Barbero, *West Virginia University, Morgantown, USA*
7. *Textile structural composites*, by Tsu-Wei Chou and Frank K. Ko, Elsevier publication

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

19.1	Software	Matlab,Abaqus, Ansis, Solidworks
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT
19.4	Laboratory	
19.5	Equipment	
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	30%
20.2	Open-ended problems	-
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	Textile Technology
2.	Course Title (<i>< 45 characters</i>)	Design of Experiments and Statistical Techniques
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 773
6.	Status (<i>category for program</i>)	DE for B.Tech. (Textile Technology) students, PC for M.Tech. (Textile Engineering) students, PE for M.Tech. (Fibre Science and Technology) students, and OC for others

7.	Pre-requisites (course no./title)	EC 90
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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	TTL773

9.	Not allowed for (indicate program names)	None
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10.	Frequency of offering	☐ Every sem ☐ 1 st sem X 2 nd sem ☐ Either sem
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11.	Faculty who will teach the course Prof. R. Chattopadhyay and Dr. Dipayan Das	
12.	Will the course require any visiting faculty?	NIL

13.	Course objective (<i>about 50 words</i>): To provide a solid foundation about the fundamentals of experimental design, analysis of results and their interpretations.	

14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Objectives and principles of experimental design. Completely randomized design. Randomized block design. Latin square design. Graeco-Latin square design. Balanced incomplete block design. Factorial designs. Two-level and three-level full and	
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	fractional factorial designs. Mixture experiments. Simplex lattice designs. Response surface methodology. Central composite and Box-Behnken designs. Analysis of variance. Statistical test of hypothesis. Analysis of correlation. Simple and multiple linear regression. Acceptance sampling by attributes and variables. Control charts for variables and attributes. Use of statistical software packages.

15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Introduction to experimental designs	1
	Objectives of experimental designs, Principles of experimental designs, Terminologies associated with experimental designs, Guidelines for designing experiments, Applications of experimental designs	
2	Completely randomized design	2
	Completely randomized single factor experiments, Practical examples, Use of software package	
3	Randomized Blocks, Latin squares, and related designs	4
	Randomized block design, Latin square design, Graeco-Latin Square design, Balanced incomplete block design, Practical examples, Use of software package	
4	Factorial designs	6
	Two-level and three-level full factorial designs, Two-level and three-level fractional factorial designs, Blocking, confounding, and replication, Practical examples, Use of software package	
5	Mixture experiments	3
	Simplex lattice designs, Augmented simplex designs, Standard mixture models, Practical examples, Use of software package	
6	Response surface methodology	4
	Response surface and contour plots, First-order and second-order models, Method of steepest ascent, Ridge systems, Response surface designs, Central composite design, Box-Behnken designs, Practical examples, Use of software package	
7	Analysis of variance	6
	Analysis of variance for one-factor experiments, Analysis of variance for two-factor experiments with and without replications, Analysis of variance for three-factor experiments with and without replications Practical examples, Use of software package	
8	Statistical test of hypothesis	2
	Objectives of hypothesis test, Types of tests, Test procedure, Type I error, Type II error, Power of statistical test, <i>P</i> -value, Practical examples	
9	Analysis of correlation	2
	Concept of correlation, Types of correlation, Scatter diagram, Index of correlation, Hypothesis test, Rank correlation, Partial correlation, Practical examples, Use of software package	
10	Analysis of regression	6
	Simple linear regression, Multiple linear regression, Scatter diagram, Least square method, Point and interval estimations, Prediction of new	

	observations, Adequacy of regression models, Practical examples, Use of software package	
11	Acceptance sampling Acceptance sampling by attributes and variables, Acceptable quality level, Lot tolerance proportion defectives, Producer's risk, Consumer's risk, OC curve, Practical examples, Use of software package	3
12	Control charts Shewhart's control charts for variables and attributes, Cumulative sum control chart, Process capability analysis, Practical examples, Use of software package	3
	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

Module no.	Experiment description	No. of hours
1		
2		
3		
4		
5		
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8		
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10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials:

Practical Statistics for the Textile Industry, Part I & Part II, G. A. V. Leaf, The Textile Institute, Manchester, 1984

Design and Analysis of Experiments, D. C. Montgomery, Wiley-India, 2007

Fundamental Concepts in the Design of Experiments, C. R. Hicks, CBS College Publishing, New York, 1982

Applied Statistics and Probability for Engineers, D. C. Montgomery and G. C. Runger, Wiley-India, 2008

Statistical Quality Control, E. L. Grant and R. S. Leavenworth, Tata McGraw-Hill Education Private Limited, New Delhi, 2010

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

19.1	Software	Design Expert [®] , Matlab [®]
19.2	Hardware	None
19.3	Teaching aides (videos, etc.)	PPT & Blackboard
19.4	Laboratory	None
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	60%
20.2	Open-ended problems	
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>)	Nonwoven Science & Engineering
3.	L-T-P structure	3-0-0
4.	Credits	3
5.	Course number	TTL 782
6.	Status (<i>category for program</i>)	DE for B.Tech. (Textile Technology) students, PE for M.Tech. (Textile Engineering) students and M.Tech. (Fibre Science and Technology) students

7.	Pre-requisites (course no./title)	EC 90
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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	Nominal overlap with TTL232 & TTL733
8.2	Overlap with any UG/PG course of other Dept./Centre	Nil
8.3	Supercedes any existing course	TTL782

9.	Not allowed for (indicate program names)	None
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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 Dipayan Das, Apurba Das, R. S. Rengasamy, Amit Rawal, and V. K. Kothari	
12.	Will the course require any visiting faculty?	NIL

13.	Course objective (<i>about 50 words</i>): This course is designed to provide students with an in-depth understanding of fundamentals of nonwoven science & engineering. It covers scientific and engineering aspects of nonwovens. The motivation for designing such a course comes from the increasing demands of nonwoven and allied industries for engineers acquainted with nonwoven processes and products.	

14.	Course contents (about 100 words) (Include laboratory/design activities): Introduction to nonwovens. Materials used in nonwovens. Principles of nonwoven processes: web formation processes, bonding processes, spunmelt processes, and chemical processes. Testing and evaluation of nonwovens: international standards, structure of nonwovens, and properties of nonwovens. Scientific analysis of structure and properties of nonwovens: fibres and their arrangement, pores and their organization, mechanics of nonwovens, fluid flow & fluid absorption, filtration, barrier & breathability, thermal insulation, and acoustic absorption. Engineering of advanced nonwoven products: medical nonwovens, nonwoven wipes, nonwoven filters, automotive nonwovens, and home furnishing nonwovens. Design and development of new nonwoven products: theories, market study, product costing, case studies, and intellectual property rights.

15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	Introduction to nonwovens	1
	Definitions of nonwovens, Classification of nonwovens, Applications of nonwovens, Key companies	
2	Materials used in nonwovens	1
	Fibre selection, Natural fibres, Synthetic fibres, Bicomponent fibres	
3	Principles of nonwoven processes	6
	Web formation processes, Bonding processes, Spunmelt processes, Chemical processes	
4	Testing and evaluation of nonwovens	6
	International standards, Structure of nonwovens, Properties of nonwovens	
5	Scientific analysis of structure and properties of nonwovens	10
	Fibres and their arrangement, Pores and their organization, Mechanics of nonwovens, Fluid flow & fluid absorption, Filtration, Bar & breathability, Thermal insulation, Acoustic absorption	
6	Engineering of advanced nonwoven products	10
	Medical nonwovens, Nonwoven wipes, Nonwoven filters, Automotive nonwovens, Home furnishing nonwovens	
7	Design and development of new nonwoven products	8
	Theories, Market study, Product costing, Case studies, Intellectual property rights	
	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

Module	Experiment description	No. of
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no.		hours
1		
2		
3		
4		
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6		
7		
8		
9		
10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials:

Introduction to Nonwovens Technology, S. Batra and B. Pourdeyhimi, DEStech Publications, Inc., 2012.

Handbook of Nonwovens, S. J. Russel, Woodhead Publishing Limited, UK, 2007.

Nonwoven Fabrics, W. Albrecht, H. Fuchs, and W. Kittelmann, Wiley-VCH, Germany, 2003.

Non-woven Bonded Fabrics, J. Lunenschloss and W. Albercht, Ellis Horwood, UK, 1985

Manual of Nonwovens, R. Krcma, SNTL, Prague, 1971.

Associations of the Nonwovens Fabrics Industry, Standard Test Methods for Nonwovens and Related Industries, USA, 2008.

Nonwovens Glossary, Associations of the Nonwovens Fabrics Industry, USA, 2002.

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 & Blackboard
19.4	Laboratory	None
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	10%
20.2	Open-ended problems	20%
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-

20.5	Others (please specify)	20% (Term paper)
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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>)	Manufactured Fiber Technology Laboratory
3.	L-T-P structure	0-0-2
4.	Credits	1
5.	Course number	TTP212
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110
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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	

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- Rajiv Srivastava, Sourabh Ghosh, Manjeet Jassal, Ashwini K. Agrawal, Bhuvanesh Gupta, Mangala Joshi, Bhanu Nandan	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): The course is aimed to provide practical training and learning through laboratory experiments about the fiber manufacturing techniques and characterization of fibers thus produced
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The laboratory experiments are planned to provide knowledge on fibre formation of selected synthetic polymers and the characterization of fibers/tapes produced. Melt-spinning, extrusion, wet spinning and dry-jet wet spinning techniques is used to produce fibres or tapes. The evaluation of structure through thermo-mechanical properties, polymer solution rheology and microscopic analysis of materials is carried out using established methods.
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15. Lecture Outline (with topics and number of lectures)

Module no	Topics	No of Hours
1	Effect of temperature and thermal treatment on MFI of PP and effect of moisture on MFI of PET	2
2	Melt spinning of PET filament	2
3	Melt spinning and cold drawing of Nylon 6	2
4	Drawing and heat setting of as-spun PET filament; mechanical testing of as-spun and processed filament	2
5	Melt extrusion of PP : effect of quenching bath temperature on structure of PP tape	2
6	Effect of drawing on stress-strain curves of as-spun and drawn fibres.	2
7	Evaluation of crystallinity and orientation in PET fibre by WAXD	2
8	Measurement of sonic modulus and thermal transitions of POY and FDY PET	2
9	Crystal growth in PP using hot stage microscopy	2
10	Crystal structure of PP and Nylon 6 fibres using WAXD	2
11	Density measurement of fibers using floatation method	2
12	Birefringence measurement of fibres	2
13	Measurement of solution viscosity of acrylic dope using Brookfield viscometer and ball-fall technique	2
14	Dry jet wet spinning of acrylonitrile copolymers	2
	Total	28

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.	Suggested texts and reference materials : 1. Manufactured Fiber Technology – Gupta and Kothari 2. Handbook of Fiber Chemistry – M. Lewin, E. M. Pearce, 2 nd Ed., Marcel Dekker, 1998. 3. Dynamics of Fiber formation and Processing, R. Beyreuther and H. Brunig 4. Textile Fibres: Developments and innovations, V.K. Kothari
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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.)	None

19.4	Laboratory	Fiber Production (spinning, extrusion), Microscopy, X-Ray, Thermal, Mechanical and Rheological analysis
19.5	Equipment	-
19.6	Classroom infrastructure	-
19.7	Site visits	-

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

20.1	Design-type problems	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	Experimental course

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>)	YARN MANUFACTURE LABORATORY– I
3.	L-T-P structure	0-0-2
4.	Credits	1
5.	Course number	TTP221
6.	Status (<i>category for program</i>)	DC for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110
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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	TTP221

9.	Not allowed for (indicate program names)	None
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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. M. Ishtiaque, R. Chattopadhyay, R. Alagirusamy, R. S. Rengasamy, Apurba Das, Dipayan Das	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To reinforce the theoretical concepts taught in lecture classes by carrying out experiments on machines	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Experiments related to the lecture course entitled "Yarn Manufacture I (TTL221)".	
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15. **Lecture Outline** (with topics and number of lectures) *Not Applicable*

16. **Brief description of tutorial activities:** *Not Applicable*

17. **Brief description of laboratory activities**

Mod uleno .	Experiment description	No. of hours
1	Study of drives and mechanisms of mixing bale opener	2
2	Study of drives and mechanisms of mono cylinder and flexi-cleaner	2
3	Study of drives and mechanisms of tuft feeding system	2
4	Determination of beating intensity of opening rollers at blowroom and licker-in at card	2
5	Determination of cleaning efficiency of blowroom and carding machines	2
6	Determination of fiber openness in bale, lap, and sliver	2
7	Study of card geometry, length of carding arc, and wire point density on cylinder, doffer, and flat	2
8	Determination of draft, its distribution and production of carding machine	2
9	Study of machine setting in carding and drawing machines, wire point density on cylinder, doffer and flat	2
10	Determination of fiber orientation in carded and drawn slivers	2
11	Study of fibre transfer coefficient in carding machine, card geometry and length of carding arc	2
12	Study of fibre neps in carded web	2
13	Determination of draft, its distribution and production of drawing machine	2
14	Study of effect of draft and doubling on mass irregularity of drawn sliver	2
15	Study of effect of draft and roller setting on drafting wave in drawn sliver	2
16	Production of carded and drawn slivers of given linear densities	2
TOTAL OF ANY FOURTEEN EXPERIMENTS		28

18. **Suggested texts and reference materials:**

1. Operating Instructions for Mixing Bale Opener Model LB3/2, Lakshmi Machine Works Ltd., India, 1998
2. Operating Instructions for the Mono Cylinder Cleaner Model LB4/2, Lakshmi Machine Works Ltd., India, 1999
3. Operating Instructions for Flexi Clean Model LB5/6, Lakshmi Machine Works Ltd., India, 2001
4. Operating Manual for the Card Feeding System Finefeed LA7/5, Lakshmi Machine Works Ltd., India, 1998

5. Operating Instructions for MMC Card
6. Lindsley, C. H., Measurement of Fiber Orientation, Textile Research Journal 21, 39-46, 1951
7. Platt Brothers, Shirley Miniature Spinning Plant – Operation Maintenance Details, Platt Brothers (Sales) Ltd. And Publicity Department, Oldham, England, 1964

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

19.1	Software	None
19.2	Hardware	Yarn manufacturing machines
19.3	Teaching aides (videos, etc.)	Manual of Yarn Manufacturing Laboratory I (TTP221)
19.4	Laboratory	Yarn manufacturing Laboratory
19.5	Equipment	Analytical instruments
19.6	Classroom infrastructure	None
19.7	Site visits	None

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

20.1	Design-type problems	40%
20.2	Open-ended problems	0%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	60% (understanding the principles on machines)

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>)	YARN MANUFACTURE LABORATORY– II
3.	L-T-P structure	0-0-2
4.	Credits	1
5.	Course number	TTP222
6.	Status (<i>category for program</i>)	DC for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120/MAL110/PHL110
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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	TTP222

9.	Not allowed for (indicate program names)	None
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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. M. Ishtiaque, R. Chattopadhyay, R. Alagirusamy, R. S. Rengasamy, Apurba Das, and Dipayan Das	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To reinforce the theoretical concepts taught in lecture classes by carrying out experiments on machines	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Experiments related to the lecture course entitled “Yarn Manufacture II (TTL222)”.	
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15. **Lecture Outline** (with topics and number of lectures) *Not Applicable*

16. **Brief description of tutorial activities:** *Not Applicable*

17. **Brief description of laboratory activities**

Module no.	Experiment description	No. of hours
1	Study of machine elements, drives and mechanisms of comber and making timing diagram	2
2	Determination of fractionation of fibers by comber	2
3	Study on mass distribution profile of a combed fringe	2
4	Study on the influence of nip speed on fibre orientation in sliver	2
5	Study on the drive to different components of roving frame and calculation of the draft constant, back zone draft constant	2
6	Mechanism of bobbin building in roving frame – cone drum mechanism, drive to bobbin, bobbin rail movement, speed variation and reversal of direction of lift	2
7	Study on true and false twist generation by flyer and flyer top in spinning zone	2
8	Study the influence of twist on roving strength	2
9	Study of spinning geometry, drafting angle, drive system of ring frame and calculation of the draft, its distribution and draft constants	2
10	Study of twisting in ring frame: spindle drive, twist in spinning zone and in yarn on bobbin	2
11	Study on the builder mechanism of the ring frame: understanding mechanism, cam rotation vs ring rail displacement diagram	2
12	Study of machine elements, drive and other mechanisms in TFO. Calculation of twist constant of TFO	2
13	Production of doubled yarn in TFO; influence of doubling twist on yarn properties (tensile, hairiness, uniformity etc.)	2
14	Study of the influence of spacer size on yarn hairiness	2
15	Study of the influence of spindle speed on yarn diameter and strength	2
16	Study the influence of break zone draft on the yarn uniformity	2
17	Study of the influence of rotor diameter on yarn strength	2
18	Study of the influence of opening roller speed on yarn uniformity	2
19	Study of the influence of carded, first and second drawn sliver on fibre orientation on rotor groove using Lindsely's method	2
TOTAL (14 EXPERIMENTS TO BE CHOSEN OUT OF 19)		28

18. **Suggested texts and reference materials:**

- [1] Operating Instructions for Comber E7/4, Lakshmi Machine Works Ltd., India, 1985.
- [2] Operating Instructions for Roving frame LF1400-A, Lakshmi Machine Works

Ltd., India, 2002.

- [3] Operating Instructions for Ring frame G5/1, Lakshmi Machine Works Ltd., India, 2002.
- [4] Operating Manual for the Two-For-One Twisting machine VJ-150 HS, Veejay Lakshmi Machine Works Ltd., India, 2003.
- [5] Operating Manual for DREF friction spinning machine.

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

19.1	Software	None
19.2	Hardware	Yarn manufacturing machines
19.3	Teaching aides (videos, etc.)	Manual of Yarn Manufacturing Laboratory I (TTP222)
19.4	Laboratory	Yarn manufacturing Laboratory
19.5	Equipment	Analytical instruments
19.6	Classroom infrastructure	None
19.7	Site visits	None

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

20.1	Design-type problems	40%
20.2	Open-ended problems	0%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	60% (understanding the principles on machines)

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>)	Fabric Manufacture Laboratory -I
3.	L-T-P structure	0-0-2
4.	Credits	1
5.	Course number	TTP231
6.	Status (<i>category for program</i>)	DC for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110
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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	Nil

9.	Not allowed for (indicate program names)	None
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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 V. K. Kothari, B. K. Behera, Abhijit Majumdar, Amit Rawal	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To explain, demonstrate and conduct experiment on different preparatory (winding, warping and sizing) and fabric forming machines (shuttle looms) for understanding the principles of these operations. To understand the role of various process parameters and timing of operations on the performance and properties of fabric.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Experiments related to the theoretical paper TTL231.	
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15. Lecture Outline (with topics and number of lectures): Not Applicable

16. Brief description of tutorial activities: Not Applicable

17. Brief description of laboratory activities

Module no.	Experiment description	No. of hours
1	Introduction to fabric manufacturing	2
2	Study of different type of packages and process of winding	2
3	Study of warping machine and preparation of warp beam	2
4	Study the effect of winding speed on yarn hairiness	2
5	Study the effect of sizing speed on size add on% and that of size add on% on tensile properties of yarns	2
6	Study the types of sheds, the tappet shedding mechanisms and to find the effect of changing the position of lam rods on the treadle levers on shed depth	2
7	Analysis of a given woven fabric sample to find out the following: thread density, warp and weft crimp, warp and weft linear density, areal density and weave pattern	2
8	Study of dobby shedding mechanism and understanding the peg plan for a given design	2
9	Study of jacquard shedding mechanism and punch a design card for the available jacquard based on a given design	2
10	Study of the parts of shuttle and shuttle box and the conventional picking mechanism and find out the effect of loom settings on the picking force	2
11	Study of the beat up mechanism, loom cycle, synchronization present in the loom and to address the loom timings	2
12	Study of the let-off and take up mechanism in conventional looms and to observe the effect of changing the change gear on the pick spacing of the fabric	2
13	Study of the auxiliary motions in the loom	
14	Study of the automation in the loom (feeler mechanism, bobbin change mechanism, multiple box motion)	
		28

18. Suggested texts and reference materials :

1. Principles of weaving by Marks and Robinson.
2. A.Ormerod, Walter S. Sondhelm, Weaving: technology and operations (1995), The Textile Institute.

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

19.1	Software	None
19.2	Hardware	Winding, warping and Sizing machines; Shuttle looms, Dobby and Jacquard systems
19.3	Teaching aides (videos, etc.)	manuals
19.4	Laboratory	Fabric manufacturing Lab
19.5	Equipment	Analytical instruments
19.6	Classroom infrastructure	
19.7	Site visits	None

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

20.1	Design-type problems	40%
20.2	Open-ended problems	0%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	60% (understanding the principles on machines)

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>)	Fabric Manufacture Laboratory -II
3.	L-T-P structure	0-0-2
4.	Credits	1
5.	Course number	TTP232
6.	Status (<i>category for program</i>)	DC for B.Tech. (textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110/TTL231
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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	TTP232

9.	Not allowed for (indicate program names)	None
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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 V. K. Kothari, B. K. Behera, Abhijit Majumdar, Amit Rawal	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To explain different fabric manufacturing techniques like shuttle-less weaving, knitting, nonwoven and braiding. Analysis of mechanisms for primary and secondary motions of projectile, rapier and fluid jet looms. Understanding the principles and operations of different flat bed and circular knitting machines. Production and analysis of different knitted structures.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Experiments related to the theoretical paper TTL232.	
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15. Lecture Outline (with topics and number of lectures): Not Applicable

16. Brief description of tutorial activities: Not Applicable

17. Brief description of laboratory activities (14 sessions × 2 hours)

Module no.	Experiment description	No. of hours
1	Introduction to shuttleless weaving, knitting and nonwoven production techniques and respective laboratories	2
2	To study the primary, secondary and auxillary motions of the projectile looms	2
3	To study the primary, secondary and auxillary motions of the rapier looms	2
4	To study the primary, secondary and auxillary motions of the air-jet and water-jet looms	2
5	To study the relationship between the type of weave and tensile properties of fabrics (woven in air-jet loom)	2
6	To determine the braid angle, helical length, pick count and pitch for known braid diameter at constant take-up speed.	2
7	To determine the braiding angle from the machine parameters and also make a comparison between the theoretical and experimental cover factors of braided structures	2
8	To produce needlepunched nonwoven fabrics at different punch densities and depth of needle penetration and test tensile properties	2
9	Production and analysis of samples on single bed and double bed flat knitting machines with different yarn counts.	2
10	Production and analysis of samples on single bed flat knitting machine with different cam settings. Analysis of relationship between cam setting and fabric parameters.	2
11	Production and analysis of samples on double bed flat knitting machine with different cam settings. Analysis of relationship between cam setting and fabric parameters.	2
12	Production and analysis of fabric samples of different designs (Cardigan, half Cardigan, double Cardigan and Double half cardigan) on double bed knitting machine	2
13	Production and analysis of fabric samples of different designs (Half Milano, Alternate half Milano, Milano rib and Rib ripple) on double bed flat knitting machine	2
14	Study of different motions and cam jackets of single jersey circular knitting and analysis of samples prepared on this machine.	2
15	Study of different motions and cam jackets of rib and interlock circular knitting and analysis of samples prepared on this machine.	2
		28

18. Suggested texts and reference materials :

1. J. J. Vincent, Shuttleless looms (1980).
2. O. Talavasek, and V. Svaty, Shuttleless weaving machines (1981) Elsevier.
3. A. Ormerod, Walter S. Sondhelm, Weaving: technology and operations (1995),

- The Textile Institute.
4. S. J. Russell, Handbook of nonwovens (2007), Woodhead publishing.
 5. W.A. Douglass, Braiding and Braiding Machinery (1964), Centrex Publishing Company
 6. W. Albrecht, H Fuchs, W. Kittelmann, Nonwoven fabrics (2003), Wiley-VCH Verlag.
 7. Knitting technology by Spenser
 8. Fundamentals and advances in knitting technology by Sadhan Ray, Woodhead.
 9. Flat knitting by Samuel Raj, Bamberg Publisher
 10. Circular Knitting by Iyer, Mammel & Schach, Bamberg Publisher

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

19.1	Software	None
19.2	Hardware	Shuttleless looms, knitting, nonwoven and braiding machines
19.3	Teaching aides (videos, etc.)	manuals
19.4	Laboratory	Fabric manufacturing Lab
19.5	Equipment	Instron, Leica microscopes etc.
19.6	Classroom infrastructure	
19.7	Site visits	None

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

20.1	Design-type problems	40%
20.2	Open-ended problems	0%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	60% (understanding the principles on machines)

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>)	Technology of Textile Preparation and Finishing Laboratory
3.	L-T-P structure	0-0-3
4.	Credits	1.5
5.	Course number	TTP241
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110
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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	None

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 B S Butola, Samrat Mukhopadhyay, Kushal Sen, Deepti Gupta	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To familiarize the students with application aspects of textile pretreatment and finishing. The students are required to treat various textile types chemically and evaluate the effect of the process.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): Natural and added impurities in textiles. Singeing, desizing, scouring, bleaching, mercerization and optical whitening of cotton. Combined preparatory processes Carbonization, scouring and bleaching of wool, degumming of silk. Chemical finishes for hand modification. Bio-polishing, Resin finishing, Water and Oil repellent finishes. Fire retardant finish, Antimicrobial finish, Weight reduction of cotton.	
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15. Lecture Outline (with topics and number of lectures): NOT APPLICABLE

16. Brief description of tutorial activities: NOT APPLICABLE

17. Brief description of laboratory activities:

Module no.	Experiment description	No. of hours
1	Desizing of cotton fabric with enzyme, acid and oxidizing agents	3
2	Scouring of desized cotton with alkali, effect of alkali type, surfactant concentration, time and temperature on scouring efficiency	3
3	Bleaching of scoured cotton with Sod. Hypochlorite, sodium chlorite and hydrogen peroxide	3
4	Mercerization of cotton fabric/yarn hank under slack and tensioned conditions	3
5	Pretreatment of silk: Degumming with soap, acid, alkali and amines. Bleaching with hydrogen peroxide	3
6	Pretreatment of wool: Carbonizing, scouring and bleaching	3
7	To modify the feel of a fabric by treatment with softening and stiffening agents	3
8	To impart Crease recovery property to cotton using DMDHEU based finish	3
9	To impart Crease recovery property to cotton using formaldehyde free system based on glyoxal	3
10	To carry out water repellent finishing of cotton	3
11	To impart flame retardant finish to cotton fabric	3
12	Weight reduction of polyester using alkali	3
13	To carry out the rot proofing of cotton by insitu formation of a rot proofing agent	3
14	Biopolishing of cotton with cellulases	3
COURSE TOTAL (42 times 'P')		42

18.	Suggested texts and reference materials: 1. Chemical Technology in the pre-treatment process of textiles, S R Karmakar, 1999, Elsevier Science 2. Textile Scouring & Bleaching by E.R.Trotman, B.I. Publications, New Delhi. 3. Handbook of Fibre Science and Technology- Volume I: Chemical Properties of fibers and fabrics fundamentals and preparation Part-A and B. ed. Mena Chem Lewin and Stephen B-Sello. Marcel Dekker Inc. New York. 4. Textile Finishing, (Ed.) Derek Heywood, 2003, Society of Dyers and Colorists 5. Chemical Finishing of Textiles, W D Schindler and P J Hauser, Woodhead Publishing, 2004
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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.)	None
19.4	Laboratory	Yes
19.5	Equipment	Various laboratory equipments
19.6	Classroom infrastructure	Lab with processing equipments
19.7	Site visits	None

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

20.1	Design-type problems	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	90% time will be spent by the students in performing the experiments. A viva exam will be conducted once. A lab-based quiz will be also a part of the course.

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>)	Technology of Textile Coloration Laboratory
3.	L-T-P structure	0-0-3
4.	Credits	1.5
5.	Course number	TTP242
6.	Status (<i>category for program</i>)	DC for B. Tech. (Textile Technology) students

7.	Pre-requisites (<i>course no./title</i>)	CYL120 / MAL110 / PHL110/TTL241
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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	None

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 B S Butola, Samrat Mukhopadhyay, Kushal Sen, Deepti Gupta	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): To familiarize the students with application aspects of colors on textiles by dyeing and printing.	
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The principles of dyeing and printing of textile materials. Dyeing equipment and the specific dyes and procedures used to dye textiles. Evaluation of Fastness. Methods of printing namely, screen, transfer, ink jet and the preparation of printing paste. Direct, discharge and resist printing styles.	
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15. **Lecture Outline** (*with topics and number of lectures*): **NOT APPLICABLE**

16. **Brief description of tutorial activities**: **NOT APPLICABLE**

17. Brief description of laboratory activities:

Module no.	Experiment description	No. of hours
1	Light absorption by Dye solutions (Beer Lambert's Law)	3
2	Dyeing of cotton with direct dyes	3
3	Dyeing with Reactive dyes	3
4	Dyeing of protein and polyamide fibres	3
5	Dyeing of Polyester with disperse dyes. Use of Exhaust and thermofixation methods	3
6	Dyeing of acrylic fibres with Basic (cationic dyes)	3
7	Dyeing of cotton with Vat Dye	3
8	Dyeing of blends: Polyester/cotton, polyester/wool and wool/acrylic	3
9	The spectrophotometer – working, calibration and repeatability	3
10	Effect of pre-treatment on dyeing of material – spectrophotometric analysis	3
11	Introduction to printing: use of various styles and methods	3
12	To study the effect of various process (pH, water hardness) and thickener parameters (type, mol. wt, concentration) on print paste viscosity.	3
13	Printing of cotton fabric with reactive dyes by using screen printing	3
14	Pigment printing on Cotton	3
COURSE TOTAL (42 times 'P')		42

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.)	None
19.4	Laboratory	Yes
19.5	Equipment	Various laboratory equipments
19.6	Classroom infrastructure	Lab with processing equipments
19.7	Site visits	None

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

20.1	Design-type problems	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	90% time is spent by the students in performing the experiments. A viva exam is conducted once. A lab based quiz is also part of the course.

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>)	Evaluation of Textile Material
3.	L-T-P structure	0-0-2
4.	Credits	1
5.	Course number	TTP361
6.	Status (<i>category for program</i>)	DC for B.Tech. (Textile Technology) students

7.	Pre-requisites (course no./title)	CYL120 / MAL110 / PHL110
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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	Supercedes any existing course	Nil

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 Apurba Das, Dipayan Das, B. K. Behera, V. K. Kothari, R. Chattopadhyay, B. S. Butola, R. Alagirusamy, S. M. Ishtiaque, R. S. Rengasamy, Abhijit Majumdar, Amit Rawal, Samrat Mukhopadhyay	
12.	Will the course require any visiting faculty?	No

13.	Course objective (<i>about 50 words</i>): It is a foundation course in the area of evaluation of textile materials and analysis techniques. The students will have knowledge about the property and performance evaluation techniques of physical characteristics of fibres, yarns, fabrics and apparel textile products.	
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14.	Course contents (about 100 words) (Include laboratory/design activities): <i>Introduction to textile testing</i> Experiments related to the lecture course entitled "Evaluation of Textile Material "
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15.	Lecture Outline (with topics and number of lectures): Not applicable
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16.	Brief description of tutorial activities: Not applicable
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17. Brief description of laboratory activities:

Module no.	Experiment description	No. of hours
1	Introduction and demonstration of all the instruments To obtain cotton fibre maturity by Caustic Soda Method.	2
2	To prepare and analysis staple diagram using Shirley comb Sorter. Determination of cotton fibre fineness by airflow method.	2
3	To obtain and analyze fibre length distribution diagram using Uster Stapling Apparatus.	2
4	To determine count strength product (CSP) using a pendulum lever machine.	2
5	To study the various factors affecting single yarn strength.	2
6	Determination of yarn twist of single and plied yarns. To obtain fibre bundle strength by Pressley Tester.	2
7	Determination of air permeability of fabrics. Determination of pilling of fabrics.	2
8	To test uniformity of slivers, rovings and yarns and to determine yarn faults at different sensitivity levels.	2
9	Determination of tensile strength of a woven fabric by raveled strip test method Determination of yarn crimp in a woven fabric	2
10	Determination of tear resistance of a fabric using Elmendorf Tear Tester Determination of bursting strength of a fabric on a Hydraulic Bursting Tester	2
11	Determination of bending stiffness of fabrics Determination of crease recovery of fabrics	2
12	Determination of abrasion resistance of a fabric Determination of compressional properties of fabrics	2
13	Determination of change in thickness of carpets under dynamic loading	2
14	Laboratory quiz Determination of crimp properties of yarn	2
TOTAL OF ANY FOURTEEN EXPERIMENTS		28

18. Suggested texts and reference materials:

Text/References

- i) Physical Testing of Textiles by B. P. Saville, 1999, Woodhead Publishing Ltd., U.K.
- ii) Principles of Textile Testing by J. E. Booth, 1961, Heywood Books, London
- iii) Testing and Quality Management – Edited by V. K. Kothari, IAFL Publications, New Delhi
- iv) Handbook of Textile Testing and Quality Control by E. B. Grover and D. S. Hamby
- v) Any basic book on applied statistics
- vi) NPTEL Course Material
- vii) The Technology of Clothing Manufacture by Harold Carr and Barbara Latham, BSP Professional Books, Oxford, 1998.
- viii) ASTM Standards.

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

19.1	Software	None
19.2	Hardware	Textile Testing Instruments
19.3	Teaching aides (videos, etc.)	Manual of Textile Testing equipments
19.4	Laboratory	Textile testing laboratory
19.5	Equipment	Textile Testing Instruments
19.6	Classroom infrastructure	None
19.7	Site visits	None

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

20.1	Design-type problems	50%
20.2	Open-ended problems	0%
20.3	Project-type activity	0%
20.4	Open-ended laboratory work	0%
20.5	Others (please specify)	50% (understanding the principles on machines)

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>)	Process Control and Economics in manmade Fibre Production
3.	L-T-P structure	1-0-0
4.	Credits	1
5.	Course number	TTV 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. Commodity and
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	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		
2		
3		
4		

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COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials :
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.

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
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	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	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>)	Management of Textile Business
3.	L-T-P structure	1-0-0
4.	Credits	1
5.	Course number	TTV 702
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 textile industry and managing textile business in India.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>): The textile industry of India : Past & its evolution to the present day. The structure of the Indian textile industry. Cotton textile sector, Jute textile sector. Silk textile sector. Manmade textile sector. Wool textile sector. Statistics of Indian textile business (domestic & export) and world textile trade. Textile policy 2000. Govt. of India. World trade practices. Norms, barriers etc. Various pertinent issues prevailing impacting textile industry and trade. Corporate social responsibility. Other compliances. ISO accreditation, etc. Retailing in textiles <i>vis-a-vis</i> consumer trend and
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	behaviour. The challenging future of the Indian textile industry and trade.
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
1	The Textile Industry of India : Past & its Evolution to the Present Day,	1
2	The Structure of the Indian Textile Industry	1
3	Cotton Textile sector	1
4	Jute Textile sector	1
5	Silk Textile sector	1
6	Man Made Textile sector,	1
7	Wool Textile sector	1
8	Statistics of Indian Textile Business (Domestic & Export) and World Textile Trade,	1
9	Various pertinent Issues prevailing impacting Textile Industry and Trade	1
10	Corporate Social Responsibility, other Compliances, ISO Accreditation etc	1
11	Retailing in Textiles vis-a-vis Consumer trend and behaviour and the challenging Future of the Indian Textile Industry and Trade	2
12	Seminar / presentation	1
13	Quiz/ Examination	1
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 APPLICABLE

Module no.	Experiment description	No. of hours
1		
2		
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COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials :
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.

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
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	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	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 Technology
3.	L-T-P structure	1-0-0
4.	Credits	1
5.	Course number	TTV 703
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 special topics of textile technology.
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14.	Course contents (<i>about 100 words</i>) (<i>Include laboratory/design activities</i>):
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15. Lecture Outline (with topics and number of lectures)

Module no.	Topic	No. of hours
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 APPLICABLE

Module no.	Experiment description	No. of hours
1		
2		
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COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials :
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.

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
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	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	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 Yarn Manufacture
3.	L-T-P structure	1-0-0
4.	Credits	1
5.	Course number	TTV 704
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 special topics of yarn manufacturing.
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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 yarn manufacture. 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
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 APPLICABLE

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

18. Suggested texts and reference materials :
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.

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
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	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	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 Fabric Manufacture
3.	L-T-P structure	1-0-0
4.	Credits	1
5.	Course number	TTV 705
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 special topics of fabric manufacturing.
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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 fabric manufacture. 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
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 APPLICABLE

Module no.	Experiment description	No. of hours
1		
2		
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10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials :
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.

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
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	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	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	TTV 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 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 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
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 APPLICABLE

Module no.	Experiment description	No. of hours
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials :
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.

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
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	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	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	TTV 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 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 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
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 APPLICABLE

Module no.	Experiment description	No. of hours
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
COURSE TOTAL (14 times 'P')		

18. Suggested texts and reference materials :
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.

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
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	-
20.2	Open-ended problems	-
20.3	Project-type activity	-
20.4	Open-ended laboratory work	-
20.5	Others (please specify)	Group discussions (20 %)

Date:

(Signature of the Head of the Department)