

**Maulana Abul Kalam Azad University of Technology, West Bengal  
(Formerly West Bengal University of Technology)  
Syllabus for B. Tech in Textile Technology (TT)  
(Applicable from the academic session 2018-2019)**

**Semester-VII**

**Technical Textile (PC TT 701)**

<b>Name of the Course:</b>		<b>Technical Textile</b>					
<b>Course Code: PC TT 701</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 3 hrs./week		Mid Semester Exam.: 15 Marks					
Tutorial: Nil		Assignment & Quiz: =10(8+2) Marks					
Practical: hr./week		Attendance: 5 Marks					
Credit Points: 3		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To familiarize the students with the manufacturing of technical textiles						
2	To provide knowledge on material-structure-property relationship in technical textiles						
3	To know the areas of applications of technical textiles						
<b>Pre-Requisite:</b>							
1	PC TT 301, PC TT 302, PC TT 303						
2	PC TT 402						
3	PC TT 501, PC TT 502, PC TT 503, PC TT 504						
4	PC TT 602, PC TT 603, PC TT 604						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks
A	1 to 9	10	10				

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<b>B</b>	<b>1 to 9</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 9</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>
<ul style="list-style-type: none"> <li>• <b>Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.</b></li> <li>• <b>Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.</b></li> </ul>							

<b>Unit</b>	<b>Content</b>	<b>Hrs/Unit</b>	<b>Marks/Unit</b>
1	<b>Introduction</b>  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	8	16
2	<b>Filter Fabric</b>  Theory of filtration, types and concepts of various 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	4	10
3	<b>Textile Composite</b>  Type of composites. Textile reinforcement requirement in different types of composites. Properties and uses of rigid composites and flexible composite. Manufacturing technique of producing rigid and flexible composite	4	10
4	<b>Geotextiles and other geosynthetics</b>	4	10

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	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. Characterisations of geotextile.		
5	<b>Medical Textile</b>  Fibre for medical application. Fibres and fabric selection criteria for medical textile. Classes of medical Textiles: Non-implantable materials, Extra-corporeal devices, Implantable materials, and Healthcare / hygiene products.	4	10
6	<b>Protective Textiles</b>  Clothing requirements for thermal protection, ballistic protection, UV-protection, protection from electromagnetic radiation and static hazards, protection against micro-organisms, chemicals and pesticides. Design principles and evaluation of protective clothing. High visibility and electromagnetic shielding fabrics.	10	20
7	<b>Sport Textile</b>  Innovation in fibres & textile materials for sportswear – design consideration of sportswear– comfort-mechanism of moisture and sweat transmission – sports foot wear: functional design, materials. Textile composites in sports products. sailing and balloon fabrics, artificial sport ground.	2	4
8	<b>Automotive Textiles</b>  Application of textiles in automobiles. Requirement and	3	6

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	design for pneumatic tyres, airbags and belts. Methods of production and properties of textiles used in these applications.		
9	<p><b>Agrotextiles, Architectural Fabrics, Textiles for Packaging</b></p> <p>Type and properties of fabrics used in these applications. Raw material, method of production and areas of application of agrotextiles, Textiles for crop covers, bird netting, shades, soil mats and silos.</p> <p>Different types of architectural fabrics and their property requirements. Design of temporary and permanent structures using fabrics.</p> <p>Different types of fabrics used for packaging. Their production techniques and properties.</p>	6	14
	Total	45	100

**Text and reference books:**

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
3. S. Adanur “Wellington Sears Handbook of Industrial Textiles”, Technomic Publishing Co. Inc., Lancaster, Pennsylvania, 1995.
4. N.W.M. John, “Geotextiles”, Blackie, London, 1987.
5. S.K. Mukhopadhyay and J.F. Partridge, “Automotive Textiles”, Text. Prog, Vol. 29, No.1/2, 1998.
6. S. Anand, “Medical Textiles”, Textile Institute, 1996.
7. R.Shishoo, Textiles in Sports, CRC press, 2005.

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8. R.Senthil Kumar, Textiles for Industrial Applications, CRC press, USA, August 2013.
9. A. K. Sen, Coated Textiles: Principal and Applications, Techno,ic Publication, Lancaster, Pennsylvania, USA, 2001.
10. Walter Fung and Mike Hard Castle, Textiles in Automotive Engineering, Woodhead Publication, USA, 2001.
12. Richard. A.Scott, Textiles for Protection, CRC press, Woodhead Publication, USA, 2005.
13. NPTEL lecture video

**Course Outcome:**

After successful completion of this course, the students should be able to

1. Describe the scope textile material for technical application
2. Classify the technical textile
3. Outline the functions and various requirements of specific technical application
4. Select the fibres, yarns and fabric types to be used for a specific technical application
5. Identify the properties required for fabric constituent to use in specific technical application
6. Design the various product with suitable specification

**Special Remarks (If any): NIL.**

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**Colour Science in Textile (PE TT 701A)**

<b>Name of the Course:</b>		<b>Colour Science in Textile</b>	
<b>Course Code: PE TT 701A</b>		<b>Semester: VII</b>	
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Theory: 2 hrs./week		Mid Semester Exam.: 15 Marks	
Tutorial: Nil		Assignment & Quiz: =10(8+2) Marks	
Practical: hr./week		Attendance: 5 Marks	
Credit Points: 2		End Semester Exam.: 70 Marks	
<b>Objective:</b>			
<b>1</b>	To make student understand the basic concept of colour, terms related to colour and their importance in textile colour measurement.		
<b>2</b>	To familiarize the student with the different colour Order System and their application in textile field		
<b>3</b>	To make student understand the principle of different Laws of absorption and scattering of light and their application in colour measurement.		
<b>4</b>	To provide basic idea about quality control in textile colour and instrumental colour measurement.		
<b>Pre-Requisite:</b>			
1	PC TT 301		
2	PC TT 402 and PC TT 492		
3	PC TT 503 and PC TT 593		
4	PC TT 603 and PC TT 692		
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>			
<b>Groups</b>	<b>Units</b>	<b>Objective Questions (MCQ only with one</b>	<b>Subjective Questions</b>

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		correct answer)		No. of questions to be set	To answer`	Marks per question	Total marks
		No. of questions to be set	Total marks				
<b>A</b>	<b>1 to 7</b>	<b>10</b>	<b>10</b>				
<b>B</b>	<b>1 to 7</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 7</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>
<ul style="list-style-type: none"> <li>• Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.</li> <li>• Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.</li> </ul>							

Unit	Content	Hrs/Unit	Marks/Unit
1	<b>Basic concept</b> Basic concept of colour, causes of colour generation and brief idea about the relation between colour and chemical constitution	2	8
2	<b>Visual measures</b> Visual description of colour, hue, value, chroma, colour order systems – Munsell Colour Order system, merits and demerits of Colour Order System.	2	8
3	<b>Transmission &amp; scattering</b> Interaction of light with object – reflection, transmission and scattering, factors governing transmission, Beer’s law, Lambert’s law, scattering of light, Kubelka-Munk function	5	15

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	<b>Instruments</b>		
4	Definition of light source, illuminant, concept of colour temperature, Principle of colour measuring instruments – colorimeters, spectrophotometers and their components.	5	15
	<b>Instrumental measures</b>		
5	Instrumental measures of colour, standard observers functions, tristimulus value, chromaticity coordinates and chromaticity diagram, uniform colour scales, colour difference equations. Instrumental, pass-fail criteria. Measurement whiteness, evaluation of optical whitening	7	26
	<b>Matching</b>		
6	Colour mixing theories – Additive and Subtracting Colour Mixing theories, brief idea of computer colour matching and formulation	6	18
	<b>Appearance</b>		
7	Metamerism, metameric indices, Brief idea about chromatic adaptation.	3	10
	<b>Total</b>	<b>30</b>	<b>100</b>

**Text and reference books:**

1. R. McDonald Colour Physics for Industry, SDC publication
2. A.K. Roy Choudhury, "Modern Concept of Color and Appearance", published jointly by Science Publishers, Inc., Enfield, NH03748, USA, pp.326, [ISBN1-57808-078-9] and Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
3. ML Gulrajani, Colour Measurement: Principles, advances and industrial applications. Edited by Woodhead Publishing Series in Textiles No. 103, ISBN 1 84569 5593,



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4. A.K. Roy Choudhury, Principles of Colour and Appearance Measurement, . Woodhead Publishing Series in Textiles
5. Committee on Colorimetry of the Optical Society of America, *The science of color*, Thomas Y. Cromwell, New York,1953.
6. K McLaren, *The Colour Science of Dyes and Pigments*, Adam-Hilger, Bristol (U.K.), 1983.
7. Kurt Nassau, *The Physics and Chemistry of Colour*, Wiley- Interscience, New York, 1983.
8. H.S. Shah and R.S. Gandhi, *Instrumental colour measurements and computer aided colour matching for textiles*,Mahajan, India,1990.
9. RWG Hunt, *Measuring Colour*, Ellis Horwood, Chichester (U.K.), 1987.
10. D.B. Judd and G. Wyszecki, *Color inbusiness, science and industry*, 2nd. Ed., John Wiley & sons, New York, 1963.

**Course Outcome:**

After successful completion of this course the students should be able to:

1. Understand the basic concept of colour and their importance in colour measurement of textiles.
2. Apply the colour order system, colour mixing theories, and absorption & scattering laws in textile colour measurement.
3. Match colour by developing new shades using colour formulation concept.
4. Understand the instrumental colour measurement, their principles, operational mechanism.
5. Analyze the quality parameters of coloured textiles.

**Special Remarks (If any): NIL.**

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**Colour Science in Textile Lab (PE TT 791A)**

<b>Name of the Course:</b>		<b>Colour Science in Textile Lab</b>
<b>Course Code: PE TT 791A</b>		<b>Semester: VII</b>
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
Theory: hrs./week		<b>Continuous Internal Assessment:</b>
Tutorial: Nil		<b>External Assessment: 60</b>
Practical: 3 hr./week		<b>Distribution of marks: 40</b>
Credit Points: 1.5		
<b>Course Outcomes:</b> After successful completion of this course, the students should be able to		
1	Use their theoretical knowledge of colour science in hands-on practices, Communicate effectively and work in groups.	
2	Measure the vision test of observer and to find out defective vision.	
3	Measure the different colour quality parameters of a coloured textile by colour-instrument and Grey Scale.	
4	Estimate colour concentration of a solution by colour measuring instruments..	
5	Formulate colour recipe to match colour.	
<b>Pre-Requisite:</b>		
1	PC TT 301	
2	PC TT 402 and PC TT 492	
3	PC TT 503 and PC TT 593	
4	PC TT 603 and PC TT 692	
<b>Practical:</b>		
		<b>1) Intellectual skills- 70%</b>
		<b>2) Motor skill- 30%</b>

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<b>Laboratory Experiment:</b>	
1	Assessment of Colour defect tests of observers using Ishahara Plate test
2	Assessment of Colour defect tests of observers using Munsell-Farnsworth 100 hue test
3	Visual assessment of colour – hue, lightness and chroma using Munsell or SCOTDIC charts
4	Measurement of different colour parameters, like – $a^*$ , $b^*$ , $c^*$ , $l^*$ , $h^*$ , $\Delta a^*$ , $\Delta b^*$ , $\Delta c^*$ , $\Delta l^*$ , $\Delta h^*$ , etc. of a coloured textile by spectrophotometer.
5	Measurement of colour difference for quality control using colour difference equations.
6	Drawing of calibration curve using known colour solution by colour measuring instruments using transmission mode.
7	Assessment of colour concentration of a unknown solution by colour measuring instruments..
8	Measurement of different colour Index, like – Whiteness Index, Yellowness Index, etc. by spectrophotometer.
9	Estimation of colour fastness to washing and rubbing by visual technique using Grey-Scale and spectrophotometer.
10	Estimation of colour fastness to light by visual technique using Grey-Scale and spectrophotometer.
11	Brief idea about metamerism
12	Brief idea about computer colour matching.
The above list is not exhaustive. Additional laboratory work or experiments can be planned to consolidate the theoretical work and to emphasize the activities for doing rather than the knowing.	

**Text and reference books:**

1. R. McDonald Colour Physics for Industry, SDC publication

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2. A.K. Roy Choudhury, "Modern Concept of Color and Appearance", published jointly by Science Publishers, Inc., Enfield, NH03748, USA, pp.326, [ISBN1-57808-078-9] and Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
3. ML Gulrajani, Colour Measurement: Principles, advances and industrial applications. Edited by Woodhead Publishing Series in Textiles No. 103, ISBN 1 84569 5593,
4. A.K. Roy Choudhury, Principles of Colour and Appearance Measurement, . Woodhead Publishing Series in Textiles
5. Committee on Colorimetry of the Optical Society of America, *The science of color*, Thomas Y. Cromwell, New York, 1953.
6. K McLaren, *The Colour Science of Dyes and Pigments*, Adam-Hilger, Bristol (U.K.), 1983.
7. Kurt Nassau, *The Physics and Chemistry of Colour*, Wiley- Interscience, New York, 1983.
8. H.S. Shah and R.S. Gandhi, *Instrumental colour measurements and computer aided colour matching for textiles*, Mahajan, India, 1990.
9. RWG Hunt, *Measuring Colour*, Ellis Horwood, Chichester (U.K.), 1987.
10. D.B. Judd and G. Wyszecki, *Color in business, science and industry*, 2nd. Ed., John Wiley & sons, New York, 1963.

**Special Remarks (If any):**

At least 10 experiments should be conducted

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**Home Furnishing (PE TT 701 B)**

<b>Name of the Course:</b>		<b>Home Furnishing</b>					
<b>Course Code: PE TT 701 B</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 2 hrs./week		Mid Semester Exam.: 15 Marks					
Tutorial: Nil		Assignment & Quiz := 10(=8+2) Marks					
Practical: hr./week		Attendance: 5 Marks					
Credit Points: 2		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To impart knowledge of home furnishing in the students and enable them to serve the textile and made-ups industry.						
2	To enable the students to learn about the Recent developments in furnishing, floor covering and other home textile products						
3	To enable the students to learn about the various kinds of materials used in home textile.						
4	To provide exposure to carpet manufacturing Technology						
<b>Pre-Requisite:</b>							
1	PC TT 501, PC TT 502, PC TT 503, PC TT 504						
2	PC TT 602, PC TT 603, PC TT 604						
3	Student must have some basic idea about household product						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of	Total	No. of	To	Marks per	Total

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		questions to be set	marks	questions to be set	answer`	question	marks
<b>A</b>	<b>1 to 6</b>	<b>10</b>	<b>10</b>				
<b>B</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

<b>Unit</b>	<b>Content</b>	<b>Hrs/Unit</b>	<b>Marks/Unit</b>
1	<b>Introduction to Home Furnishing</b>  Definition - Different types of furnishings materials Developments in Textile Furnishing – Type of Furnishings Materials – Woven and non-woven – Factors affecting Selection of Home Furnishings - Development in living room furnishing including upholstery, Wall hangings, Cushion, Cushion covers, Bolster and Bolster Covers.	8	28
2	<b>Floor Coverings and Bed Linens</b>  Manufacturing of floor coverings - requisite properties of floor coverings, types - Hard Floor Coverings - Resilient Floor Coverings - Soft Floor Coverings - Rugs - Cushion and Pads – Use and Care of floor coverings.	4	12
3	<b>Bed sheets</b>	4	12

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	<p>Required qualities, sizes of different bed sheets, woven and printed bed sheets manufacturing processes, quality parameters of yarn used, preparatory and weaving processes, weaving machine parameters and its selection, wet processing and finishing of bed sheets</p> <p>Different types of Bed Linens - Sheets - Blankets - Blanket covers - Comforters - Comfort covers - Bedspreads - Mattress and Mattress Covers - Quilting - Pads - Pillows.</p>		
4	<p><b>Curtains and Draperies</b></p> <p>Draperies – requisite properties, Choice of Fabrics for different types of doors and windows - their applications.</p>	4	12
5	<p><b>Curtains</b></p> <p>– Types of Curtains - basic requirements, quality requirements, types of fabric with respect to woven and knit, Finishing of Draperies – uses of Drapery Rods, Hooks, Tape Rings and Pins.</p>	4	12
6	<p><b>Carpets</b></p> <p>Fundamentals of Carpets : Classification of Carpets, history, textures and other relevant features. Materials used in carpet: Fibres - Yarns - Fabrics used, Familiarization with terms used to describe Quality and construction of Carpet, - Tufted Carpets</p>	6	24

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	- Chemical coating of Carpets.		
	<b>Total</b>	30	100

**Text and reference books:**

1. Wingate I.B. & Mohler J.E. ‘Textile Fabrics & their Selection’, Prentice Hall Inc. New York, 1984
2. “Advances in Carpet Manufacture” by K.K. Goswami, Woodhead Publishing. 2011
3. Donserkey K.G. “Interior decoration in India” D.B.Taraporevala sons and co. Pvt. Ltd. 1973
4. Elsasser, Virginia Henken, “Know Your Home Furnishings”, Fairchild Books & Visuals, September, 2003

**Course Outcome:**

After successful completion of this course the students should be able to:

1. Understand the production method of different types of home textile products.
2. Summarize the quality standards for various home textile products.
3. Analyze home furnishing product from design point of view.
4. Select various forms of textile material for different types of home textile products.
5. Design the some basic home furnishing products.

**Special Remarks (If any): NIL**



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**Home Furnishing Lab (PE TT 791 B)**

<b>Name of the Course:</b>	<b>Home Furnishing Lab Home Furnishing Lab</b>
<b>Course Code: PE TT 791 B</b>	<b>Semester: VII</b>
<b>Duration: 6 months</b>	<b>Maximum Marks: 100</b>
<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Theory:	Continuous Internal Assessment: 40
Tutorial: Nil	External Assessment: 60
Practical: 3 hr./week	Distribution of marks:
Credit Points: 1.5	
<b>Course Outcomes: After successful completion of this course, the students should be able to</b>	
1	Plan and design specific product for specific application
	Select the raw material for designing of product
2	Produce different types of home textile products
3	Test quality of various home textile products
5.	Design the some basic home furnishing products
<b>Pre-Requisite:</b>	
1	PC TT 501, PC TT 502, PC TT 503, PC TT 504
2	PC TT 602, PC TT 603, PC TT 604
3	Student must have some basic idea about household product
<b>Practical:</b>	
	Intellectual skills-- Creative ideas , consumer psychology, Good Imagination power , Colour psychology
	Motor skill- Technical textiles, functional features, performance testing, eco-parameters

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Laboratory Experiment:	
1	Prepare samples of living room furnishing including upholstery, Wall hangings - their use and care.
2	Prepare samples of Soft Floor Coverings - Rugs - Cushion and Pads - their use and care.
3	Prepare samples of Cushion covers, Bolster Covers - their use and care.
4	Prepare samples of 8"x10' - Curtains – their use and care
5	Developments in tucks and Pleats in Finishing of Draperies - their use and care.
6	Prepare samples of Kitchen appliances cover - Dish cloth - Hand towels - their use and care.
7	Prepare samples of Table Linens -Table cloth and Hand Towels– their use and care
8	Prepare samples of Placemats –their use and care
9	Prepare samples of 8"x10" – doormats , floor mats manually – their care and use.
10	Students are required to set up a single colour wrap (white) to weave at least 15 samples, the size of each sample to be at least 8"x10"
11	The weft used to weave these samples has to non conventional material (e.g. jute, ribbons, coir, dori )
12	The weft used to weave these samples has to non conventional material (e.g. paper, feathers, fancy yarns, laces)
The above list is not exhaustive. Additional laboratory work or experiments can be planned to consolidate the theoretical work and to emphasize the activities for doing rather than the knowing.	

**Text and reference books:**

1. K. Amutha, A Practical Guide to Textile Testing
2. John E. Booth, Principles of textile testing: an introduction to physical methods of testing textile fibres, yarns, and fabrics.

**Special Remarks (If any): NIL**

At least 10 experiments should be conducted

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**IT and CAD & CAM in Textile (PE TT 701 C)**

<b>Name of the Course:</b>	IT and CAD & CAM in Textile
<b>Course Code:</b> PE TT 701 C	<b>Semester:</b> VII
<b>Duration:</b> 6 months	<b>Maximum Marks:</b> 100
<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Theory: 2 hrs./week	Mid Semester Exam.: 15Marks
Tutorial: Nil	Assignment & Quiz: =10(=8+2) Marks
	Attendance: 5 Marks
Practical: hr./week	End Semester Exam.: 70 Marks
Credit Points: 2	
<b>Objective:</b>	
1	To impart the conception of application-software and its relevance in the present day
2	To impart basic conception of flowchart, algorithm, reasoning , flow of information
3	To make students familiar with different domains of application of Information Technology in Textile Industry
4	To make students familiar with different types of software for the information flow and production planning and control in Textile Industry
5	To make students aware about the difference between CAD and CAM and corresponding relevance in the field of Textile design and Production
6	To impart about the theoretical knowledge of different CAD software and tools and corresponding principles/algorithms in different fields like weaving , knitting , printing , embroidery etc.
<b>Pre-Requisite:</b>	
1	ES-CS201 , ES-CS291
2	PC TT 302
3	PC TT 401, PC TT 491
4	PC TT 501 , PC TT 502, PC TT 591, PC TT 592
5	PC TT 601 , PC TT 602, PC TT 604
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>	

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Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks
<b>A</b>	<b>1 to 7</b>	<b>10</b>	<b>10</b>				
<b>B</b>	<b>1 to 7</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 7</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>

- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Unit	Content	Hrs/Unit	Marks/Unit
1	<p><b>Introduction to software</b></p> <p>Different categories of software ,Basics of Data base management system - database design concepts , basic programming syntax for database management and query generation in SQL etc., Introduction to program Algorithms and program logics – writing simple algorithms related to Textile Manufacturing</p> <p><b>Introduction to modern Input/Output devices</b></p>	4	12
2	<p><b>Computer aided production planning in Textile Manufacturing:</b></p> <p>Path of information flow through the process sequence,</p>	6	20

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	<p>Application of Information Technology in sourcing, inventory control, production planning and control.</p> <p>Introduction to finite scheduling concept and fast react software.</p> <p>Concept of ERP, CIM, CAPP, MRP-I , MRP-II etc. in Textile Production planning , scheduling and control.</p> <p>Application of RFID.</p> <p>Application of RDBMS in Textile manufacturing.</p> <p><b>Problem solving and Case Studies</b></p>		
3	<p><b>Product Simulation and 3D Product Visualization :</b></p> <p>Concept and relevance of Product simulation in Fashion and Textile , product development , principles of product simulations for yarn(yarn CAD) , fabric , garment etc. , Software tools for product design and product simulation in fashion and textile ,digital system for weave pattern recognition.</p>	4	12
4	<p><b>Application of CAD in Fabric Formation:</b></p> <p><b>i) Weaving:</b> CAD software for textile design – fabric design , fabric color-ways , weave design , weaving CAD , creating of drafting and lifting plan , basic principles of weave simulation and drafting-lifting plan in case of weaving CAD. Features of relevant software.</p> <p><b>ii) Knitting:</b> Concept of CAD in Knitting , software for knitting design , simulation of knit structure.</p>	6	20
5	<p><b>Application of CAM in Fabric Formation: i) Weaving:</b></p>	4	12

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	<p>Features of Electronic Dobby &amp; Electronic Jacquards :- Electronic Dobby -- Working principle - Machine parameters – Microelectronics Design features – general features of computerized loom</p> <p>ii) <b>Knitting:</b> Characteristics of Computerized Knitting Machines.</p>		
6	<p><b>Applications of CAD/CAM in fabric surface ornamentation: i) Embroidery:</b></p> <p>Features of CAD software for embroidery design- features of computerized Multi Head Embroidery Machines – principles of needle selection, stitch formation etc.</p> <p><b>ii) Printing:</b></p> <p>Development of printing designs through CAD, software tools, features of computerized printing machine.</p>	4	12
7	<p><b>Computerized Quality Control for Textile Products:</b></p> <p>Introduction to image processing and image analysis system- Fabric defect identification using image processing - Data acquisition and fault classification. Yarn Scanner. Yarn Fault Identification - application of Artificial Neural Networks (ANN) , Fuzzy-Logic etc. in fabric or yarn fault recognition</p>	4	12
	Total	32	100

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**Text and reference books:**

1. Alexis leon and Mathews leon "Fundamentals of Information Technology" Leon press, 1999
2. Dennis P Curtin "Information Technology", Tata McGraw hill Pvt Ltd 1999
3. James A Senn "Information Technology in Business", Prentice Hall of India Pvt Ltd 1998.
4. Windows office XP/MSOFFICE/MSACCESS/
5. Stephen Gray "CAD / CAM in clothing and Textiles ", Gower Publishing Limited, 1998, ISBN 0-566-07673X.
6. Compilation of papers presented at the Annual world conference Sep 26 -29, 1984 Hongkong,
7. " Computers in the world of textiles ", The textile Institute ISBN: 0-0900739-69X.
8. W.Aldrich, " CAD in clothing and Textiles ", Blackwell Science 2nd edition, 1992, ISBN: 0-63 -3893 - 4
9. Jacob Solinger, " Apparel Manufacturing Handbooks ", Van no strand and Reinhold Company, 1980, ISBN: 0-442-21904-0.
10. Computer technology for textile apparel Edited by Jinlian Hu, Woodhead Publishing Limited, 80 High Street, Sawston, Cambridge CB22 3HJ, UK.

**Course Outcome:**

After successful completion of this course the students should be able to:

1. Develop program algorithms and flow-charts for the path of information flow for different textile applications.
2. Generate codes for the database management related to textile manufacturing process.
3. Differentiate between CAD and CAM and identify suitable software for specific applications related to textile production planning and control.
4. Identify suitable software and software tools for specific applications like fabric design, weave formation, drafting and lifting plan, knitting design, embroidery or printing design, quality inspection and fault identification for yarn and fabric etc

**Special Remarks (If any): NIL**

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**IT and CAD & CAM in Textile Lab (PE TT 791C)**

<b>Name of the Course:</b>		<b>IT and CAD &amp; CAM in Textile Lab</b>
<b>Course Code: PE TT 791C</b>		<b>Semester: VII</b>
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
<b>Theory: hrs./week</b>		<b>Continuous Internal Assessment:</b>
<b>Tutorial: Nil</b>		<b>External Assessment: 60</b>
Practical: 3 hr./week		<b>Distribution of marks: 40</b>
Credit Points: 1.5		
<b>Course Outcomes:</b> After successful completion of this course the students should be able to:		
1	Create Database Tables and link between them to create Relational Database relevant to textile manufacturing , using database software	
2	Execute Database query through codes and syntax relevant to textile manufacturing	
3	Students will be able to create fabric design through CAD/Illustration/Graphic design software	
4	Create embroidery and printing design through CAD/Illustration/Graphic design software	
5	Create weave and drafting & lifting plan for different weaves	
6	Execute application-modules related to production planning , sourcing , AQL etc. relevant to textile industry	
<b>Pre-Requisite:</b>		
1	ES-CS201 , ES-CS291	
2	PC TT 302	
3	PC TT 401, PC TT 491	
4	PC TT 501 , PC TT 502, PC TT 591, PC TT 592	
5	PC TT 601 , PC TT 602, PC TT 604	
<b>Practical:</b>		
		<b>1) Intellectual skills- Reasoning and programming skill ,</b>



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	<b>creative skill, Drawing skill- 70%</b>
	<b>2) Motor skill- Planning skill-30%</b>

<b>Laboratory Experiment:</b>	
1	Different Jobs on database software like MS-ACCESS , SQL etc. for creation of database , relevant to textile manufacturing. (At least 2 jobs)
2	Different jobs on linking of databasetables , query generation through database software , relevant to textile manufacturing. (At least two jobs)
3	Different jobs on creation of print / embroidery motif , with the application of illustration software/Textile design CAD ,
4	Simulations of printed or embroidered fabrics using digital images of actual thread , fabric etc. , application on garments
4	Different Jobs on creation of weave design and fabric simulation , with the application of illustration software/Textile design CAD , Application on garment , virtual draping on digital croque.
5	Different Jobs on Development of simple Dobby designs like Twill , Plain , Matt , Satin , Sateen alongwith Drafting and Lifting plan using weaving- CAD
6	Different Jobs on Development of complex Dobby designs like Huckaback , Mock Leno, Diamond , Herringbone etc. alongwith Drafting and Lifting plan using weaving CAD
7	Different Jobs on Development of Jacquard Designs on Floral, Geometric and Damask or Paisley Motif.
8	Jobs on the application software for the production planning , AQL etc. related to textile manufacturing
9	Case Study and simple problem solving related to Textile calculations , with the application of any standard programming language .
10	Case Study and simple problem solving related to Textile production planning , with the

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	application of any standard programming language .
11	Simulation of the end products (Garments or home furnishings) using virtual motif or weave.
12	Industry oriented jobs / field works / mini projects on comparisons between actual and virtual textile products. Evaluation of the amount of replication and simulation-accuracy using standard methods.
The above list is not exhaustive. Additional laboratory work or experiments can be planned to consolidate the theoretical work and to emphasise the activities for doing rather than the knowing.	

**Text and reference books:**

1. Alexisleon and Mathews leon "Fundamentals of Information Technology" Leon press, 1999
2. Dennis P Curtin "Information Technology", Tata McGraw hill Pvt Ltd 1999
3. James A Senn "Information Technology in Business", Prentice Hall of India Pvt Ltd 1998.
4. Windows office XP/MSOFFICE/MSACCESS/
5. Stephen Gray "CAD / CAM in clothing and Textiles ", Gower Publishing Limited, 1998,
6. ISBN 0-566-07673X.
7. Compilation of papers presented at the Annual world conference Sep 26 -29, 1984 Hongkong,
8. " Computers in the world of textiles ", The textile Institute ISBN: 0-0900739-69X.
9. W.Aldrich, " CAD in clothing and Textiles ", Blackwell Science 2nd edition, 1992, ISBN: 0-63 -3893 - 4
10. Jacob Solinger, " Apparel Manufacturing Handbooks ", Van no strand and Reinhold Company,
11. 1980, ISBN: 0-442-21904-0.

**Special Remarks (If any):**

At least 10 experiments should be conducted

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**Advances in Chemical Processing (PE TT 702A)**

<b>Name of the Course:</b>		<b>Advance in Chemical Processing</b>	
<b>Course Code: PE TT702A</b>		<b>Semester: VII</b>	
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>	
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Theory: 2 hrs./week		Mid Semester Exam.: 15 Marks	
Tutorial: Nil		Assignment & Quiz: =10(=8+2) Marks	
Practical: hr./week		Attendance: 5 Marks	
Credit Points: 2		End Semester Exam.: 70 Marks	
<b>Objective:</b>			
1	To enhance the knowledge of the students related to the advancements in colouration and textile wet processes. Design, conduct and interpret the results of the textile experiments d. Design new processes and products e		
2	To explain the advancements in textile chemical pretreatments, dyeing, printing and finishing operations to the students.		
3	To describe the garment dyeing and mass coloration techniques and quality aspects of dyeing to the students.		
4	To enable the students to engross in life-long learning to keep abreast with emerging technologies related to textile chemical processing.		
<b>Pre-Requisite:</b>			
1	PC TT 301		
2	PC TT 402, PC TT 492		
3	PC TT 503, PC TT 593		
4	PC TT 603, PC TT 692		
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>			
<b>Groups</b>	<b>Units</b>	<b>Objective Questions</b>	<b>Subjective Questions</b>

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		(MCQ only with one correct answer)					
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks
<b>A</b>	<b>1 to 7</b>	<b>10</b>	<b>10</b>				
<b>B</b>	<b>1 to 7</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 7</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1	<p><b>Developments in pretreatment processes</b></p> <p>Quick response pretreatment, continuous open width processing, use of environment friendly chemicals, application of enzymes. Use of biotechnology in Pre-treatment. Developments in singeing, desizing, size recovery, bleaching and its eco-aspects, influence of enzymatic pre-treatment on the colours of bleached and dyed fibers, combined bio scouring and bleaching of cotton fibers, effect of ultrasound on the performance of industrial enzymes used in cotton bio-preparation/bio-finishing applications, Enzymatic degumming, enzymatic H<sub>2</sub>O<sub>2</sub> bleaching, Other developments like solvent scouring, eco friendly per acetic acid bleaching.</p>	5	16
2	<p><b>Developments in dyeing</b></p>	7	24

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	<p>Dyeing and its eco-aspects, new dyes and their advantages. New forms of dyes, i.e. encapsulated, polymeric, pearl and granular forms. New direct, reactive and disperse dyes. Dyeing of microfibre fabrics. Continuous dyeing, right-first-time approach. Eco-friendly dyeing with sulphur &amp; vat dyes. New developments in reactive dyes like HF dyes, low and no salt reactive dyes, multifunctional dyes, neutral fixing and acid fixing reactive dyes. Photo chromic dyes, thermo chromic dyes, fluorescent dyes. Super critical CO<sub>2</sub> dyeing – concept, mechanism, methods and techno economical features. Ultrasound in dyeing - Concept, mechanism, methods and techno-economical features. Low temperature dyeing - concept, mechanism, methods and techno economical features.</p>		
3	<p><b>Mass colouration and Colouration of blends</b></p> <p>Objective, principle, method, advantages and disadvantages of mass colouration of textiles -different methods of mass coloration. Method of dyeing of Polyester cotton blends - method of Dyeing of Polyester and wool blends -method of dyeing acrylic cellulose blends -process of dyeing with common natural dyes</p>	3	10
4	<p><b>Dyeing of garments and quality aspects in dyeing</b></p> <p>Process flow chart for dyeing of woven garments, knitted garments -advantages of garment dyeing - process of dyeing cotton garments -process of dyeing woollen garments -process of dyeing Polyester garments – dyeing faults</p>	3	10
5	<p><b>Developments in printing</b></p>	3	10

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	Automated colour kitchens, Kerosene substitutes, Novel printing techniques like Ink Jet printing, Xerox printing. Ink, machinery and process for Digital printing – UV, solvent and latex inks. 3-D printing – concept, mechanism, methods and techno economical features.		
6	<p><b>Developments in finishing</b></p> <p>Advances in mechanical finishing of textile materials like calendaring, compacting, sanforizing, peach finishing. Foam Finishing – foam application - drawbacks. Micro encapsulation techniques in finishing process -Silk like Polyester. Stiffening of textile materials. Zero formaldehyde easy-care finishes and use of Polycarboxylic acids, polysiloxanes based softeners. Breathable water-proof fabrics. Finishing of microfibre fabrics. Plasma technology; Effect and application on textiles, Nanofinishing; E-Control processing. Eco conformance certifications – OekoTex (Confidence in Textiles), GOTS, REACH, etc.</p>	5	16
7	<p><b>Advances in machineries</b></p> <p>Advances in cheese dyeing machine- importance of winding in yarn dyeing — various yarn dyeing defects caused by cheese dyeing machine. Advances in Beam dyeing - Advances in soft flow dyeing machines, Advances in jet dyeing machines — Developments in jiggers, Continuous dyeing machineries &amp; its developments. Hydro extractor, Rope opener RF dryer. Principle and working of fully automatic flat bed screen printing machine –Rotary Printing machine, Transfer Printing Machine-Garment Printing machines. Garment dyeing</p>	4	14

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	machines, Tumble dryer, Fusing machines, Backfilling machine, Machineries used for foam application.		
	Total	30	100

**Text and reference books:**

1. Handbook of Fiber Science and Technology, Vol. II,
2. Chemical Processing of Fibers and Fabrics, Part A and B by M. Lewin and S.B. Sello,
3. Principles of Colour Technology, F.W. Billmeyer,
4. Dyeing and Chemical Technology of Textile Fibres by E.R. Trotman,
5. Textile Printing (second edition) by L.W.C. Miles
6. An Introduction to Textile Finishing by J.T. Marsh,
7. Technology of Textile Finishing by V.A. Shenai,
8. Methods of Test for Colour Fastness of Textiles and Leather by The Society of Dyers and Colourists,
9. Textile Finishing by A.J. Hall,
10. Colour Physics for Industry by R. McDonald,
11. Chemical After-Treatment of Textiles by H. Mark, N.S. Wooding and S.M. Atlas,
12. Instrumental Colour Measurement and Computer Aided Colour Matching for Textiles by H.S. Shah and R.S. Gandhi,
13. BS Handbook, Methods of Test for Textiles by British Standards Institution, Reference Books of Textile Technologies: Finishing by Pietro Bellini, Ferruccio Bonetti, Ester Franzetti, Giuseppe Rosace, Sergio Vago.
14. Chemistry and Technology of fabric Preparation and Finishing by Charles Tomasino.
15. Plasma technologies for textiles – R Shishoo, Woodhead Publishing Ltd
16. ISI Handbook of Textile Testing by Bureau of Indian Standards.

**Course Outcome:**

After successful completion of this course the students should be able to:

1. Understand the basics and modifications in textile chemical pre-treatment operations
2. Describe the developments in various dyes and dyeing & printing process.
3. Summarize different types of advancements in textile finishing and processing machineries.
4. Understand the advanced techniques, skills, and modern tools necessary for practicing in the textile wet processing industry.

**Special Remarks (If any): NIL**

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**Advances in Chemical Processing Lab (PE TT 792 A)**

<b>Name of the Course:</b>		<b>Advances in Chemical Processing Lab</b>
<b>Course Code: PE TT 792 A</b>		<b>Semester: VII</b>
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>
<b>Teaching Scheme</b>		<b>Examination Scheme</b>
Theory: hrs./week		<b>Continuous Internal Assessment:</b>
Tutorial: Nil		<b>External Assessment: 60</b>
Practical: 3 hr./week		<b>Distribution of marks: 40</b>
Credit Points: 1.5		
<b>Course Outcomes:</b> After successful completion of this course the students should be able to		
1	Use their theoretical knowledge in hands-on practices.	
2	Communicate effectively and work in groups.	
3	Acquaint with some modern textile wet processing machineries which will help them during their industrial exposure.	
4	Apply enzymes, natural dyes and pigment in textile chemical processing for development of eco-friendly wet processing and open a new venue of textile wet processing.	
5	Dye some multiple fibre components textile.	
6	Estimate exhaustion percentage, diffusion coefficient of dye to understand dyeing behavior of dyes.	
<b>Pre-Requisite:</b>		
1	PC TT 301	
2	PC TT 402, PC TT 492	
3	PC TT 503, PC TT 593	
4	PC TT 603, PC TT 692	
<b>Practical:</b>		
		<b>1) Intellectual skills-50%</b>



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	<b>2) Motor skill-50%</b>

<b>Laboratory Experiment:</b>	
1	Bio-scouring of cotton fabric
2	Bio-polishing of cotton fabric
3	Demonstration of various modern dyeing machines
4	Dyeing of cotton fabric with pigment colour
5	Dyeing of Cotton with natural dyes
6	Dyeing of Wool with natural dyes
7	Dyeing of Silk with natural dyes
8	Determination of diffusion coefficient, exhaustion percentage by optical density methods
9	Dyeing of polyester/wool
10	Dyeing of polyester/cellulose
11	Dyeing of wool/acrylic blends
12	Flat bed screen printing/Rotary screen printing on cotton/polyester
The above list is not exhaustive. Additional laboratory work or experiments can be planned to consolidate the theoretical work and to emphasis the activities for doing rather than the knowing.	

**Text and reference books:**

1. Handbook of Fiber Science and Technology, Vol. II,
2. Chemical Processing of Fibers and Fabrics, Part A and B by M. Lewin and S.B. Sello,
3. Principles of Colour Technology, F.W. Billmeyer,
4. Dyeing and Chemical Technology of Textile Fibres by E.R. Trotman,
5. Textile Printing (second edition) by L.W.C. Miles
6. An Introduction to Textile Finishing by J.T. Marsh,
7. Technology of Textile Finishing by V.A Shenai,

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8. Methods of Test for Colour Fastness of Textiles and Leather by The Society of Dyers and Colourists,
9. Textile Finishing by A.J. Hall,
10. Colour Physics for Industry by R. McDonald,
11. Chemical After-Treatment of Textiles by H. Mark, N.S. Wooding and S.M. Atlas,
12. Instrumental Colour Measurement and Computer Aided Colour Matching for Textiles by H.S. Shah and R.S. Gandhi,
13. BS Handbook, Methods of Test for Textiles by British Standards Institution, Reference Books of Textile Technologies: Finishing by Pietro Bellini, Ferruccio Bonetti, Ester Franzetti, Giuseppe Rosace, Sergio Vago.
14. Chemistry and Technology of fabric Preparation and Finishing by Charles Tomasino.
15. Plasma technologies for textiles – R Shishoo, Woodhead Publishing Ltd
16. ISI Handbook of Textile Testing by Bureau of Indian Standards.

**Special Remarks (If any):**

At least 10 experiments should be conducted

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**Apparel Technology (PE TT 702 B)**

<b>Name of the Course:</b>		Apparel Technology					
<b>Course Code: PE TT 702 B</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 2 hrs./week		Mid Semester Exam.: 15 Marks					
Tutorial: Nil		Assignment & Quiz: =10 (8+2) Marks					
		Attendance: 5 Marks					
Credit Points: 2		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To provide knowledge of the apparel manufacturing process.						
2	To explain pre-production and post-production process of garment industry.						
3	To explain the basic of apparel industry.						
<b>Pre-Requisite:</b>							
1	PC TT 301, PC TT 302, PC TT 303						
2	PC TT 402						
3	PC TT 501, PC TT 502, PC TT 503, PC TT 504						
4	PC TT 602, PC TT 603, PC TT 604						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks
A	1 to 7	10	10				
B	1 to 7			6	3	5	15
C	1 to 7			6	3	15	45

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- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Unit	Content	Hrs/Unit	Marks/Unit
1	<b>Introduction</b>  Overview of apparel industry, size of the industry and its recent developments. Overview of apparel manufacturing technology,	2	6
2	<b>Basics of pattern making</b>  Standard body measurement and basic pattern making, Methods of pattern making, Basic Bodice blocks, Dart manipulation, Marker planning, Types of marker making, Figure analysis and body measurements. Spreading technology and quality control in pattern making, Application of computer in pattern construction and lay planning.	4	10
3	<b>Marking and cutting process,</b>  Different methods of cutting, Straight, Circular or round knife cutting machine, band knife cutting machine, die cutting machine, drilling, notching and automatic cutters.	6	18
4	<b>Sewing operations</b>  Different stitch types, Classification of seams, Feeding mechanisms, Parts of sewing needles and their functions, Needle size, Sewing threads, Ticket number, Sewing thread	8	30

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	packages, Properties of sewing threads. Types of sewing machines and basic work aids.		
5	<b>Quality control in apparel manufacturing</b>  Fabric quality requirements, Thread quality requirements, Sewability, Seam pucker, Seam slippage, Sewing defects, Sewing parameters such as ticket number, needle number, yarn tension, stitch density and stitch type for desired sewability.	8	30
6	<b>Fusing process</b>  Fusing machinery, Purpose of pressing, Pressing equipments, Garment finishing and garment accessories.	2	6
	Total	30	100

**Text and reference books:**

1. Solinger Jacob, "Apparel Manufacturing Hand Book - Analysis, Principles and Practice", Columbia Boblin Media Corp., 1988.
2. David J. Tyler, "Materials Management in Clothing Production", 2000.
3. William K. Hodson, "Maynard's Industrial Engineering Handbook", IV edition, McGraw Hill Inc., New York, 2010.
4. Herold Carr and Barbara Lathem, "The Technology of Clothing Manufacturing", II nd Edition, Blackwell Scientific Publications, London, 1988.
5. Prodip V. Mehta, "An Introduction of Quality Control for the Apparel Industry". ASQC quality Press, Marcel Dekker Inc., Newyork, 1992.
6. Managing Quality In Apparel Industry, S.K. Bhrdwaj & Pradip V Mehta. Quality is Free, Philip Crosby.
7. V. Ramesh Babu "Industrial Engineering in Apparel Production" Wood Head publishing India Ltd., ISBN 13:978-93-80308-17-3, 2012.

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**Course Outcome:**

After successful completion of this course, the students should be able to

1. Discuss various apparel manufacturing process.
2. Illustrate production planning techniques in marker planning and spreading.
3. Illustrate production planning techniques sewing line.
4. Apply production control techniques in garment industry.
5. Determine man and machine requirement for production line

**Special Remarks (If any): NIL**

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**Apparel Technology Lab (PE TT 792 B)**

<b>Name of the Course:</b>	<b>Apparel Technology Lab</b>
<b>Course Code: PE TT 792 B</b>	<b>Semester: VII</b>
<b>Duration: 6 months</b>	<b>Maximum Marks: 100</b>
<b>Teaching Scheme</b>	<b>Examination Scheme</b>
Theory: hrs./week	<b>Continuous Internal Assessment:</b>
Tutorial: Nil	<b>External Assessment: 60</b>
Practical: 3 hr./week	<b>Distribution of marks: 40</b>
Credit Points: 1.5	
<b>Course Outcomes:</b> After successful completion of this course, the students should be able to	
1	Discuss various apparel manufacturing process.
2	Illustrate production planning techniques in marker planning and spreading.
3	Illustrate production planning techniques sewing line.
4	Apply production control techniques in garment industry.
5	Determine man and machine requirement for production line
<b>Pre-Requisite:</b>	
1	
2	
3	
<b>Practical:</b>	
	<b>1) Intellectual skills-50%</b>
	<b>2) Motor skill-50%</b>

<b>Laboratory Experiment:</b>	
1	Jobs on taking body measurements, creation of measurement charts. Preparation of measurement charts for given garments.

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2	Preparation of basic patterns for the Basic bodice , Back , Sleeve (both full and half) , collar , collar bands , placket , pocket , etc.
3	Grading of patterns at least for two new sizes.
4	Planning of Marker & Practical assignments to be given on Marker Planning. Calculations of Marker Efficiency.
5	Identification of different categories and parts of sewing needles , Identification of different types of sewing machines , Identification of different parts of sewing machines . Understanding of driving mechanisms of the different parts of commonly used industrial sewing machines like Single Needle Lockstitch (SNLS) Machine , Overlock machine etc.
6	Thread mounting & Stitch adjustment of Single needle lock stitch machine.
7	Thread mounting & Stitch adjustment of 4, 5, 6 thread over lock machine.
8	Thread mounting & Stitch adjustment of Chainstitch machine, Buttonholing machine, Bar-tacking machine etc..
9	Formation of different types of seams a) Flat Seam b) Bound Seam
10	Formation of different types of seams a) Superimposed Seam b) French Seam c) Lap Seam
11	Construct, finish and press the same using the drafted patterns: A. Bodice B. Cuffs C. Sleeves.
12	Construct, finish and press the same using the drafted patterns: D. Yokes E. Pockets F. Collars
The above list is not exhaustive. Additional laboratory work or experiments can be planned to consolidate the theoretical work and to emphasize the activities for doing rather than knowing.	

**Text and reference books:**

1. A.J Chuter “Introduction to clothing production management”
2. Jacob Soliner “Apparel manufacturing hand book”
3. Shaeffer Clair : Sewing for Apparel Industry” Prentice Hall, New Jersey 2001.
4. Sewing machine technical manuals.
5. Gerry cooklin “Introduction to clothing manufacture”
6. Charline Phillips “Sewing machine attachment Hand book”.

**Special Remarks (If any):**

At least 10 experiments should be conducted



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**New Generation Fibre (PE TT 703A)**

<b>Name of the Course:</b>		<b>New Generation Fibre</b>					
<b>Course Code:</b> PE TT 703A		<b>Semester:</b> VII					
<b>Duration:</b> 6 months		<b>Maximum Marks:</b> 100					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 2 hrs./week		Mid Semester Exam.: 15 Marks					
Tutorial: Nil		Assignment & Quiz: 10 =(8+2) Marks					
Practical: hr./week		Attendance: 5 Marks					
Credit Points: 2		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To study the transition of new fibres						
2	To impart knowledge of the super fibre with new performance						
3	To impart knowledge about High-tech fibres with biomimetic chemistry						
4	To impart knowledge of fibres for the next generation						
5	To impart knowledge of bio-polymer frontiers						
<b>Pre-Requisite:</b>							
1	Knowledge of General Physics						
2	Knowledge of General Chemistry and Bio-chemistry						
3	PC TT 301: Textile fibre						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks

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<b>A</b>	<b>1 to 10</b>	<b>10</b>	<b>10</b>				
<b>B</b>	<b>1 to 10</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 10</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>
<ul style="list-style-type: none"> <li>• <b>Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.</b></li> <li>• <b>Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.</b></li> </ul>							

<b>Unit</b>	<b>Content</b>	<b>Hrs/Unit</b>	<b>Marks/Unit</b>
1	<b>New Generation Fibres</b>  Introduction, Background, Transition to new fibres	2	5
2	<b>The super-fibre with new performance</b>  Introduction, basic classes of super-fibre, the need for a strong fibre, concept of gel spinning, The aramid fibre race, Polyacetal fibre, strong Vinylnon RM, New liquid crystalline polymers: engineering plastics, Vectran: a fully aromatic polyester fibre, developing polyallylate fibre, Final stage of pitch-based carbon fibre development, use of super-fibres, The future of super-fibres	4	20
3	<b>High-tech fibres</b>  A silk-like fibre that surpasses natural silk, ultra-fine fibres, skin like fabrics, Chameleonic fabrics, Photochromism controlled clothing material, Perfumed fibres, Power fibres that store solar energy, iridescent textiles, Protein plastics with the feel of human skin.	4	10
4	<b>Biomimetic chemistry and fibres</b>	2	8

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	Application, Morphology/Structure, Hybridisation technology		
5	<p><b>Bio-polymer frontiers</b></p> <p>Mimicking the functions of enzymes and co-enzymes, Polysaccharides in semiconductors and medicine, fibres from biomass of crab and shrimp shells, New applications of silk, Fibres produced by bacteria, New functions for cellulose.</p>	3	12
6	<p><b>Progression of high-tech fibres</b></p> <p>Introduction, Biotechnology and fibres, Electronics and fibres, Cars and fibres, Fibres in space, Fibres and nuclear power, Fibres in sport, Fibres in geotextiles, fibres in ocean.</p>	4	10
7	<p><b>New high-tech fibres</b></p> <p>Various categories of high-tech fibres, Development of <i>Shingosen</i>, Design of specialist fibres</p>	3	5
8	<p><b>Cellulosic fibres</b></p> <p>New solvent systems, New cellulosic fibre derivatives, New environmental and cost saving developments, Life cycle assessment, Cellulose: the renewable resource.</p>	3	10
9	<p><b>Fibres for the next generation</b></p> <p>High-tenacity and high –modulus fibres, microdenier (ultra-fine) fibres and biomimetics, the next stage: technological improvements, new frontier fibres, super-bio0mimetic fibre materials, super-natural materials, resources recycling, fibres for health</p>	3	15

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10	<b>Carbon fibres</b>  Production, properties, uses	2	5
	Total	30	100

**Text and reference books:**

1. Hongu T. and Phillips G. O. New fibres, 2<sup>nd</sup> Edition, Woodhead Publishing Ltd. 1997.
2. Hongu t., Takigami M. and Phillips G. O. New Millennium fibres, 1<sup>st</sup> edition, Woodhead Publishing Ltd. 2005.
3. Seymour R. B. Polymers for Engineering Applications, Us Department of Energy, Office of scientific and Technological Information, US, 1987.
4. Lewin M. and Preston S. Handbook of Fibre Science and technology, Vol. III, High Technology Fibres, Taylor & Francis, 1991.

**Course Outcome:**

After successful completion of this course, the students should be able to

1. Explain not only the transition to new fibres but also the super-fibres with new performance
2. Understand the progression of high-tech fibres
3. Understand the biomimetic chemistry and fibres
4. Explain the manufacturing of fibres for the next generation

**Special Remarks (If any): NIL.**

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**Specialty Yarn & Nonwoven Technology (PE TT 703 B)**

<b>Name of the Course:</b>		<b>Specialty Yarn &amp; Nonwoven Technology</b>					
<b>Course Code: PE TT 703 B</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 2 hrs./week		Mid Semester Exam.: 15 Marks					
Tutorial: Nil		Assignment & Quiz: =10(=8+2) Marks					
Practical: hr./week		Attendance: 5 Marks					
Credit Points: 2		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To impart knowledge of specialty yarn						
2	To provide knowledge of making of various type of specialty yarn						
3	To impart knowledge of various web formation technique						
4	To impart knowledge of various finishing of nonwoven for technical application						
<b>Pre-Requisite:</b>							
1	PC TT 302 , PC TT 303						
2	PC TT 401						
3	PC TT 501, PC TT 502, PC TT 504						
4	PC TT 601, PC TT 602, PC TT 604						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks
A	1 to 6	10	10				

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<b>B</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>
<ul style="list-style-type: none"> <li>• <b>Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.</b></li> <li>• <b>Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.</b></li> </ul>							

<b>Unit</b>	<b>Content</b>	<b>Hrs/Unit</b>	<b>Marks/Unit</b>
1	<p><b>Textured yarn technology</b></p> <p><b>Introduction:</b> Flat filament yarn and its limitations; Scientific principle in twist texturing; Classifications of Textured yarn manufacturing; Characteristics of various classes of textured yarns.</p> <p><b>False Twist Texturing:</b> Principle of False twist texturing techniques, Methods of production of stretched and modified stretched yarns by conventional methods.</p> <p><b>Draw-Texturing:</b> Sequential (False twist process) and simultaneous draw-texturing, Study of simultaneous draw-texturing process; Draw-texturing machine profiles; Twisting devices - Various friction twisting units, heaters, cooling devices, coning oil application, process variables; Quality of draw textured yarns; Technological developments in draw-texturing technology.</p> <p><b>Air Jet Texturing:</b> Basics of air jet texturing principle, Air-jet texturing machine and types of yarns produced; Air jets and wetting systems, stabilizing devices; Process variables in air texturing such as over feed, air pressure temperature and water content; types of Nozzles;</p>	7	25

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	<p>Properties and evaluation of air textured yarns; Blending of filaments yarn in air texturing.</p> <p><b>Other Texturising Method:</b> Overview of Stuffer box crimping, Edge Crimping, Knit-de-knit, Gear crimping, Chemical texturing processes..</p>		
2	<p><b>Specialty Yarn Technology:</b></p> <p><b>Fancy/Novelty Yarns</b> – Comprehensive Classification of fancy/novelty yarns; Basic concept of Mono-fancy yarns such as slubs, multi-count, multi-twist yarns and their production techniques; Basic principles of producing various profile of plied-fancy yarns such as Knop yarn, Snarl yarn, Loop yarn, Spiral yarn, diamond yarns etc. using ring-doubling, fancy-doubling system as well as rotor, hollow-spindle spinning; Concepts of mélange fancy yarn, Process and sequence used for producing mélange fancy yarn; Chenille yarn manufacturing technique.</p> <p><b>Specialist Yarns</b> - Principle of formation of <b>Compound (Core-spun and Cover-spun) yarns</b>, machine details and production methods of Compound yarns in brief; Concept of <b>Hybrid/engineered yarns</b> and its manufacturing; Overview of Special purpose yarns such as High bulk yarn, reflective yarn, electro-coated yarn, elastomeric yarn, plasma-treated yarn, conductive yarn.</p>	8	30
3	<b>Introduction to Nonwoven</b>	1	3
4	<p><b>Web formation systems</b></p> <p>Dry laid web Formation: Raw material - Fibre Opening –</p>	5	15

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	<p>Carding – Cross lapping - perpendicular-laid web formation - Airlaid web formation: Air laying technology - bonding systems &amp; finishing - properties &amp; applications. Wet-laid web formation: theoretical basis of wet forming – raw materials – fibre preparation – web forming technology – bonding systems – finishing- properties &amp; applications. Polymer laid web formation: Spun bonding and Melt blown process: raw material - production technology – operating variables – bonding techniques – structure and properties –application.</p>		
5	<p><b>Bonding Technique of Web</b></p> <p>Mechanical Bonding: Stitch bonding, Needle Punching: Needle design and selection – various factors influencing needle punching process – needle punching technology – properties and applications – Hydroentanglement: Principle – fibre selection – process technology – properties and applications. Thermal Bonding: principle – raw materials – technologies such as calender bonding, thorough air bonding, ultrasonic &amp; IR bonding – structure and properties – applications.</p> <p>Chemical Bonding: Chemical binders – mechanism of chemical bonding – methods of binder application – drying – Limitations and applications.</p>	5	15
6	<p><b>Finishing and Testing of Nonwoven</b></p> <p>Testing of Nonwoven fabrics: weight, thickness, fibre orientation, fabric porosity, pore size &amp; pore size distribution, dry sieving, wet sieving, hydrodynamic</p>	4	12



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	sieving, bubble point test method, measuring tensile properties, measuring gas and liquid permeability, measuring water vapour transmission, measuring wetting and liquid absorption, measuring thermal conductivity and insulation.		
	Total	30	100

**Text and reference books:**

1. “Yarn texturing technology” by J W S Hearle, L Hollick and D K Wilson, CRC Press, Woodhead Publishing Limited, 2002;
2. “Fancy yarns: Their manufacture and applications” by R H Gong & R M Write, CRC Press, Woodhead Publishing Limited, 2002;
3. “Specialist Yarn and Fabric Structures Developments and Applications” by R. H Gong, Woodhead Publishing Limited, 2011 (Woodhead Publishing Series in Textiles);
4. “Spun Yarn Technology” by Eric C. Oxtoby;
5. S.J.Russell, “Hand Book of Nonwovens”, Wood head publications Ltd., ISBN-13: 978-1-85573-603-0, 2007.
6. Wilhelm A, Hilmar F and Walter K, “Nonwoven Fabrics: Raw Materials, Manufacture, Applications, Characteristics, Testing Processes”, Wileyverlag Gmbh & Co. Kгаа, Weinheim, 2003
7. NPTEL lecture note

**Course Outcome:**

After successful completion of this course, the students should be able to

1. Understand various technologies of textured yarn formation
2. Classify fancy/novelty yarns
3. Explain the characteristics of various specialist yarns
4. Identify basic principles of producing various profiles of fancy/novelty yarns
5. Demonstrate the manufacturing technology fancy/novelty yarns

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6. Describe the various nonwoven web laying and web bonding systems
7. Explain the principle of working of various web laying and web bonding systems.
8. Summarize the various nonwoven fabric characterization techniques.
9. Summarize the application of nonwoven in technical textiles.

**Special Remarks (If any): Nil.**

1. Illustrate various technologies of textured yarn formation. (Understanding)
2. Classify fancy/novelty yarns and identify basic principles of producing various profiles of them. (Applying + Understanding)
3. Explain the need and characteristics of various specialist yarns and demonstrate their manufacturing technology. (Understanding + Applying).
4. Describe the various nonwoven web laying and web bonding systems
5. Explain the principle of working of various web laying and web bonding systems.
6. Summarize the various nonwoven fabric characterization techniques.
7. Summarize the application of nonwoven in technical textiles.

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**Introduction to Composites (PE TT 703 C)**

<b>Name of the Course:</b>		<b>Introduction to Composites</b>					
<b>Course Code: PE TT 703 C</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 2 hrs./week		Mid Semester Exam.: 15 Marks					
Tutorial: Nil		Assignment & Quiz: =10(=8+2) Marks					
Practical: hr./week		Attendance: 5 Marks					
Credit Points: 2		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To enlighten the students about different types of fibrous reinforcement						
2	To provide knowledge of various components of the composite						
3	To impart various classes of composite						
4	To impart knowledge of various composite manufacturing technique						
5	To impart knowledge of different application area of composite						
<b>Pre-Requisite:</b>							
1	PC TT 301 , PC TT 302, PC TT 303						
2	PC TT 401						
3	PC TT 501, PC TT 502, PC TT 504						
4	PC TT 601, PC TT 602						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks

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<b>A</b>		<b>10</b>	<b>10</b>				
<b>B</b>				<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>				<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>
<ul style="list-style-type: none"> <li>• <b>Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.</b></li> <li>• <b>Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.</b></li> </ul>							

<b>Unit</b>	<b>Content</b>	<b>Hrs/ Unit</b>	<b>Marks/ Unit</b>
<b>1</b>	<b>Introduction to Composite</b> Definition and classification of the composite. Advantages of composite over others. Fibre reinforced composite.	<b>2</b>	<b>6</b>
<b>1</b>	<b>Introduction to various reinforcing materials and the effect of their geometry on the properties of composite from the fibrous structure</b>  <b>a. Introduction to fibres for high performance composites.</b> Different fibre architectures used for composites and their characteristics and properties. Influence of fibre architectures on the properties of opposites.  <b>b. Introduction to speciality yarn for high performance composites.</b> Different yarn architectures used for composites and their characteristics and properties. Influence of yarn architectures on the properties of opposites.  <b>c. Introduction to fabric for high performance composites.</b> Different fabric architectures used for composites and their characteristics and properties. Influence of fabric architectures on	<b>8</b>	<b>30</b>

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	<p>the properties of opposites.</p> <p><b>d. Different types of perform</b></p> <p>Unidirectional, planar, 3D and net-shaped performing.</p>		
2	<p><b>Introduction to continuous phase: Matrix</b></p> <p>Types matrix and their properties. Thermoset and thermoplastic matrix. Property of Polymeric matrices for rigid and flexible composites. The fibre-matrix interface. Definition of interface, role of interface, critical length of fibre role of coupling agents. Transfer of load/stress at the interface. Mechanism of stress transfer.</p>	4	14
3	<p><b>Various techniques of composites design and fabrication of fibre reinforced composite.</b></p> <p>Extrusion, Compression moulding, Injection moulding, Transfer moulding, Rotational moulding, Blow moulding, Hand-layup, Spray-layup, Compression moulding Injection moulding, Reaction injection moulding, Autoclaving, Resin transfer moulding, Filament winding, Pultrusion, Sheet moulding, Pre-pegging</p>	6	20
4	<p><b>Characterisation of fibre reinforced composite</b></p> <p>Evaluation of Matrix- Thermoset and Thermoplastic matrix, Evaluation of reinforcing materials. Characterisation of Composite- Failure mechanism of composite, Tensile, Flexural, Impact, IFSS, Dynamic stiffness and loss component, Compression, Density and void content, Non-Destructive Test</p>	5	15
5.	<p><b>Application of fibre reinforced composite</b></p> <p>Composites for structural engineering, electrical, civil, aerospace, defence, automobile, sporting goods and other applications. Design and analysis of textile structural</p>	5	15

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	composites.		
	Total	30	100

**Text and reference books:**

1. Engineering Mechanics of Composite Materials, (2nd edition), by Isaac and M Daniel, Oxford University Press, 2006 .
2. Analysis and performance of fibre Composites, (Second Edition), by B. D. Agarwal and L. J. Broutman, John Wiley & sons, NewYork , New York, 1990.
3. Mechanics of Composite Materials, (3ed edition), by R. M. Jones, Mc Graw Hill Company, New York, 2006.
4. Analysis of Laminated Composite Structures, by L. R. Calcote, Van Nostrand Rainfold, New York, 1969.
5. Mechanics of Composite Materials, (Second Edition), by Autar K. Kaw, CRC, 2010.

**Course Outcome:**

After successful completion of this course, the students should be able to

1. Classify the various fibre reinforced composite
2. Select the suitable fibrous reinforcement in making composite
3. Explain the behaviour of constituents in the composite materials
4. Understand the various composite manufacturing techniques.
5. Identify and describe the properties of fibre reinforcements, polymer matrix materials and composites.
6. Apply knowledge of composite mechanical performance and manufacturing methods for different applications.

**Special Remarks (If any): NIL**

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**Image Processing (OE TT 701A)**

<b>Name of the Course:</b>		<b>Image Processing (OE TT 701A)</b>					
<b>Course Code: OE TT 701 A</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 3 hrs./week		Mid Semester Exam.: 15 Marks					
Tutorial: Nil		Assignment & Quiz: =10(=8+2) Marks					
Practical: hr./week		Attendance: 5 Marks					
Credit Points: 3		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To cover the basic theory and algorithms those are widely used in image processing.						
2	To expose students to current technologies and issues that is specific to image processing systems.						
3	To develop hands-on experience in using computers to process images.						
<b>Pre-Requisite:</b>							
1	ES-CS 201 and ES-CS 291						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks
A	1 to 6	10	10				
B	1 to 6			6	3	5	15
C	1 to 6			6	3	15	45

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- Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.
- Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.

Unit	Content	Hrs/Unit	Marks/Unit
1	<p><b>Introduction and fundamentals of Image Transform</b></p> <p>Elements of digital image processing ,Image model ,Sampling and quantization, Relationships between pixels ,Basic geometric transformations- Introduction to Fourier Transform and DFT – properties of 2D Fourier Transform – FFT – Separable Image Transforms - Walsh – Hadamard – Discrete Cosine Transform, Haar, Slant – Karhunen – Loeve Transforms.</p>	10	25
2	<p><b>Image Enhancement Techniques</b></p> <p>Enhancement by point processing , Spatial Domain methods: Basic grey level transformation – Histogram equalization – Image subtraction – Image averaging, Spatial filtering- Smoothing, sharpening filters – Laplacian filters – Frequency domain filters : Homomorphic filtering. Enhancement in the frequency domain , Color Image Processing</p>	10	25
3	<p><b>Image restoration</b></p> <p>Model of Image Degradation/restoration process –</p>	6	12



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	Noise models – Inverse filtering -Least mean square filtering – Constrained least mean square filtering – Blind image restoration – Pseudo inverse – Singular value decomposition.		
4	<b>Image compression</b>  Lossless compression: Variable length coding – LZW coding – Bit plane coding- predictive coding- DPCM. Lossy Compression: Transform coding – Wavelet coding – Basics of Image compression standards: JPEG, MPEG, Basics of Vector quantization.	6	12
5	<b>Image Segmentation and Representation</b>  Edge detection – Thresholding - Region Based segmentation – Boundary representation: chain codes- Polygonal approximation – Boundary segments – boundary descriptors: Simple descriptors-Fourier descriptors - Regional descriptors –Simple descriptors- Texture	7	14
6	<b>Morphological Image Processing</b>  Dilation and Erosion , Opening and Closing, Some basic Morphological algorithms , Extensions to gray level images	6	12
	Total	45	100

**Text and reference books:**

1. William K Pratt, Digital Image Processing John Willey (2001)
2. Image Processing Analysis and Machine Vision – Millman Sonka, Vaclav hlavac, Roger Boyle, Broos/colic, Thompson Learniy (1999).

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3. A.K. Jain, PHI, New Delhi (1995)-Fundamentals of Digital Image Processing.
4. Chanda Dutta Magundar – Digital Image Processing and Applications, Prentice Hall of India, 2000
5. Rafael C Gonzalez, Richard E Woods 2nd Edition, Digital Image Processing - Pearson Education 2003.

**Course Outcome:**

After successful completion of this course, the students should be able to

7. Understand the basic theory digital image processing.
8. Explain image analysis process sequence
9. Understand applications in the field of Image Processing.

**Special Remarks (If any): NIL**

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**Nano Technology (OE TT 701 B)**

<b>Name of the Course:</b>		<b>Nano Technology</b>					
<b>Course Code: OE TT 701 B</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 3 hrs./week		Mid Semester Exam.: 15 Marks					
Tutorial: Nil		Assignment & Quiz: 10 (8+2) Marks					
Practical: hr./week		Attendance: 5 Marks					
Credit Points: 3		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To impart knowledge on nanotechnology						
2	To impart knowledge on production of nano particles, nano fibres and nano composites						
3	To impart knowledge on characterization of nano particles, nano composites and bionanocomposites						
4	To impart knowledge on application of nanotechnology in diverse fields with special emphasis in textiles						
<b>Pre-Requisite:</b>							
1	General Physics and Chemistry						
2	Knowledge of PC TT 301: Textile fibre						
3	Knowledge of Biochemistry						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of	Total	No. of	To	Marks	Total

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		questions to be set	marks	questions to be set	answer`	per question	marks
<b>A</b>	<b>1 to 6</b>	<b>10</b>	<b>10</b>				
<b>B</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

<b>Unit</b>	<b>Content</b>	<b>Hrs/Unit</b>	<b>Marks/Unit</b>
1	<b>Introduction</b> History of nanotechnology, definition, bottom-up and top-down approach for synthesis of nanoparticles, application of nanotechnology	4	10
2	<b>Nanofibre production</b> Principle of electro-spinning, electro-spinning of nanofibres-conditions, structure formation, properties, effect of process parameters upon fibre formation, methods to produce continuous filaments, electro-spinning of polyamide and polyesters	8	25
3	<b>Carbon nanotubes (CNT)</b> Definition, synthesis, characterization and properties of CNT, application of CNT in polymer and textiles, effect of process conditions upon CNT structure and properties, nanotubes/nanofibre polymer composite, development of nanotubes/nanofibre polymer composites, analysis of rheological properties and microstructure of	8	20

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	nanotubes/nanofibre polymer composites, introduction of multifunctional polymer nano composites.		
4	<b>Nanoparticles</b> Preparation, characterization and application of `Ag, Fe, ZnO, TiO <sub>2</sub> , MgO <sub>2</sub> , SiO <sub>2</sub> for coating and composites, clay nanoparticles, cellulose nano whiskers and nanoparticles, self assembled nanolayer films, nano structuring of polymer with cyclodextrins.	9	20
5	<b>Characterization of nanoparticles</b> Different nanomaterial characterization techniques, nano-finishing: self cleaning of fabrics, UV-protection, antibacterial, water repellent, antistatic and wrinkle resistant.	9	15
6	<b>Ecological aspects</b> Ecological considerations of nanoparticles and nanofibres, human health hazards, hazard to environment, aquatics and to useful microbes responsible for biodegradation, Global regulation concerning nanoparticles and products.	7	10
	Total	45	100

**Text and reference books:**

1. Brown P. J. and Stevens K. Nanofibres and Nanotechnology in textiles, Woodhead publishing Ltd., Cambridge, 2007.
2. Gogotsi Y. Nanotubes and Nanofibres, CRC Taylor & Francis, Boca Raton, 2006.
3. Cao G. Nanostructure and Nanomaterials, Imperial College press, USA, 2006.
4. Wilson M., Kannangara K., Smith G., Simons M. and Raguse B. Nanotechnology--- Basic Science and Engineering Technologies, Oversees Press, New Delhi, 2005.

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**Course Outcome:**

After successful completion of this course, the students should be able to

1. Understand the objectives, tasks and basic principles behind nanotechnology
- 2 Understand the synthesis and characterization of nanoparticles, nanofibres and nanocomposites
- 3 Examine the effect of different nanoparticles on functional properties of different textile materials.
- 4 Apply the knowledge of nanotechnology in diverse fields as a whole and textiles in particular.

**Special Remarks (If any): NIL**

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**Robotics (OE TT 701 C)**

<b>Name of the Course:</b>		<b>Robotics</b>					
<b>Course Code: OE TT 701 C</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 3 hrs./week		Mid Semester Exam.:15Marks					
Tutorial: Nil		Assignment & Quiz: 10 (=8+2)Marks					
Practical:		Attendance: 5 Marks					
Credit Points: 3		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To impart knowledge about the engineering aspects of Robots and their application.						
2	To make students acquaint with the principles of Robotics , theory and working principles of different types of sensors and mechanical systems used in the Textile Industry.						
<b>Pre-Requisite:</b>							
1	ES-EE101 , ES-EE191						
2	ES TT 401/PE TT 401A , ES TT 492						
3	ES-CS-201						
4	PC TT 302 ,PC TT 401, PC TT 501 , PC TT 502 , PC TT 601 , PC TT 602						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks

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<b>A</b>	<b>1 to 6</b>	<b>10</b>	<b>10</b>	<b>12</b>	<b>10</b>	<b>1</b>	<b>10</b>
<b>B</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>
<ul style="list-style-type: none"> <li>• <b>Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.</b></li> <li>• <b>Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.</b></li> </ul>							

<b>Unit</b>	<b>Content</b>	<b>Hrs/Unit</b>	<b>Marks/Unit</b>
1.	<p><b>Basic concepts of Robotics</b></p> <p>Definition of Robot, History of robotics, Robotics market and the future prospects, Robot Anatomy, Robot configurations: Point to point control, continuous path contour. Robot motions, Joints, Work volume, Robot drive systems, Precision of movement – Spatial resolution, Accuracy, Repeatability.</p>	8	16
2.	<p><b>End Effectors</b></p> <p>End effectors- classification- mechanical, magnetic, vacuum and adhesive gripper- gripper force analysis and design. Robot control- Unit control system concept- servo and non-servo control of robot joints, adaptive and optimal control</p>	7	15
3.	<p><b>Robot actuation and feedback components</b></p> <p>Position sensors – Potentiometers, resolvers, encoders, velocity sensors. Actuators - Pneumatic and Hydraulic Actuators, Electric Motors, Stepper motors, Servomotors,</p>	5	10



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	Power Transmission systems.		
4.	<p><b>Robot Sensors and Machine vision system</b></p> <p>Sensors in Robotics - Sensor devices, Types of sensors- contact, Force and torque sensors- Proximity and range sensors- acoustic sensors- use of various sensors in Robotics.</p> <p>Machine Vision System: Introduction to Machine vision, the sensing and digitizing function in Machine vision, Image processing and analysis, Training and Vision systems.</p>	8	18
5.	<p><b>Robot programming and Automation</b></p> <p>Robot Programming: Robot language classification- programming methods- off and on line programming- Lead through method Teach pendent method- VAL systems and language, simple program.</p> <p>Automation: History of Automation, Reasons for automation, Disadvantages of automation, Automation systems, Types of automation – Fixed, Programmable and Flexible automation, Automation strategies</p>	10	25
6.	<p><b>Application in Textile Industry</b></p> <p>Robotized Machines for cotton harvesting , PR robot for folding of cloth, PUMA robot for handling fabric ,Nomad 200 for cleaning, piecing ROBO in ring spinning machine ROBO lap in combing m/c , Robot pickup and place of cans , automatic splicer arm robot , dispenser in dyeing, Robotic Fiber Assembly and Control System (RFACS) in</p>	7	16

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	nonwoven, AI in textile industry.		
	Application of Robotics in automatic Printing and Embroidery Process		
	Applications of Robotics in material handling in the production floor.		
	Total	45	100

**Text and reference books:**

1. S.R. Deb, Robotics technology and flexible automation, McGraw Hill publishing company limited, New Delhi, 1994.
2. M.P. Groover. Industrial Robotics Technology Programming and Applications, McGraw Hill Book Co, Singapore, 1987.
3. S.K. Saha, Introduction to Robotics, McGraw-Hill Publication, 2014.
4. Y. Koren, Robotics for Engineers, McGraw Hill, New York, 1985.
5. P.G. Ranky and C.Y. Ho, Robots Modelling Control and Applications with Software, Springer Verlag, 1985.
6. J.J. Craig, Introduction to Robotics, Addison-Wesley, 2009.
7. R.J. Schilling, Fundamentals of Robotics Analysis and Control, Prentice Hall of India, 1996.
8. T. Yoshikawa, Foundations of Robotics Analysis and Control, Prentice Hall of India, 2010.
9. K.S. Fu, R.C. Gonzales and C.S.G. Lee, Robotics: Control, Sensing, Vision and Intelligence, McGraw Hill, 1997.
10. W. Stadler, Analytical Robotics and Mechatronics, McGraw Hill Book Co., 1995.
11. Khushdeep Goyal- Industrial Automation & Robotics
12. Kevin M. Lynch and Frank C. Park: Modern Robotics: Mechanics, Planning, and Control, Kindle Edition

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**Course Outcome:**

After successful completion of this course, the students should be able to

1. Comprehend basic knowledge of robotic.
2. Understand transducers, sensors, actuators and controllers employed commonly in robotics.
3. Understand the design and construction of robotics system.
4. Understand and Explain automation strategies.
5. Identify the different areas of application and future scopes of Robotics in Textile Industry.

**Special Remarks (If any): NIL.**

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**Soft Computing (OE TT 701D)**

<b>Name of the Course:</b>		<b>Soft Computing</b>					
<b>Course Code: OE TT 701D</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 3 hrs./week		Mid Semester Exam.: 15 Marks					
Tutorial: Nil		Assignment & Quiz: 10(8+2) Marks					
		Attendance: 5 Marks					
Practical: hr./week		End Semester Exam.: 70 Marks					
Credit Points: 3							
<b>Objective:</b>							
1	Introduce students to soft computing concepts and techniques and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems.						
2	Introduce students to fuzzy systems, fuzzy logic and its applications.						
3	Explain the students about Artificial Neural Networks and various categories of ANN.						
<b>Pre-Requisite:</b>							
1	ES-CS 201, ES-CS-291						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks
A	1 to 7	10					

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<b>B</b>	<b>1 to 7</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 7</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>
<ul style="list-style-type: none"> <li>• <b>Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.</b></li> <li>• <b>Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.</b></li> </ul>							

<b>Unit</b>	<b>Content</b>	<b>Hrs/Unit</b>	<b>Marks/Unit</b>
1	<p><b>Introduction</b></p> <p>Basics of Soft computing and artificial intelligence, basic differences with the traditional computing process. Necessity of soft computing. Knowledge Representation–Reasoning, Issues and Acquisition: Propositional and Predicate Calculus Rule Based knowledge Representation. Symbolic Reasoning Under Uncertainty Basic knowledge Representation. Fundamentals of Heuristic model: Techniques for Heuristic search Heuristic Classification.</p>	6	12
2	<p><b>Introduction to Fuzzy Logic.</b></p> <p>Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Membership functions, interference in fuzzy logic, , Fuzzy implications and Fuzzy algorithms, Fuzzyfications &amp; Defuzzifications, fuzzy if-then rules and rule base , Fuzzy Controller, Application of Fuzzy logic in Textile Research.</p>	7	16
3	<p><b>Fundamentals of Neural Network</b></p>	8	18

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	Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.		
4	<b>Neural Network</b>  <b>(Back Propagation network)</b> Architecture: preceptor model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training, applications.	8	18
5	<b>Applications of Artificial Neural network</b>  Introduction, applications in prediction, pattern recognition, image processing, classification, fault diagnosis, machine control etc	4	8
6	<b>Neuro Fuzzy Modeling</b>  Adaptive Neuro-Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm– Learning Methods that Cross-fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework Neuron. Functions for Adaptive Networks – Neurofuzzy Spectrum.	7	16

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7	<b>Genetic algorithm</b>  Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.	5	12
	<b>Total</b>	45	100

**Text and reference books:**

1. Introduction to Fuzzy Logic using MATLAB by S. N. Sivanandam, S. Sumathi and S. N. Deepa ,Springer
2. Fuzzy Logic: Intelligence, Control, and Information by John Yen and Reza Langari
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications, Third Edition" ,Wiley | 2010
4. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" Prentice Hall of India.
5. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.
6. Siman Haykin,"Neural Netowrks"Prentice Hall of India
7. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India.
8. Kumar Satish, "Neural Networks" Tata Mc Graw Hill

**Course Outcome:**

After successful completion of this course, student will be able to

1. Understand soft computing techniques and their role in problem solving.
2. Conceptualize and parameterize problems to be solved through basic soft computing techniques.
3. Analyze soft computing techniques in order to solve problems effectively and efficiently.

**Special Remarks (If any): NIL.**

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**Wearable Electronics (OE TT 701E)**

<b>Name of the Course:</b>		<b>Wearable Electronics</b>					
<b>Course Code: OE TT 701E</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 3hrs./week		Mid Semester Exam.:15Marks					
Tutorial: Nil		Assignment & Quiz: 10 (=8+2)Marks					
Practical:		Attendance: 5Marks					
Credit Points:3		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To impart knowledge about the engineering aspects of wearable electronics and their application.						
2	To acquaint the wearable electronics with conductive materials and use of sensors for wearable context ,actuators in the Textile .						
3	To acquaint the wearable electronics application						
<b>Pre-Requisite:</b>							
1	Basic Electrical and Electronics Engineering						
2	Basic Instrumentation						
3	Textile fibres and polymer						
4	Basics of computer system						
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of	Total	No. of	To	Marks	Total



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		questions to be set	marks	questions to be set	answer`	per question	marks
<b>A</b>	<b>1 to 6</b>	<b>10</b>	<b>10</b>				
<b>B</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>

- **Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.**
- **Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.**

Unit	Content	Hrs/Unit	Marks/Unit
1.	<p><b>Electrostatically generated nanofibres for wearable electronics</b></p> <p>Current and future wearable technology , Applications of wearable electronics and photonics Implications of wearable technology Electro spinning process Electroactive nanofibres</p> <p>Ultra-low dielectric constant of nanocomposite fibrous film, Fabrication of samarium and manganese doped lead titanate, Fabrication of ceramic fibre/epoxy composites , Electromechanical properties of ceramic fibre/epoxy ,composites , modified parallel and series model of ceramic/polymer ,composites , Possible uses of ceramic fibres and composites in intelligent apparel applications</p>	10	24
2.	<p><b>Electroactive fabrics and wearable man–machine</b></p> <p>Sensing fabrics ,Actuating fabrics , Smart fabrics for health care, Smart fabrics for motion capture , Smart textiles as kinaesthetic interfaces Conductive textiles , Electromechanical properties of</p>	7	15

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	PPy-coated conductive fibres/yarns , Performance of electrically conductive fabrics and its applications,		
3.	<b>Integration of fibre optic sensors and sensing networks into textile structures</b>  Smart textiles , Modelling and analysis , Manufacturing of smart textiles , Applications of smart textiles , Photonic band-gap materials , Fibre-harvesting ambient light-reflective displays Electroluminescent fibres and fabrics , Textile-based flexible displays ,	7	15
4.	<b>Communication apparel and optical fibre fabric display Wearable computing systems .</b>  Communication apparel, Optical fibre fabric display , Electronic textiles , Electrical characterisation of textile networks, Smart clothing concept model , Data transfer in smart clothing , Implementations for communication.	8	18
5.	<b>Switches, electronics wearable making electronics wearable, microcontrollers, wireless</b>  Off the shelf switches, DIY switches, making something wearable, microcontrollers, and, sensors, actuators, communicating with Bluetooth.	9	20
6.	<b>Interaction design in smart textiles clothing and applications</b>  Design and development: multidisciplinary collaboration, combining the real and the virtual , Technology enablers.	4	8
	<b>Total</b>	45	100

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**Text and reference books:**

1. Kate Hartman Make:Wearable Electronics ,Shroff publishers & distributors pvt ltd .2010.
2. Wearable Electronics and Smart Textiles: A Critical Review, Matteo Stoppa and Alessandro Chiolerio ,Sensors,2014
3. Xiaoming Tao Wearable electronics and photonics , Woodhead Publishing Limited in association with The Textile Institute Cambridge England.

**Course Outcome:**

At the end of this course students should be able to

1. Learn concept of wearable electronics.
2. Understand conductive textiles used in wearable electronics .
3. Understand common sensors, actuators and controllers employed in wearable electronics
4. Learn the communication and data transfer system with a specific application .
5. Extend the knowledge in different applications.

**Special Remarks (If any): NIL**

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Syllabus for B. Tech in Textile Technology (TT)  
(Applicable from the academic session 2018-2019)**

**Medical Textiles (OE TT 701 F)**

<b>Name of the Course:</b>		<b>Medical Textiles</b>					
<b>Course Code: OE TT 701 F</b>		<b>Semester: VII</b>					
<b>Duration: 6 months</b>		<b>Maximum Marks: 100</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>					
Theory: 3hrs./week		Mid Semester Exam.:15Marks					
Tutorial: Nil		Assignment & Quiz: 10 (=8+2)Marks					
Practical:		Attendance: 5Marks					
Credit Points:3		End Semester Exam.: 70 Marks					
<b>Objective:</b>							
1	To impart information about applications of various structures of fibre, yarn, fabric in the medical textiles						
2	To gain knowledge of medical textiles used for medical purposes						
3	To impart knowledge of the manufacturing of technical textiles.						
<b>Pre-Requisite:</b>							
1	The basic concept of fibre						
2	BS BIO 301						
3							
<b>End Semester Examinations Scheme. Maximum Marks – 70. Time allotted – 3 hrs.</b>							
Groups	Units	Objective Questions (MCQ only with one correct answer)		Subjective Questions			
		No. of questions to be set	Total marks	No. of questions to be set	To answer`	Marks per question	Total marks
A	1 to 6	10	10				

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<b>B</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>5</b>	<b>15</b>
<b>C</b>	<b>1 to 6</b>			<b>6</b>	<b>3</b>	<b>15</b>	<b>45</b>
<ul style="list-style-type: none"> <li>• <b>Only multiple choice type questions (MCQ) with one correct answer are to be set in the objective part.</b></li> <li>• <b>Specific instruction to the students to maintain the order in answering objective questions should be given on top of the question paper.</b></li> </ul>							

Unit	Content	Hrs/Unit	Marks/Unit
1.	<b>Materials and Structures Used for Healthcare and Medical Textile</b> Materials for Healthcare and Medical Textiles. Applications of Healthcare and Medical Textiles Polymers, Fibers Yarns Fabrics and 3D Structures Fiber-Reinforced Composites , Finishing for Textile Products ,Biopolymers Used for Nanofibers its Modification , Biomedical Applications of Nanofibers	12	25
2.	<b>Textiles as a Source of Comfort and Healthcare Problems and Biocompatibility</b> Microclimate and Thermophysiological Comfort Textile/Skin Interaction and Sensorial Comfort Types of Fiber as Related to Comfort ,Textile-Related Healthcare Problems , Bioresorbability and Biostability	6	15
3.	<b>Disposable Hygiene and Healthcare Protective Textiles</b> The Diaper , Other Disposable Hygiene Textiles Environmental Issues , Textiles for Infection Control ,Flame Retardant (FR) Textiles ,Antistatic Textiles	6	15
4.	<b>Textiles for Wound Care and Biotextiles</b> Human Skin and Skin Wounds ,Wound Dressing and Wound Dressing Materials ,Pressure Garment Sutures,Vascular	10	20

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	Grafts,Ligament Prosthesis ,Hernia Repair Mesh Grafts ,Extracorporeal Devices: Artificial Kidney		
5.	<b>Tissue Engineering</b> Bioengineered Skin Grafts ,Bioengineered Vascular Grafts , Bioengineered Extracorporeal Device	6	15
6.	<b>Intelligent Medical and Healthcare Textiles.</b> Intelligent Materials ,Intelligent Textile Products	5	10
	<b>Total</b>	45	100

**Text and reference books:**

1. A.R. Horrocks & S.C. Anand (Edrs.), —Handbook of Technical Textiles, The Textile Institute, Manchester, U.K., Woodhead Publishing Ltd., Cambridge, England, 2000.
2. S. Anand, Medical Textiles, Textile Institute, 1996
3. Wen Zhong ,An Introduction to HEALTHCARE and medical Textiles , DesTech Publication Inc,USA

**Course Outcome:**

At the end of this course students should be able to

1. Describe the classification of medical textiles
2. Outline the fibres, yarns and fabric structures used in medical textiles technical textiles
3. Outline the functions and various requirements of medical textiles.
4. Develop solutions during medical textiles product development

**Special Remarks (If any): NIL**

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**Industrial Internship (PW TT 781)**

**4 weeks**

**Project 1 (PW TT 782)**

**10 hrs/week**