

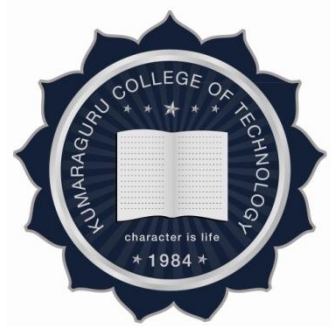
KUMARAGURUCOLLEGE OF TECHNOLOGY

An autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049.

M. Tech - APPAREL TECHNOLOGY

REGULATIONS 2018



CURRICULUM AND SYLLABI

I to IV Semesters

Department of Fashion Technology

Signature of BOS chairman, FT

VISION

Achieve excellence in academics and research by bestowing technological prowess and managerial acumen to our students to face the global challenges of the clothing industry the context of professional and social responsibility.

MISSION

- Disseminate core competencies with a comprehensive curriculum encompassing apparel design, manufacture and management.
- Stimulate analytical and creative thinking to transform the students as competent professionals and researchers.
- Promote collaborations with industry to comprehend global practices leading to excellence.
- Mould the students as socially responsible technocrats and entrepreneurs to develop products and offer services useful for society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Program Educational Objectives of post graduate program M.Tech Apparel Technology are to prepare the students:

- I. To pursue a successful profession in apparel industry
- II. To conduct research to design and develop new products to meet functional and other requirements in clothing and technical apparels. .
- III. To continue their professional development by utilizing educational and career building opportunities through their employer, educational institutions, or professional bodies.

PROGRAMME OUTCOMES (POs)

Graduates of the M.Tech Apparel Technology post graduate program should have the ability to:

PO1: An ability to independently carry out research / investigation and development work to solve practical problems

PO2: Ability to write and present a substantial technical report / document

PO3: Demonstrate a degree of mastery over the domain area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Graduates of the post graduate program M.Tech Apparel Technology will have the ability to:

PSO1: Apply reasoning skill in product engineering and development to meet industry and consumer needs.

PSO2: Understand the impact of the professional engineering solutions for technical and social compliance.

PSO3: Apply ethical principles and sustainable development while ensuring availability of resources for future generations.



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KUMARAGURU COLLEGE OF TECHNOLOGY
COIMBATORE – 641 049
REGULATIONS 2018
M.Tech. APPAREL TECHNOLOGY
CURRICULUM

Semester I									
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C
1	P18ATT1001	Automation in Apparel Manufacture	Theory	PC	3	0	0	0	3
2	P18ATT1002	Sustainable Apparel Manufacture	Theory	PC	3	0	0	0	3
3	P18ATI1003	Science of Clothing Comfort	Embedded	PC	3	0	2	0	4
4	P18ATI1004	Forecasting and Product Development	Embedded	PC	3	0	2	0	4
5	P18INT0001	Research Methodology and Statistics	Theory	PC	3	0	0	0	3
Total Credits									17
Total Contact Hours/week									22

Semester II									
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C
1	P18ATT2001	Engineering of Functional Clothing	Theory	PC	3	0	0	0	3
2	P18ATT2002	Advanced Knitwear Technology	Theory	PC	3	0	0	0	3
3	P18ATI2003	Technology of Apparel Finishing	Embedded	PC	3	0	2	0	4
4	P18ATI2004	Apparel Enterprise Resource Management	Embedded	PC	3	0	2	0	4
5	P18ATI2005	New Product Development and Assessment	Theory	PC	3	0	0	2	4
Total Credits									18
Total Contact Hours/week									21



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Semester III									
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C
1	P18ATE001*	Program Elective I	Theory	PE	3	0	0	0	3
2	P18ATE001*	Program Elective II	Theory	PE	3	0	0	0	3
3	P18ATP3001	Internship / Project Phase I	Project	PW	0	0	0	18	10
Total Credits									16
Total Contact Hours/week									24

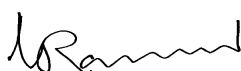
Semester IV									
S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C
1	P18ATP4001	Internship / Project Phase II	Project	PW	0	0	0	30	20
Total Credits									20
Total Contact Hours/week									30
Grand Total Credits									71



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List of Program Electives

Code No.	Course Title	Course Type	L	T	P	J	C
P18ATE1001	Textile Composites	Theory	3	0	0	0	3
P18ATE1002	Computer Integrated Apparel Manufacture	Theory	3	0	0	0	3
P18ATE1003	Nano Textiles	Theory	3	0	0	0	3
P18ATE1004	Protective Clothing	Theory	3	0	0	0	3
P18ATE1005	Sports and Medical Apparels	Theory	3	0	0	0	3
P18ATE1006	Engineering of Apparels	Theory	3	0	0	0	3
P18ATE1007	Lean Manufacture & Logistics Management	Theory	3	0	0	0	3
P18ATE1008	Fashion Entrepreneurship Management	Theory	3	0	0	0	3
P18ATE1009	Energy Management in Apparel Industry	Theory	3	0	0	0	3
P18ATE1010	Compliance Standards in Apparel Industry	Theory	3	0	0	0	3



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FASHION TECHNOLOGY

M. Tech. - APPAREL TECHNOLOGY

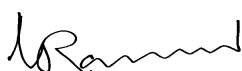
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SYLLABUS



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SEMESTER I

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Signature of BOS chairman, FT

P18ATT1001 AUTOMATION IN APPAREL MANUFACTURE

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

- CO1:** Acquire knowledge on various mechanical and electrical drives used in automation of apparel manufacturing.
- CO2:** Gain knowledge on various hybrid energy transfer power transmission drives
- CO3:** Explain the working of automated elements in cutting, sewing and special machines.
- CO4:** Gains knowledge about automated apparel finishing equipment.
- CO5:** Describe the concepts of automated material handling equipment.
- CO6:** Explain the application robotics in various areas in apparel industry.

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

CONCEPT OF AUTOMATION**9 Hours**

Base subject information, basic terms and definitions from mechanization area and automation area. Energy transfer in kinematic system, drive requests, types of drives, comparison, characteristics, fluid drives, characteristics, comparing, pneumatic drives, air properties as a medium for energy transfer. Hydraulic drives, schematic diagram, power packs, Proportional hydraulic system, servo-operated valves, circuits with PAS (power assisted steering). Electric drives, general view, characteristics, powers (outputs).

AUTOMATION IN APPAREL DESIGNING AND FIT ANALYSIS**9 Hours**

Automated elements in clothing production - cutting of fabric - cutting by water jet, laser, plasma - automated sewing machines - Types of driving mechanism of sewing machines – single needle lock stitch machine, over lock and flat lock machine. Automation in special machines – bar tack, pocket making and patterning machines, button holing and sewing machines.

AUTOMATION IN APPAREL FINISHING:**9 Hours**

Automation in fusing, pressing and folding machines. Automation in apparel packing equipments.



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AUTOMATION IN MATERIAL HANDLING**9 Hours**

Types of equipment- Automated storage and retrieval systems- Overview of conceptions of “Work Robots” and “Manipulators”. Conveyor systems – Unit production systems. Ply separation; Transportation - position and orientation, pick and place – clamping grippers and pinch grippers. Machine vision system – image acquisition, feature enhancement; Image segmentation – feature extraction, image understanding.

ROBOTICS IN APPAREL INDUSTRY**9 Hours**

Robotics in spreading and cutting; Robotics in sewing – double lock stitching, one side stitching, Tufting; Robotics for material handling; Robots as 2D and 3D folding machines; Robot control and simulation. Return on investment on automation.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Berkstresser, G.A. & Buchanan, E.M., Automation and Robotics in the Textile and Apparel Industries, Noyes Publications, 1986.
2. M.G.Mahadevan, “Textile Robotics and Automation”, Abhishek Publications, Chandigarh, 2001.
3. A.Gordan, et al., “Automation and Robotics in the Textile and Apparel Industries (Textile series)”, Noyes Publication, UK, 1986.
4. G.A.Berkstresser, “Automation in the Textile Industry: From Fibers to Apparel”, 1st Edition, Technomic Publishing Co., Inc, UK, 1995.
5. M.Acar, “Mechatronic Design in Textile Engineering”, NATO Science Series, 1st edition, Springer, USA, 1994.
6. Carr, H. and Latham, B., ‘The Technology of Clothing Manufacture’, Wiley-Blackwell, 2009.
7. Relis, N. & Strauss, G, ‘Sewing for Fashion Design’, Upper Saddle River, NJ: Prentice Hall, 1997.
8. Stylios G, ‘Textile Objective Measurement and Automation in Garment Manufacture’ Ellis Horwood Ltd., U.K., 1991
9. Solinger, J, ‘Apparel Manufacturing Handbook’, 2nd Ed., Van Nostrand Reinhold, New York, 1995
10. Crum, R.J, ‘Methods of Joining Fabrics’, Shirley Institute, 1983.
11. V.Jayakumar, ‘Applied Hydraulics & Pneumatics’, Lakshmi Publications, Chennai, June 2010.
12. Tain kok Kiong, Andi Sudjana Putra “Drives and Control for Industrial Automation”, Springer – Verlag London Limited 2011.
13. Dave Polka, “Motors and Drives – A Practical Technology Guide”, ISA – The Instrumentation Systems and Automation Society, 2003
14. P. Khanna, “Industrial Engineering and Management”, Dhanpat. Rai Publications, New Delhi, 1999.



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L	T	P	C
3	0	0	3

P18ATT1002 SUSTAINABLE APPAREL MANUFACTURE

COURSE OUTCOMES

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

CO1: Gain knowledge importance and concept of sustainability

CO2: Understand features of product and process design with focus on sustainability

CO3: Gain skill on sustainable manufacture with modern technology tools

CO4: Learn about sustainable manufacturing of apparel and reuse and recycling in the apparel manufacturing to achieve sustainability

CO5: Gain knowledge on Corporate Social Responsibility and mandatory certification towards sustainability.

CO6: Understand the concepts norms for technical and social compliance requirements for apparel industry in domestic and international context.

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

SUSTAINABLE DESIGN

11 Hours

Definition of Sustainability – need for sustainability. Factors influencing sustainability. Impact of ecology, economy, and culture on sustainability. Product Life Cycle. Product design sustainability using low - impact materials, recyclable material content. Energy efficient product design, design for longer-lasting and better-functioning products, product design for reuse and recycling. Assessing the product sustainability. Sustainable fibres – organic cotton, recycled polyester, alternative sustainable fibers.

SUSTAINABLE PROCESS DEVELOPMENT

9 Hours

Sustainability through Manufacturing Resource Efficiency - raw material, plant and machinery, human resource, financial resource. Sustainable manufacture through application of alternative energy source, reuse and recycle of energy. Sustainable process through technology innovation – application of CAD / CAM / CIM in process innovation and improvement. Extending product life cycle through reuse and recycle of process waste. Assessing process sustainability



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SUSTAINABLE MANUFACTURE**9 Hours**

Sustainable elements in manufacture – cost of production, power consumption, and waste creation – process waste and defects, operational safety and ergonomics, environmental friendliness. Sustainability in supply chain - supplier sustainability assessment. Safe and efficient care method for apparels to increase sustainability.

REUSE AND RECYCLE OF WASTE**7 Hours**

Types of wastes in textile and apparel manufacture – material waste, human resource waste, energy waste. Scope of reuse and recycle of waste in textile and apparel manufacture. Waste elimination at source in textile and apparel manufacturing.

COMPLIANCE FOR SUSTAINABILITY**9 Hours**

Role of National and international regulating organizations in sustainability –,Worldwide Responsible Accredited Production (WRAP). mandatory requirements – benefits to company, labour and society.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Lewis, H. and Gertsakis, J. Design and Environment: A Global Guide to Designing Greener Goods, Greenleaf Publishing, Sheffield, 2001.
2. Dalcacio.R, Julius.W, ‘Product Design in the Sustainable Era’, Taschen Publication. 2000
3. Cynthia.L, ‘Apparel Product Design and Merchandising Strategies’, Prentice Hall, 2007.
4. Janet Hethorn, Connie Ulasewicz, ‘Sustainable Fashion: Why Now? A conversation exploring issues, practices, and possibilities’, Fairchild Books, 2007.
5. Ann Paulins and Julie L. Hillery, Ethics in the Fashion Industry New York, Fairchild Books, 2009.
6. Bartlett N., Mc Gill I. and Morley N., Maximising the Reuse and Recycling of UK Clothing & Textiles, UK: Oakdene Hollins, 2009
7. Liz Parker and Marsha A. Dickson, ‘Sustainable Fashion: A Handbook for Educators’ Labour Behind the Label, 2009.
8. Marsha.A, Dickson, Suzanne.L, Molly.E, “Social Responsibility in the Global Apparel Industry”, Bloomsbury Publishing Plc. 2011



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P18ATI1003 SCIENCE OF CLOTHING COMFORT

L	T	P	C
3	0	2	4

COURSE OUTCOMES

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

CO1: Understand what is comfort and its importance in fabrics

CO2: Define and classify the different types of comfort.

CO3: Influences of different factors on overall comfort perception

CO4: Evaluate comfort for fabrics using necessary equipments

CO5: Recognize the suitability of garment based on comfort level.

CO6: Design and develop garment with necessary comfort for various end uses

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6. End Semester Examination (Theory and lab components)
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

THEORY COMPONENT CONTENT**INTRODUCTION TO COMFORT****9 Hours**

Definition, Sensory comfort, Human- clothing- environment system.

Comfort Perception and Preferences: Influences of different factors on overall comfort perception- Dimensions of sensory comfort perceptions

Thermal comfort: Thermo-physiology of the human body, Thermoregulation of the human body, Thermal - interaction between the body and clothing, Physics of thermal comfort, Heat and moisture transfer, Moisture exchange between fibre and air; Moisture behavior of fabrics made from various fibres.

BODY AND TACTILE SENSATIONS**9 Hours**

Introduction, coolness and warmth to touch, dampness sensation, clamminess and moisture buffering during exercise, environmental buffering.

Tactile sensation: Fabric prickliness, itchiness, stiffness, softness, smoothness, roughness and scratchiness; Garment fit and pressure comfort.

LOW STRESS MECHANICAL CHARACTERISTICS**9 Hours**

Low stress Mechanical Characteristics and their influence on Physical comfort. Objective



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evaluation of comfort by KES and FAST and analysis of KES results.

EVALUATION OF MOISTURE AND THERMAL COMFORT **9 Hours**

Evaluation of thermal comfort – Alambita equipment and analysis of Alambita results, Tog meter-Sweating guarded hot plate method-Evaluation of moisture comfort-Permetest water vapour permeability tester-Water vapour permeability test using cup method- Interaction between moisture, thermal and Physical Comfort.

SUBJECTIVE EVALUATION OF COMFORT **9 Hours**

Methods of assessment- Calculation of subjective preferences of clothing-rating scales- Relationship between subjective and objective analysis of fabric hand-Statistical analysis and survey.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Li.Y, “The Science of Clothing Comfort”, Textile Progress, Vol.31, Textile Institute, 2001.
2. Saville B.P, “Physical Testing of Textiles”, The Textile Institute, Wood head Publishing Limited, Cambridge, 1999.
3. Ed.Postle R., Kawabata.S and Niwa. M., “Objective Evaluation of fabrics”, Textile Machinery Society, Japan, Osaka, 1983.
4. Ukpononmwan .J.O., “The Thermal Insulation Properties of Fabrics”, Textile Progress, Vol.24,No.4, 1992.
5. Buchanan D.R, “The Science of Clothing Comfort”, Textile Progress, Vol.31,No.1/2, 1999.
6. Apurba Das and R. Alagirusamy, “Science in Clothing comfort”, Indian Institute of Technology, New Delhi, India
7. Hassan Behery, Professor Emeritus, “Effect of mechanical and physical properties on fabric hand” Woodhead Publishing Series in Textiles No. 42

PRACTICAL COMPONENT CONTENT

1. Determination of thermal resistance of fabrics.
2. Determination of air and water vapour permeability of fabrics.
3. Determination of sublimation fastness and spray rating of fabrics.
4. Analysis of peel bond strength of fabrics under different temperature and pressure.
5. Analysis of stretchability and spirality of various types (raw materials) of knitted fabrics.
6. Wickability of different fabrics

Theory: 0	Tutorial: 0	Practical: 15	Project: 0	Total: 15 Hours
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L	T	P	C
3	0	2	4

P18ATI1004 FORECASTING AND PRODUCT DEVELOPMENT

COURSE OUTCOMES

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

CO1: Acquire knowledge on types, sources, processes and services of fashion forecasting.

CO2: Explain the forecaster's and forecasting services role and decision making processes

CO3: Develop plans to engineer apparel products

CO4: Acquire knowledge on idea generation, planning and line development

CO5: Develop new products and evaluate it from design to commercialization

CO6: Evaluate the economics underlying apparel products and projects

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6. End Semester Examination (Theory and lab components)
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

THEORY COMPONENT CONTENT

FASHION FORECASTING

9 Hours

Definition of forecasting - types of forecasting – source of Fashion forecasting information – forecasting agencies and their role in forecasting. Seasons and their impact on fashion. Compiling fashion forecasting information - forecasting agencies – forecasting magazines – websites – information in the forecasting publications.

ROLE OF FORECASTERS

9 Hours

Fashion forecasting packages and magazines specialist fashion forecasting companies – the role of forecaster in aiding fashion designers, developers and retailers- process of forecasting- decision making process- when to start forecasting for the selling season.

APPAREL PRODUCT DEVELOPMENT

9 Hours

Design logic of apparel products - Classification of textile products, components, Aesthetics and Comfort of textile products, Anthropometry, sizing, body scanning and fit analysis. Material, Specification, Properties, and Technology of constituent fibres, yarns, fabrics and apparels.



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FASHION TRIANGLE OF BALANCE**9 Hours**

Building of the first design ideas, planning to costing, line building, from spec to samples, production selling, three seasons.

Developing New Product: Idea generation, idea screening, Concept testing, Business Analysis, the product development Process, group product development, research, Test marketing, commercialization.

ECONOMIC ANALYSIS**9 Hours**

Evaluation of Portfolio of products or projects – introduction and purpose of economic analysis – market potential – market demand – estimating sales – estimating cost and profit.

Theory: 45	Tutorial: 0	Practical: 15	Project: 0	Total: 45 Hours
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REFERENCES

1. Susan Dillon, “The Fundamentals of Fashion Management”, AVA Publishing (UK) LTd., 2012
2. Kathryn McKelvey and Janine Munslow, “Fashion Forecasting”, Wiley – Blackwell, USA, 2008
3. Rita Perna, “Fashion Forecasting: A Mystery or a Method”, Fairchild Publishers, USA, 1987.
4. Maurice J. Johnson & Evelyn C.Moore, “Apparel Product Development”, Second Edition, Prentice Hall Upper saddle river, New Jersey, 2001.
5. Mastudaira T and Suresh M.N., "Design Logic of Textile Products", Textile Progress, Textile Institute, Manchester, 1997.
6. Donald R.Lehmann, Rusell S.Winer, “Product Management”, McGraw Hill, 1996.
7. Doris H. Kincade, Fay Gibson, and Ginger Woodard “Merchandising Math: A Managerial Approach”, Pearson Education, Inc. Published by Prentice Hall, 2004.

PRACTICAL COMPONENT CONTENT

1. Develop design, Pattern Drafting (2D), grading, Marker Planning, Simulation of garment fit (3D) for Baby frock
2. Develop design, Pattern Drafting (2D), grading, Marker Planning, Simulation of garment fit (3D) for Ladies skirt
3. Develop design, Pattern Drafting (2D), grading, Marker Planning, Simulation of garment fit (3D) for T-shirt
4. Develop design, Pattern Drafting (2D), grading, Marker Planning, Simulation of garment fit (3D) for Formal shirt
5. Develop design, Pattern Drafting (2D), grading, Marker Planning, Simulation of garment fit (3D) for Formal trouser

Theory: 0	Tutorial: 0	Practical: 15	Project: 0	Total: 15 Hours
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P18INT0001 RESEARCH METHODOLOGY AND STATISTICS

L	T	P	C
3	0	0	3

COURSE OUTCOMES:

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

CO1: Understand and apply the concepts of research

CO2: Apply statistical and other research tools to analyze and interpret data

CO3: Demonstrate skills in writing research topics

COURSE ASSESSMENT METHODS:

Direct
1. Mid Term Examination 2. Research Assignment, Presentation 3. End Semester Examination
Indirect
1. Course-end survey

UNIT I: Introduction to Research Methods**9 Hours**

Definition and Objectives of Research, Scientific Methods, Various Steps in Scientific Research, Research planning , Selection of a Problem for Research , Formulation of the Selected Problems, Purpose of the Research, Formulation of research objectives, Formulation of research questions, Hypotheses Generation and Evaluation, Literature search, and review, Research abstract

UNIT II: Introduction to Statistics**9 Hours**

Population and Sample, Sampling and sample size, Population Proportion and Population Mean, Sample Proportion and Sample Mean, Estimation of Standard Error and confidence Interval, Identifying the dependent and independent variables, Introduction to data, Types of data and their importance, Descriptive Statistics and Inferential Statistics, Summarizing and describing data, Measures of Central Tendency and Measures of Dispersion, Mean, Median, Mode, Range, Variance, Standard Deviation

UNIT III: Statistical Modeling and Analysis**12 Hours**

Probability Distributions, Normal, Binomial, Poisson, Fundamentals of Statistical Analysis and Inference, Hypothesis Testing, Confidence interval, Test of Significance, Comparison of Means (T test, Z test), Analysis of variance (ANOVA), Measures of association/Relationship, Chi-square test, Simple Regression Analysis, Multiple Regression analysis, Correlation, Data visualization techniques



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UNIT IV: Research Design/Plan**6 Hours**

Types and Methods of Research, Classification of Research, Research Ethics, Sampling Techniques, Methods of Collecting Primary Data, Use of Secondary Data, Experimentation, Design of Experiments, Survey Research and Construction of Questionnaires, Pilot Studies and Pre-tests, Data Collection methods, Processing of Data, Editing, Classification and Coding, Transcription, Tabulation, Validity and Reliability,

UNIT V: Research Reports**9 Hours**

Structure and Components of Research Report/thesis, Types of Report, Planning of Report/thesis Writing, Research Report Format, Layout of Research Report, Presentation of data and Data Analysis Reporting, Mechanism of writing a research report, Principles of Writing, Writing of Report

Reference Books:

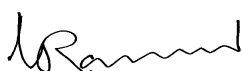
1. C.R. Kothari, Research Methodology Methods and Techniques, 3/e, New Age International Publishers, 2014.
2. Ranjit Kumar, Research Methodology A Step-by-Step Guide for Beginners, 4th Edition, Sage Publishing, 2014
3. R. Pannerselvam, Research Methodology, 2nd edition, Prentice Hall India, 2014
4. Devore, J.L., Probability and statistics for Engineering and the Sciences, Cengage Learning, ebook, 8th edition, 2010

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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SEMESTER II



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P18ATT2001 ENGINEERING OF FUNCTIONAL CLOTHING

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1: Acquire knowledge on different functional requirements of clothing and technology used in the manufacture of various functional clothing.

CO2: Explain the basic principle of materials used for functional clothing

CO3: Explore new ideas to design and use different materials for creating new functional clothing.

CO4: Evaluate design new functional clothing based on the requirement

CO5: Explain basic science and engineering principle used in Functional clothing design.

CO6: Explain engineering principle used in multi-functional protective clothing

COURSE ASSESSMENT METHODS

DIRECT
1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
1. Course-end survey

FUNCTIONAL CLOTHING

7 Hours

Introduction, definition, classification of functional clothing- protective, medical, sports, vanity, cross functional assemblies, clothing for special needs

PROTECTIVE FUNCTIONAL CLOTHING

12 Hours

Environmental hazard protective- Protection against extreme heat or cold, fire, rain, snow, dust, wind or UV exposure, Biological, chemical and radiation hazard protective-Protection against ignition, penetration or skin contact of hazardous chemicals, toxic gases, body fluids, germs or radioactive particulate matter.

Injury protective- slash and cut protection, ballistic and blunt impact protection

MEDICAL FUNCTIONAL CLOTHING

10 Hours

Therapeutic rehabilitative clothing- pressure garments for lymphatic and venous disorders, scar management

Bio sensing- Monitoring of physiological parameters, heart rate, blood oxygenation, body temperature, telemedicine applications



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SPORTS FUNCTIONAL CLOTHING**8 Hours**

Performance enhancing, fatigue reduction, body shaping to reduce drag Vanity functional clothing- Body shaping, support and contouring for enhanced appearance

MULTIFUNCTIONAL CLOTHING / CROSS FUNCTIONAL ASSEMBLIES**8 Hours**

Multi functional performance, protection, life support, comfort, communication clothing for special needs- enabling clothing for elderly, infants, and disabled

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. S.C. Anand, M.M.Traftab, S. Rajendra, 'Medical Textiles & Biomaterial for Healthcare', Woodhead Publication, 2005
2. S. Rajendra, 'Advance Textile for Wound Care,' Woodhead Publication, 2009
3. J.F. Kennedy, S.C. Anand & F.Miraftab, 'Medical Textiles 2007: Proceedings of the Fourth International Conference on Health Care & Medical Textile. CRC Press, 1st Edition, 2009.
4. S.C Anand, Medical Textile: Proceeding of the Second International Conference & Exhibition, CRC Press; 1st Edition, 2001.



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P18ATT2002 ADVANCED KNITWEAR TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1: Appreciate importance of seamless knits in apparels

CO2: Identify machinery for making seamless knit apparels

CO3: Understand technology involved in making seamless knit apparels

CO4: Understand technology involved in manufacturing integrated and fully fashioned knit apparels

CO5: Recognize fabric requirements for knitwear

CO6: Possess required knowledge on quality control of knitted apparels.

COURSE ASSESSMENT METHODS

DIRECT
1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. Model Examination 5. End Semester Examination
INDIRECT
1. Course-end survey

INTRODUCTION TO ADVANCED KNITWEAR MACHINERY 9 Hours

Classification of knitwear machines - fully cut-stitch shaped, fully fashioned, and integral garment machines. Modern circular knitting machines, Tubular, Open width and Multi-track knitting machines. Automatic V bedflat knitting machine-Seamless garment knitting machine.

STITCH AND SEAM GEOMETRY 9 Hours

Classification of stitches and seams, Run-in-ratio, Application of stitches and seams in inner and outerwear knitted garments, Seam Quality. Production Technology of Intimate Apparels: Fabric requirements for intimate apparels, Operation sequence and production techniques of men's brief, lingerie and vest. Machinery used and special attachments.

PRODUCTION TECHNOLOGY OF OUTER WEAR GARMENTS 9 Hours

Fabric requirements for outwear garments. Operation Sequence and production techniques of knit- T- shirts, combo wears, swimwear, arm warmer, sports garments and bifurcated garments.



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PRODUCTION TECHNOLOGY OF FULLY FASHIONED SWEATERS AND INTEGRAL GARMENTS

9 Hours

Shape generation in fully fashioned garments, production of slippers and cardigans. Basic techniques in integral garments, integral garment production of sock, upper and lower body garments.

QUALITY CONTROL OF KNITWEAR GARMENTS

9 Hours

Fabric quality-course length, tightness factor, fabric aerial density, spirality of knitted fabrics, fabric dimensional state - dry relaxed state, wet relaxed state and fully relaxed state. Requirements of action and power stretch in sports garments. Common stitching and seaming defects and assembly defects, Seam Puckering and causes.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Charles Richman, "Guide to manufacture of Sweater, Knit shirts and Swim wear", National Knitted Outer Wear Association, New York, 1992.
2. Terry Brackenbury, "Knitted Clothing Technology", Blackwell Science, 2005.
3. David Spencer., "Knitting Technology", Pergamon Press, Oxford 2005.
4. "A Study on Quality of Knit Wears that are being Made by Knitting Industry" – SITRA Publications, 1990.
5. Pradip V Mehta, "Introduction to Quality Control for the Apparel industry", ASQC Quality Press, 1992.



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P15ATI2003 TECHNOLOGY OF APPAREL FINISHING

L	T	P	C
3	0	2	4

COURSE OUTCOMES

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

CO1: Gain knowledge on pre-treatment and surface modification techniques

CO2: Discuss and describe the advanced printing and garment finishing techniques.

CO3: Describe the advanced finishing techniques and unconventional finishing techniques.

CO4: Identify advanced finishing techniques for different finishing applications.

CO5: Define and identifying the eco parameters for eco-friendly finishing processes and chemicals.

CO6: Suggest and adopt eco friendly measures for dyeing, printing and finishing for sustainable development

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6. End Semester Examination (Theory and lab components)
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

THEORY COMPONENT CONTENT

PRE-TREATMENT AND SURFACE MODIFICATION

12 Hours

Plasma for Surface Modification:Types of Plasma - low pressure, atmospheric pressure and high pressure plasmas, Methods of plasma generation for treatment of textiles and apparels; mechanism of plasma-surface interactions, plasma-aided functionalization, etching, grafting/deposition, implantation and polymerization; plasma modification of cellulosic, protein, and synthetic fibres; Advantages and limitations of plasma surface modification of textile materials.

Enzyme surface modification: Role and action of various enzymes in the surface modification of cellulosic, protein and synthetic fibres - reaction of textile surfaces to enzymatic treatments – Strengths and weaknesses of enzyme surface modification.

ADVANCED DYEING AND PRINTING

12 Hours

Advanced Dyeing Techniques: Modified reactive dyes, HF dyes, low and no salt reactive dyes, multifunctional dyes, neutral fixing and acid fixing reactive dyes, and Natural dyes. Microwave, Electrochemical, low liquor ratio dyeing techniques, Ultrasonic assisted dyeing, dyeing using Supercritical carbon dioxide.



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Advanced Printing: Digital printing, Xerographic printing, Developments in transfer printing.

Eco-friendly Processing & Finishing: Problems faced in the Conventional processing. Recent developments in eco-friendly dyeing, printing and finishing for natural and synthetic textiles.

ADVANCED GARMENT FINISHING

12 Hours

Apparel finishing process sequence. Easy care finishes- Durable press finish, Wrinkle free finish, Bio Finishing.

Functional finishes - water repellent, water proof, flame retardant, anti-microbial, soil resistance, anti-static, UV repellent finish, cool finish, deodorizing finish.

Advanced finishing and coating techniques - Microencapsulation techniques, finishing using micro capsules; preparation of nano-particles for apparel finishing, nano-finishes; Electro chemical treatment of textile materials. Film coating, spray coating, powder coating, foam coating. Coating materials for functional finishes. Process conditions and chemicals used.

CHARACTERIZATION OF MODIFIED SURFACES

9 Hours

Physical characterization: Working principles and analysis of results from Atomic Force Microscopy (AFM), scanning electron microscope (SEM), environmental scanning electron microscope (ESEM), transmission electron microscope (TEM). Mechanism and Analysis of Surface wetting and contact angles on substrates.

Chemical characterization: Working principles and analysis of results from Fourier Transform Infrared Spectroscopy (FTIR), X-ray photoelectron spectroscopy (XPS), Energy Dispersive X-ray Spectrometry (EDS);

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Wei. Q., 'Surface modification of Textiles', Woodhead Publishing, 2009.
2. Michael A. Lieberman, Allan J. Lichtenberg, 'Principles of Plasma Discharges and Materials Processing', John Wiley & Sons, 1994.
3. Edited by Roshan Shishoo, 'Plasma Technologies for Textiles', Woodhead Publishing, 2007.
4. Michael A. Lieberman, Alan J. Lichtenberg "Principles of Plasma Discharges and Materials Processing", John Wiley & Sons, 2005.
5. Rory A. Wolf, 'Atmospheric Pressure Plasma for Surface Modification, John Wiley & Sons, 2012.



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PRACTICAL COMPONENT CONTENT

1. Study of effect of different plasma atmosphere on water absorbency of cotton and synthetics fabrics.
2. Surface chemical characterization of plasma-treated substrates (cotton and synthetics) using FTIR.
3. Study of influence of plasma pre-treatment on the dyeability of textile materials. (Analysis of difference between samples pre-treated by plasma and without plasma treatment using colour matching unit)
4. Study of influence of enzyme pre-treatment on the dyeability of textile materials. (Analysis of the difference between samples enzyme pre-treated and non-treated using colour fastness tests)
5. Enzyme treatment of textile substrates and characterization of the treated surface.

Theory: 0	Tutorial: 0	Practical: 15	Project: 0	Total: 15 Hours
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**P18ATI2004 APPAREL ENTERPRISE RESOURCE
MANAGEMENT**

L	T	P	C
3	0	2	4

COURSE OUTCOMES

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

- CO1.** Business processes common to most businesses--order processing, inventory management, procurement, etc.
- CO2.** Master data common to most businesses--customer, vendor, inventory, etc.
- CO3.** Process modeling--creating diagrams to depict the sequence of tasks completed in a business process.
- CO4.** How a business process often spans different functional areas of the business:accounting, marketing, material management, etc.
- CO5.** How enterprise systems, such as SAP, integrate business functional areas into one enterprise-wide information system.
- CO6.** The issues involved in implementing an ERP system.

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) (Theory component) 4. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 5. Model Examination (lab component) 6. End Semester Examination (Theory and lab components)
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

THEORY COMPONENT CONTENT

INTRODUCTION:

9 Hours

Introduction to ERP: Defining ERP, Origin and Need for an ERP System, Benefits of an ERP System, Reasons for the Growth of ERP Market, Reasons for the Failure of ERP Implementation: ERP Selection Methods and Criteria Factors for the Success of an ERP Implementation

ERP & RELATED TECHNOLOGIES:

ERP and Related Technologies: Business Process Re-engineering, Management Information systems, Decision Support Systems, Executive Information Systems- Advantages of EIS; Disadvantages of EIS, Data Warehousing, Data Mining, On-Line Analytical Processing, Product Life Cycle Management, Supply Chain Management, ERP Security

ERP FUNCTIONAL MODULE:

6 Hours



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ERP Modules Structure: Finance, Sales and Distribution, Manufacturing and Production Planning- Material and Capacity Planning; Shop Floor Control; Cost Management; Data Management; Quality Management - Functions of Quality Management; CAQ and CIQ; Materials Management.

ERP MANUFACTURING PERSPECTIVE:

10 Hours

Role of Enterprise Resource Planning (ERP) in manufacturing, Computer Aided Design/Computer Aided Manufacturing (CAD/CAM), Materials Requirement Planning (MRP)-Master Production Schedule (MPS);Bill of Material (BOM);Inventory Records; Closed Loop MRP; Manufacturing Resource Planning (MRP-II), Manufacturing and Production Planning Module, Distribution Requirements Planning (DRP). Product Data Management (PDM)- Data Management, Process Management; functions of PDM; Benefits of PDM, Manufacturing Operations- Make-to-Order (MTO) and Make-to-Stock (MTS); Assemble-to-Order (ATO); Engineer-to-Order (ETO); Configure-to-Order (CTO)

ERP: PURCHASE AND SALES PERSPECTIVE:

10 Hours

Role of ERP in Purchasing, Purchase Module: Features of purchase module; Benefits of purchase module, ERP Purchase System.

Role of ERP in Sales and Distribution, Sub-Modules of the Sales and Distribution Module: Master data management, Order management, Warehouse management, Shipping and transportation, Billing and sales support, Foreign trade, Integration of Sales and Distribution Module with Other Modules

Role of ERP in Inventory Management: Features of ERP inventory management system; Benefits of ERP inventory management system; Limitations of ERP inventory management system. Importance of Web ERP in Inventory Management.

ERP: CRM PERSPECTIVE:

10 Hours

Role of ERP in CRM, Concept of CRM: Objectives of CRM; Benefits of CRM; Components of CRM, Types of CRM: Operational CRM, Analytical CRM, Sales intelligence CRM, Collaborative CRM, Sub-Modules of CRM: Marketing module; Service module; Sales module

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES:

1. Alexis Leon, ERP demystified, second Edition Tata McGraw-Hill, 2006.
2. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008
3. Alexis Leon, Enterprise Resource Planning, second edition, Tata McGraw-Hill, 2008.
4. Mahadeo Jaiswal and Ganesh Vanapalli, ERP Macmillan India, 2006.
5. Vinod Kumar Grag and N.K. Venkitakrishnan, ERP- Concepts and Practice, Prentice Hall of India, 2006.
6. Monk, Wagner, Concepts in Enterprise Resource Planning, : Cengage Learning India Private Ltd, 2016



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7. Shankar. R, Jaiswal.S, Enterprise Resource Planning, Galgotia Publishing Pvt. Ltd, 2015

PRACTICAL COMPONENT CONTENT

1. Sourcing and Order planning for given product
2. Purchase and Workflow management for given product
3. Cost Control for order placed and in manufacture
4. Creation of product data, style and Product Catalogue
5. Product Costing and Control, Creating Sample Order

Theory: 0	Tutorial: 0	Practical: 15	Project: 0	Total: 15 Hours
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P18ATI2005 New Product Development and Assessment

L	T	P	J	C
3	0	0	2	4

COURSE OUTCOMES

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

CO1. Comprehend nuances of new product development and factors influencing it.

CO2. Developing of alternate products with reduced cost of development

CO3. Developing of alternate products with reduced time for development

CO4. Comprehend fibre properties and relating with specific product requirements.

CO5. Analyze and Develop yarn to meet specific requirement of new product or modify yarn properties to enhance functional performance.

CO6. Analyze and Develop knitted and woven fabric to meet specific requirement of new product or modify fabric properties to enhance functional performance.

COURSE ASSESSMENT METHODS

DIRECT
7. Mid Term Assessment Test 8. Assignment and Presentation (Project component) 9. Mini project to develop yarn and fabric to meet specific end use product 10. End Semester Examination (Theory component) Viva Voce (Project component)
INDIRECT
2. Course-end survey

THEORY COMPONENT**INTRODUCTION:****9 Hours**

Introduction to new product development - factors to be considered in new product development. Deriving aesthetic and functional requirements of new product from customer needs. Strategies to develop alternate product or modify existing product to meet customer needs, reduce development cost and time.

FIBRES**12 Hours**

Understanding properties of natural and synthetic fibres, Evaluation of fibre properties and relating product requirements. Application of fibres for various uses and assessment for compliance. Selection and Assessment of fibre properties for specific end use. Development and Documentation of new product from fibres.

YARNS**12 Hours**

Types of yarns - properties - manufacturing method - development of new product or modify existing product to meet current market requirements. Selection and assessment of yarn properties for specific end use. Development and Documentation of new product from fibres.



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FABRICS**12 Hours**

Types of fabrics - properties - manufacturing method - knitted and woven fabrics - finishing process for various applications. Selection of appropriate fabric and assessment of fabric properties for specific end use. Development and Documentation of new product from knitted and woven fabrics.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. The Technology of Short Staple Spinning by W. Klein
2. Manufactured Fibre Technology V B Gupta and V K Kothari.
3. Textile Fibres: Developments and Innovations, by V K Kothari.
4. Carl A. Lawrence "Fundamentals of Spun Yarn Technology" CRC Press.
5. Weaving mechanism by Marks and Robinson (Textile Institute).
6. Weaving: Conversion of Yarn to Fabric by Lord and Mohamed.
7. Woven cloth http://nptel.ac.in/syllabus/syllabus_pdf/116102026.pdf construction by Robinson.
8. Knitting Technology : D. Spencer; Published by Pergammon Press.
9. Physical Testing of Textiles by B. P. Saville, 1999, Woodhead Publishing Ltd., U. K.
10. Principles of Textile Testing by J. E. Booth, 1961, Heywood Books, London.

Project Component

Students will identify specific problems and develop new product or modify existing product to meet specific end use requirements.

Theory: 0	Tutorial: 0	Practical:	Project: 6	Total: 6 Hours
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ELECTIVES

A handwritten signature in black ink, appearing to read "Bosman", enclosed within a rectangular box.

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P18ATE1001**TEXTILE COMPOSITES**

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1 : Acquire knowledge in manufacturing techniques of textile preforms

CO2 : Acquire knowledge in different types of composites

CO3 : Explain different terminologies and different methods of manufacturing textile composites

CO4 : Understand the different structural parameters of composites

CO5: Gain knowledge on various properties of composites

CO6 : Acquire knowledge in evaluation of textile composites

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

INTRODUCTION**9 Hours**

Textile Reinforced Composites (TRC): Fibres – Filaments - Woven fabrics - Braided fabrics - Stitched - Knitted fabric reinforcements. Filament winding: Method – Applications.

PREPREGS AND PREFORMS: Introduction - manufacturing techniques - property requirements - Textile preforms - weaving, knitting and braiding.

TYPES OF COMPOSITES POLYMER**11 Hours**

Matrix Composites: Types – Processing – Thermal matrix composites – Hand layup and spray technique, filament winding, Pultrusion, resin transfer moulding, autoclave moulding – Thermoplastic matrix composites – Injection moulding, film stacking – Diaphragm forming – Thermoplastic tape laying. Glass fibre / polymer interface. Mechanical properties – Fracture. Application.

Metal Matrix Composites: Types. Important metallic matrices. Processing – Solid state, liquid state, deposition, insitu. Sic fibre / Titanium interface. Mechanical properties. Applications.

Ceramic Matrix Composites: Ceramic matrix materials – Processing – Hot pressing, liquid infiltration technique, Lanxide process, insitu chemical reaction techniques – chemical vapour deposition (CVD), CVI, sol gel process. Interface in critical micelle concentration



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(CMC). Mechanical properties – Thermal shock resistance – Applications – Overview of apparel soft composites.

COMPOSITE MANUFACTURING TECHNOLOGY

11 Hours

Vacuum bagging - compression molding - Injection molding - pultrusion Thermoforming - Filament winding - Resin Transfer Molding. Composites with Glass Fibres - Glass fibres properties; glass fiber reinforced polymers; manufacture of glass fibre composites, Composites with Carbon Fibres - Carbon fibre reinforced composites; testing of carbon reinforced composites, Composites with Fabrics - Textile structure of composites- woven, knitted, braided material and three dimensional fabrics, Flexible Composites - Fibre reinforced plastics; fabric reinforced composites; flexible composites; applications

PROPERTIES OF COMPOSITES

9 Hours

Geometrical Aspects: Unidirectional laminas – Volume fraction and weight fraction – Woven roving, in-plane random fibres – Fibre length and fibre orientation distribution – Voids – Fibre orientation during flow. Fatigue and Creep in Composite Materials: Fatigue – S-N curves – Fatigue behaviors of critical micelle concentration (CMC) – Fatigue of particle and whisker reinforced composites – Hybrid composites – Thermal fatigue – Creep.Characteristics of composites - tensile, shear, composition, flexural; thermoplastic responses of composite; use of high performance fibres

EVALUATION OF TEXTILE COMPOSITES

5 Hours

Design and analysis of textile structural composites. Toughness and thermal behaviour of composites.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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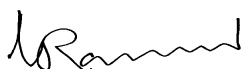
REFERENCES

1. Horrocks A. R., Anand S.C., “Handbook of Technical Textiles”, Woodhead Publishing, Cambridge, 2000
2. Adanur S., “Handbook of Industrial Textiles”, Technomic Publication, Lancaster, 2001
3. Kanna M.C., Hearle, O Hear., Design and Manufacture of Textile Composites, Textile process, Textile Institute, Manchester, April 2004.
4. Mathews F L and Rawlings R D, “Composite Materials: Engineering and Science”, CRC Press and Woodhead Publishing Limited, 2002.
5. Krishnan K Chawla, “Composite Materials Science and Engineering”, Springer, 2001.
6. Handbook of Composites – American Society of Metals, 1990.
7. Derek Hull, “An introduction to Composite Materials”, Cambridge University Press, 1988.



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8. Bhagwan D. Agarwal, Lawrence J. Broutman, and K. Chandrashekhara, 'Analysis and Performance of Fiber Composites', John Wiley & Sons, 2006.
9. Daniel Gay, Suong V. Hoa & Stephen, W. Tsai, 'Composite Materials: Design and Applications', CRC Press, 2002.
10. Long C. A., 'Design and Manufacture of Textile Composites', Woodhead Publishing, 2005



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**P18ATE1002 COMPUTER INTEGRATED APPAREL
MANUFACTURE**

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1 : Assess the scope of application and features of various CAD/CAM systems available for the apparel industry

CO2 : Assess the scope of application image processing systems in apparel industry

CO3 : Appraise the features of various computer aided fabric design systems and choose the right system suitable for an apparel industry.

CO4 : Acquire knowledge on the E-prototyping for apparels

CO5: Prescribe the basic features required for CAD/CAM integrations which can minimize the lead time and maximize the quality in the apparel production.

CO6: Evaluate the various automations in manufacturing and management systems available in apparel industry

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

COMPUTER AIDED FABRIC DESIGN SYSTEM:

11 Hours

Introduction to the operation of design software for woven, knitted and printed textiles.

Computer Aided Fashion Design System: Tools, manipulating techniques.

Knowledge Based System- Introduction to image processing and imaging system-Fabric and sewing defect identification using image processing-Artificial neural networks.

COMPUTER AIDED PATTERN DESIGNING:

7 Hours

3D Body scanning- Digitizing- Grading and Lay Planning System: Introduction to graphic interface of the software- Tools and functions used for pattern making, grading and marker planning.

VIRTUAL GARMENTING AND E PROTOTYPING:

9 Hours

Preparation of virtual dummies, Texture mapping, 2D and 3D draping, 3D Modeling, E-Fit analysis, Animation, Prototyping – Virtual and rapid. Made to measure systems.



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COMPUTERIZED CUTTING AND SEWING:**9 Hours**

Applications of Computer integration in fabric cutting, spreading and labeling machines. Computer aided special purpose sewing machine with control panels – Preprogrammed options. Computer controlled embroidery machines.

AUTOMATION IN MANUFACTURING AND MANAGEMENT: 9 Hours

Application of EDI - UPS- Selection of line- Control system- Data base management system. Automatic material handling, storage, tracing and retrieval system. Applications of E-Commerce and MIS in apparel industry, Supply Chain Planning. Computerized Color Matching system.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Alison Beazley and Terry Bond, “Computer Aided Pattern Design and product development”, Blackwell publishers, UK, 2004.
2. Buchman G A, Grady D R and Latimer Trend P L, “Automation in the Textile Industry form Fiber to Apparel”, Berkstresser III, Textile Institute, 1995.
3. Patrick Taylor, “Computer in the Fashion Industry”, Heinemann Professional Pub, London, 1990.
4. “Computers in the World of Textiles”, The Textile Institute, 1984.
5. Yixiang Frank Zhang, Randall and Bresse R, “Fabric Defect Detection and Classification using image analysis”, TRJ 65 (I), 1-9, 1995.
6. Taejin Kang, Soo hyun choi, Sung min kim and Kyung wha oh, “Automatic Structure Analysis and Objective Evaluation of Woven Fabric using Image Analysis” TRJ, 71(3), 261-270, 2001.
7. Fuzz and Pills “Evacuated on Knitted Textiles by Image Analysis” TRJ 72(I) 32-38, 2002
Sigmon D M, Grady P L and Winchester S C, “Computer Integrated Manufacturing and Total Quality Management”, Textile Institute Publication, 1998.



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P18ATE1003 NANO TEXTILES

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1 : Describe the nano technology concepts and applications in textiles and apparel sector.

CO2 : Explain the methodology of synthesizing nano materials by different processes and techniques.

CO3 : Gains knowledge on nano tubes, nano composites and nano coatings.

CO4: Gain knowledge on nano polymer structuring and nano coating

CO5 : Acquire knowledge on next generation nano finishes on Textiles and Apparels.

CO6 : Explain the characterization techniques and instrumentation for nano materials.

COURSE ASSESSMENT METHODS

DIRECT
1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
1. Course-end survey

INTRODUCTION TO NANOTECHNOLOGY**6 Hours**

Concept of nanoscale and Historical background of nanotechnology, Fundamental concepts of nanotechnology - Bottom-up approaches, Top down approaches, Scope of nano technology in textile and apparel manufacturing.

SYNTHESIS AND PROPERTIES OF NANOFIBRES**9 Hours**

Electro spinning of nanofibres. Continuous yarns from electrospun nanofibres. Principles of electrostatic atomization, Electro spraying and electrospinning by the capillary method, Electro spraying and Electrospinning by the charge injection method, Controlling fiber orientation, Applications of nanofibres viz, tissue engineering, filter media.

NANOTUBES, NANO COMPOSITES**12 Hours**

Synthesis, Characterization and application of carbon nanotubes. Nano fibres reinforced polymer fibres. Production of carbon nano tubes- polymer fibres using melt spinning. Multifunctional polymer nano composites for industrial applications. Nano filled polypropylene fibres.

POLYMER FUNCTIONALITY AND NANO COATING: Nano structuring polymers with cyclo dextrans. Development of dyeable polypropylene, Nano technologies for coating and structuring of textiles.



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NANO TEXTILES AND APPAREL**8 Hours**

Development of nano textiles and apparel using - Nano-Text, Nano-Care, Nano-Dry, Nano-Touch, for home furnishing, technical textiles, smart and medical apparels

CHARACTERIZATION OF NANOPARTICLES**10 Hours**

X-Ray Diffraction, Transmission Electron Microscopy and Spectroscopy; Scanning electron microscopy (SEM); Transmission electron microscopy (TEM); Energy-dispersive x-ray spectroscopy (EDS), Small-Angle X-Ray Scattering (SAXS), The Cone Calorimeter (CC), The Mass Loss Calorimeter (MLC).

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Brown P J and Stevens K, "Nanofibres and Nanotechnology in Textiles", Woodhead Pub. Ltd., Cambridge, 2007
2. Yury Gogotsi, "Nanotubes and Nanofibres", CRC Taylor & Francis, Boca Raton, 2006
3. Guazhong Cao, "Nanostructure and nanomaterials", Imperial College Press, USA, 2006
4. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simons and Burkhard Raguse, "Nanotechnology- Basic Science and Emerging Technologies", Overseas Press, New Delhi, 2005. ISBN:81-88689-20-3



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P18ATE1004**PROTECTIVE CLOTHING**

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1: Acquire knowledge on different functional requirements of protective clothing and technology used in the manufacture of protective clothing.

CO2: Design and select materials for new protective clothing

CO3: Explore new ideas to design and use different materials for creating innovative protective clothing.

CO4: Evaluate and design new protective clothing based on the requirement

CO5: Understand the different international standards for protective clothing

CO6: Gain knowledge material selection, production of healthcare and hygiene apparels

COURSE ASSESSMENT METHODS

DIRECT
1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
1. Course-end survey

CHEMICAL PROTECTION**12 Hours**

Chemical Hazards- Need, evaluation of barrier effectiveness of protective clothing-performance of protective clothing. Material requirements- test methods.

THERMAL PROTECTION**13 Hours**

Thermal Protective Clothing-Thermal characteristics and combustion mechanism of fibres-Heat resistant and Flame retardant - Inherently flame retardant fibres and chemical modified fibres, Flame retardant finishes. Requirements of ballistic protection.

MECHANICAL PROTECTION**7 Hours**

Requirements-knife performance- fundamental principle of knife impact, protection levels-test methods-ballistic protection-requirements- materials used- test methods

ELECTRICAL AND RADIATION PROTECTION**7 Hours**

Material Selection, production techniques: Nuclear Hazards, Protection from Electromagnetic radiation waves-UV and others. Electrical protective clothing and its evaluation



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HEALTH CARE AND HYGIENE CLOTHING**7 Hours**

Material Selection, production and processing techniques: bedding, surgical wound dressings, bandages and sanitary napkins. Quality parameters.

Surgical drapes, Gowns for operating personnel, theatre masks, non-woven swabs, post operation dress-Materials and quality parameters.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Bajaj.P., and Sengupta.A.K., "Protective clothing", The Textile Institute, 1992.
2. Richard A.Scott., "Textile for Protection"Woodhead Publishing Ltd., 2005.
3. Eugene W Ilusz., "Military Textiles" Woodhead Publishing Ltd., 2008.
4. L.Van Langenhove., "Smart Textile For Medicine And Health Care" Woodhead Publishing ltd
5. Johnson J.S., and Mansdork.S.Z., "Performance of Protective Clothing", American Society for Testing and Materials (ASTM),1996.
6. P.W.Harrison., "The Design of Textiles for industrial Application", The Textile Institute, Manchester, 1998
7. Sabit Adanur,Wellington Sears Handbook of Industrial textiles,Technomic publishing company,1995, ISBN 1-56676-340-1
8. J T Williams, De Montfort University, UK., "Textile for cold weather apparel" Woodhead Publishing Series in Textiles No. 93



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P18ATE1005 SPORTS AND MEDICAL APPARELS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1: Gain knowledge on requirements of sports apparels

CO2: Acquire knowledge on sports apparels and cross functional assemblies

CO3: Describe the bio materials of metals, ceramics, polymers, natural bio materials and specialty fibers.

CO4: Define and classify the different types of healthcare and hygiene products, infection control and barrier materials and non woven products.

CO5: Identify and construct the different types of bandaging materials and pressure garment with suitable construction techniques.

CO6: Recognize the suitability, specifications of medical textile products and garments for wounds and selection factors for different implantable products for various end uses and intelligent textiles. Identify the suitable materials for developing implantable products.

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

REQUIREMENTS FOR APPAREL:**9 Hours**

Introduction to apparel design & types – Aesthetic, functional, Exploratory, Incremental. Requirements for clothing design - physiological, biomechanical, ergonomic, psychological requirements. Process, steps involved in clothing design. Emerging trends: smart clothes and wearable technology; biomimicry; environmental issues. Smart textile materials: auxetic materials; chromic materials; conductive fibres and textiles; other smart materials; holofiber; stomatex; d3o (dee-three-oh);

SPORTS CLOTHING & CROSS FUNCTIONAL ASSEMBLIES**9 Hours**

Test methods and standards for different sport clothing Vanity functional clothing- Body shaping, support and contouring for enhanced appearance. Multi functional performance, protection, life support, comfort, communication Clothing for special needs - enabling clothing for elderly, infants, and disabled



Signature of BOS chairman, FT

TISSUE ENGINEERING, BIOPOLYMERS & WOUND DRESSINGS 9 Hours

Biopolymers: classification and their properties, requirements and applications. Bio active dressing, Metals, ceramics, composites and textile materials; specialty medical fibres. Tissue engineering: properties and materials – scaffolds in tissue engineering. Testing methods; *In - vitro* tests, *In - vivo* assessment. Wound dressing - types - Traditional and advanced wound dressings. Testing of wound care materials.

FUNCTIONAL SMART MATERIALS & BIO SENSORS 9 Hours

Smart textiles in wound care; phase change and shape memory materials –applications. Monitoring pregnancy, children and cardio patients. Mobile health monitoring; electronics in medical textiles; Smart textiles in rehabilitation and applications; Sensors for healthcare, Wearable technology. Therapeutic rehabilitative clothing- pressure garments for lymphatic and venous disorders, scar management. Bio sensing- Monitoring of physiological parameters, heart rate, blood oxygenation, body temperature, telemedicine applications

CLOTHING EVALUATION 9 Hours

Measurement of physiological, sensorial, tactile, thermal comfort: wear comfort as a measurable quantity; wearer trials; skin model; skin sensorial test apparatus. Standard test methods. Measurements of clothing performance: thermal insulation & conductivity; evaporative resistance; wind & air resistance; breathability, Moisture transport – wetting and wicking, water resistance; water vapour transfer.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. S.C. Anand, M.M.Traftab, S. Rajendra, 'Medical Textiles & Biomaterial for Healthcare', Woodhead Publication, 2005
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6. Anand S., " Medical Textiles", Textile Institute, 1996, ISBN: 185573317X
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8. Shishoo R., 'Textiles in Sport', Woodhead Publishing Limited, CRC Press,, 2005
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10. J. W. S. Hearle, 'High Performance Fibres', Woodhead Publishing Limited, CRC Press, 2001
11. 'Surfaces for Sports Areas. Determination of Resistance to Impact', B S I Standards, 2000
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P18ATE1006 ENGINEERING OF APPARELS

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1: Gain knowledge on the concept of apparel product engineering based on aesthetic and functional requirements

CO2: Gain knowledge on objective and subjective methods for assessing fabric parameters for making-up quality

CO3: Understand the concept of apparel product engineering based on aesthetic and functional requirements

CO4: Understand factors influencing selection of materials and their influence on product performance

CO5: Learn and appreciate the correlation between fabric and sewing parameters and product performance.

CO6: Acquire knowledge on influence of sewing materials on sewn product.

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

CONCEPTS OF APPAREL ENGINEERING**9 Hours**

Introduction to the Concepts of Apparel Engineering Relating apparel design and manufacture process to end use requirements - comfort, workmanship, appearance and appearance retention, durability, aftercare and other special functional requirements. Freedom to body movement, the effect of aesthetic factors to personal preference. Evaluation of Making-up Quality and Analysis of Making-up Problems Subjective and objective methods for evaluating the making-up quality of garments (including quality in terms of fusing, sewing, and finishing etc). Relationship between sewing quality and fabric, thread and sewing machine parameters. Solutions to sewing problems. Application of Kawabata and FAST systems for assessing fabric making-up performance.

SELECTION OF MATERIALS**9 Hours**

Selection of fabric, yarn, fibre and fabric finishing techniques for specific end-uses. Fabric design appreciations in relation to aesthetic, fashion and functional requirements. Influence of Mechanical properties of fabrics on tailorability: Weight, thickness, tensile, shear, bending (drape), compression, stretchability.



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Understanding relationship of these mechanical properties with the end use of requirements both in woven and knits. Effect of fabric characteristics of Tailorability - seam appearance, puckering, thermal or mechanical damage, and seam slippage. Understanding the major characteristics of various fabric types (woven and knits) in relation to their end use/applications.

CO-RELATION BETWEEN FABRIC CHARACTERISTICS AND SEWING PARAMETERS:

9 Hours

Understanding of co-relation between fabric characteristics and sewing process parameters. Comparison of various types of seam finishing for industrial use in relation with performance and cost effect. Relation between end use of fabric and seam performance in regards to sewn materials. Understanding of seam properties and their application in relation to different fabrics and apparels

ANALYSIS OF STITCHES AND SEAMS

9 Hours

Identification of Stitches and Seams in different types of garments. Seams and their effect on performance, costs and quality in industrial sewing process Understanding of Stitch Types and Stitch Formation processes and its impact on garment performance. Suitability of different stitch types in relation to fabric behavior. Machinery used for formation of various stitch types according to classification.

COMPATIBILITY OF SEWING NEEDLE AND SEWING THREAD


9 Hours

Compatibility of Sewing Needle and Sewing Thread in relation with other sewing parameters. Understanding the structure and specifications of sewing machine needles and their importance in sewing processes. Needle size and its relation to fabric and sewing quality requirements. Co relation between sewing thread and fabric and its impact to stitch performance. Controlling stitch performance and quality and minimizing of defect occurrence.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Burns.L.D., Bryant.N.G., 'Business of Fashion – Designing, Manufacturing and Marketing,' Fairchild NewYork, 2008
2. Barbara Stewart, Beverly Kemp-Gatterson, 'Apparel Concepts and Practical Applications', Fairchild New York, 2010
3. J Fan, "Engineering Apparel Fabrics and Garments", Wood Head Publishing Limited, 2012.
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P18ATE1007 LEAN MANUFACTURE AND LOGISTICS MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO 1 : Understand concepts and tools in lean manufacture and the difference between traditional management concepts and lean.

CO 2 : Gain knowledge and skill in application of lean concepts and tools in manufacturing process

CO 3 : Appreciate the application of Six Sigma concepts designing defect free product and process and process control.

CO 4 : Acquire knowledge on principle and strategies applied in logistics management

CO 5 : Comprehend the process of designing and managing supply chain system

CO 6: Understand sourcing and supply strategies in global context

COURSE ASSESSMENT METHODS

DIRECT
1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
1. Course-end survey

INTRODUCTION

9 Hours

Introduction – Lean concept - 8 Wastages - profit leakages due to wastages – over production, higher inventory, waiting time, unnecessary conveyance and motion of materials, over processing, rework- repairs - rejections, customer returns, wastage of people talents.

Cost of Poor Quality – Cost of Quality – calculation of Cost of Poor Quality.

5 S – Seiri, Seiton, Seisō, Seiketsu, Shitsuke – house keeping practices for cleaner production.

CRITICAL TO QUALITY AND VALUE STREAM MAPPING

Critical to Quality (CTQ) – defining process objectives important to customer as CTQ.

Supplier Input – Process Output – Customer (SIPOC) – SIPOC and Process Flow – what it desires to be – what it is – how to improve.

Value Stream Mapping - Identifying non – value activities – eliminating non – value activities



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LEAN CONCEPTS IN INVENTORY CONTROL**9 Hours**

Takt Time - Calculation of time for producing exactly quantity required.

Reduction of inventory using simple Economic Order Quantity (EOQ) and Batch Production Models.

Continuous Improvement – application of KAIZEN in reducing rejections.

Application of KANBAN Cards for production planning and control for traceability and identification.

DESIGN FOR SIX SIGMA (DFSS)

Six Sigma Basics: Overview and Implementation. Process measurement, Process analysis, Process improvement and Process control.

Design for Six Sigma, Six Sigma implementation. Six Sigma Metrics: DPU, DPO, DPMO, Sigma levels, Yield, First Time Yield, Overall Yield, Throughput Yield, Rolled Throughput Yield, Normalized Yield Process Capability Indices: Cp, Cpk, Cpm, Cpkm.

OVERVIEW OF SCM AND LOGISTICS**9 Hours**

Logistics and supply chain management. Principles of supply chain management. Apparel supply chain management, Customer focus in supply chain management – customer service, efficient consumer response (ECR), quick and accurate consumer response.

DESIGN AND MANAGEMENT OF SUPPLY CHAIN

Inbound and outbound logistics – suppliers to manufacturers, manufacturers to consumers. Pull and push strategy. Demand management in fashion and apparel sector- demand forecasting and shaping. Types of inventory Bull wick effect- Influencing factors, control measures.

STRATEGIC SUPPLY CHAIN MANAGEMENT**9 Hours**

Types of sourcing, supply alliances, supplier quality management, supply chain re engineering. World class supply chain management (WCSCM). Global strategies to apparel SCM

IT ENABLED SUPPLY CHAIN MANAGEMENT

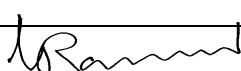
Information technology in the integrated supply chain, importance, information requirements and applications. Material resource planning, manufacturing resource planning, enterprise resource planning.

DISTRIBUTION NETWORK PLANNING**9 Hours**

Transportation mix – ware housing, transportation cost, transportation decision. RFID ,futuristic direction in transportation. Location strategy – plant location, distribution problem, ware house location, retail facility location.

EMERGING TRENDS IN SUPPLY CHAIN MANAGEMENT Collaborate strategies, vendor managed inventory (VMI), third and fourth party logistics, green supply chain, reverse logistics

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

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**P18ATE1008 FASHION ENTREPRENEURSHIP
MANAGEMENT**

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1: Organize, innovate and take risk in a Business activity

CO2: Acquire knowledge on various forms businesses

CO3: Develop a Business Plan

CO4 Determining financial needs and the sources of finance,

CO5 Analyze the PESTEL Business Environment and make Strategic decisions

CO6: Analyze the challenges and to make ethical business decisions

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

INTRODUCTION TO ENTREPRENEURSHIP

9 Hours

Definition, Characteristics and Functions of an Entrepreneur, Importance of Entrepreneurship and small business management. Creativity and Innovation: The role of Creativity, the Innovation process, Source of new ideas, Methods of generating ideas.

FORMS OF BUSINESS ORGANIZATION

12 Hours

Sole proprietorship, Partnership, Joint Stock companies, Co- operatives, Public sector, Public Utilities Feasibility and technical analysis of business: Nature of business decision, business development cycle, and opportunity studies, pre -feasibility and feasibility studies, Technical analysis.

DEVELOPING BUSINESS PLAN

10 Hours

The importance of a business plan- Components of an effective business plan – Developing and writing a business plan. Financing the new venture: Determining financial needs, sources of financing, equity and debt funding, evaluating financial performance.



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STRATEGIC ANALYSIS**8 Hours**

Marketing research, Demand forecasting. Environmental analysis - PESTEL frame work, environmental scanning, competitive forces- porter's frame work, Internal analysis – resources, critical success factor (CSF), quantitative and qualitative assessments, SWOT analysis. Growth strategies: Expansion strategies – Intensification, Integration and International. Diversification – concentric, conglomerate diversifications, mergers and acquisitions, strategic partnering.

CHALLENGES FOR ENTREPRENEURS**6 Hours**

Ethical, Political, Cultural, Regional, Technological and social responsibility – ethics and business decisions.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Robert D Hisrich, Michael P Peters and Dean Shepherd, “Entrepreneurship”, Tata McGraw Hill, Sixth Edition, 2007.
2. Marc J Dollinger, “Entrepreneurship – Strategies and Resources”, Pearson Education, Third Edition, 2003.
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P18ATE1009 ENERGY MANAGEMENT IN APPAREL INDUSTRY

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO1: Gain knowledge on need for energy management and global concerns on energy.

CO2 : Understand the process and metrics in energy audit.

CO3 : Learn about on energy consumption analysis and factors influencing consumption and means to reduce consumption

CO 4: Acquire knowledge and skill energy production and consumption monitoring and control, data analysis and control

CO 5: Gain knowledge on developments in energy efficient technologies

CO 6 : Gain knowledge on non-conventional energy sources and developments in energy efficient technologies.

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

ENERGY MANAGEMENT AND CONSERVATION

7 Hours

Concept of energy management - need for energy conservation - Demand - Supply Management. Global Energy Concerns: Global energy conservation scenario – energy conservation measures in India. United Nations Framework on sustainable development, Kyoto Protocol.

ENERGY MANAGEMENT AND AUDIT

11 Hours

Definition of Energy Audit, need and types of energy audit, energy audit instruments. Understanding energy costs, bench marking energy performance, matching energy use to requirement, basic principles for optimizing the input energy requirements. Energy Management Department - Top management support, managerial function, roles and responsibilities of energy manager, accountability. Motivation of employees: Information system – overcoming barriers. Energy Monitoring and Control: Cumulative Sum of Differences (CUSUM) of Energy production and consumption, Energy production and consumption monitoring and control, elements for monitoring, data analysis and control.



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ENERGY CONSUMPTION ANALYSIS**12 Hours**

Methods for energy consumption analysis. Analysis for apparel manufacturing machineries and finishing equipments. Cost of energy Vs sales value of apparel product. Energy Conservation in Factory: Energy saving opportunities with energy efficient motors. Factors affecting the electrical energy performance and energy saving opportunities. Factors affecting Refrigeration and Air conditioning system performance and saving opportunities. Lighting System - Light source, choice of lighting, luminance requirements, and energy conservation avenues. Diesel Generating system - Factors affecting selection, diesel energy conservation avenues. Waste Heat Recovery - Classification of waste heat. Source of waste heat in apparel industry. Commercially viable waste heat recovery devices, saving potential.

DEVELOPMENTS IN ENERGY EFFICIENT TECHNOLOGIES**7 Hours**

Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, and energy efficient lighting controls.

APPLICATION OF NON CONVENTIONAL ENERGY SOURCES**8 Hours**

Scope of application of non-conventional energy - Solar energy: different type of collectors — photovoltaic cells. Wind energy, Bio energy, environmental impact on energy and co-generation by using different techniques.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERENCES

1. Kalyanaraman. A.R, "Energy Conservation in Textile Industries", SITRA 1995 (Revised)
2. Palaniappan. C et al, "Renewable Energy Applications to Industries", Narose Publishing House, New Delhi, 1998.
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4. Pradeep Chaturvedi and Shalini Joshi, "Strategy for Energy Conservation in India", Concept Publishing Co., New Delhi, 1995.
5. Proceedings of International Seminar cum Exhibition ASIA Energy Vision 2020 — Sustainable Energy Supply, November 15-17, 1996
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7. Proceedings of the Seminar, "Strategies for Sustainability of Energy Efficient and Environmental Friendly Technologies in Small and Medium Scale Sector", PSG College of Technology, November 24, 2000.
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**P18ATE1010 COMPLIANCE STANDARDS FOR
APPAREL INDUSTRY**

L	T	P	C
3	0	0	3

COURSE OUTCOMES

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

CO 1 : Acquire knowledge on concept and need for compliance in Apparel industry.

CO 2 : Acquire knowledge on social compliance followed in Apparel industry.

CO 3 : Gain knowledge on health and safety compliance followed in Apparel industry.

CO 4 : Understand on environmental compliance to be adhered by Apparel industry.

CO 5 : Comprehend technical compliance norms followed in Apparel industry.

CO 6: Comprehend compliance norms followed by various international sourcing companies.

COURSE ASSESSMENT METHODS

DIRECT
<ol style="list-style-type: none"> 1. Mid Term Assessment Test 2. Assignment, Presentation 3. Demonstration etc (as applicable) 4. End Semester Examination
INDIRECT
<ol style="list-style-type: none"> 1. Course-end survey

COMPLIANCE - INTRODUCTION

9 Hours

Scope and Need for different compliances Social, health and safety, environmental, technical, international compliance - concept, need, benefits for industry, workers, and society. Social accountability and Corporate Social responsibility - scope and need. Social Compliance in supply chain management.

SOCIAL COMPLIANCE

9 Hours

Conventions on Gender and caste discrimination, forced labour, child labour, minimum age convention. SA 8000 – Elements, Worldwide Responsible Apparel Production (WRAP). Ethical Trading Initiative (ETI). Corporate Social Responsibility (CSR) Compensation – norms applicable in India, Code of conduct, Minimum wages Act, remuneration, Trade Union Acts.

HEALTH AND SAFETY

9 Hours

Environment and climate, health and safety – safety norms and measures to be enforced for safe working environment – protection against fire, water facilities, rest rooms, working Hours - conventions on Acquired Immune Deficiency Syndrome (AIDS). Requirements of local statutory bodies - PF, ESI etc, OHSAS 18001



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ENVIRONMENTAL COMPLIANCE**9 Hours**

Environmental Laws and Regulations, The Regulations Related to Handling, Recycling, and Disposal of Hazardous Materials. Requirements of Pollution Control Board, ISO 14000 – elements and certification. Eco standards, Eco labels, REACH, OEKO TEX, GOTS Certification requirements for apparel industry

TECHNICAL COMPLIANCE**9 Hours**

Elements and requirements of ISO 9000, Meeting vendor compliance – WALMART, JC PENNY, etc. Needle policy, maintenance of safety data of materials in stain removal, Poly bags, Children wear requirements.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours
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REFERNCES

1. Das.S, Li & Fung, “Product safety and restricted substances in apparel”, Woodhead Publishing
2. Christie. R, “Environmental aspects of textile dyeing”, Heriot-Watt University, UK Woodhead Publishing Series in Textiles No. 66
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7. <http://www.indianchild.com>
8. <http://www.paycheck.in>
9. <http://www.sa-intl.org>.



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