VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examinations and Syllabus

M.Tech. Textile Technology (JTT)

(Effective from Academic year 2022 - 23)

M.TECH. TEXTILE TECHNOLOGY (JTT)

SEMESTER – I

Semester - I

ADVANCED TEXTILE MATHEMATICS			
Course Code	**22JTT11**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**03-00-00**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course objectives: This Course aims at updating knowledge of students in fields of

- Advanced statistical quality control
- Calculations involved in Spinning, Weaving and Garment manufacturing.

Module-1	
Confidence limits- Estimation of confidence intervals, confidence limits for large and small samples, confidence limits for standard deviation and difference in mean and SD. Significance tests-interpretation of significance tests, single tail and double tail tests, chi-square distributions Analysis of variance- the design of experiments, randomized variation in experiments, randomization, completely randomized design (CRD) and randomized block design (one way & two-way ANOVA).	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-2	
Linear regression and time series-relation between variables, variation about regression line, regression equation, correlation coefficient, interpretation of "R", equation for regression partial and multiple correlation. Components of time series, measurement of trend using method of least squares.	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-3	
Spinning calculations- forces acting on ring and traveller, calculations related to various drives viz, belt, rope, chain, gear etc. Details of average count and resultant count of yarn. Calculation related spin plan-preparation of spin plan for known count and known quantity of yarn produced with given spinning machinery details.	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-4	
Calculations related OE spinning, Air jet spinning, and friction spinning. Calculation of no. of fibres in the yarn, calculation related to evenness of sliver, riving, single & double yarns. Weaving and knitting calculation - estimation of production of different types of preparatory machines, sizing machines and looms. Calculation of fabric weight, cloth cover, stitch density of knitted fabric, air porosity, fabric thickness. Preparation of plan for weaving industry from known machine and material parameters	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-5	
Calculations in garment manufacturing - standard time, importance of GSD & its benefits in garment industry. SAM calculations using synthetic data and time study techniques. Garments CM cost estimation using SAM. Calculation of product capacity of a factory, seam efficiency, seam strength, thread consumption factor etc	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
   to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Textile Testing – J E Booth., CBS Publishers, New Delhi, 1996
2. Handbook of textile testing and quality control - Hamby and Grover, IndiaEastern Pvt. Ltd., Delhi 2011
3. Practical statistics for textile Industry – Part-1 & 2, Gave Leaf, Textile Institute 1984
4. Textile Mathematics-Vol. 1, 2, 3, J E Booth. Butterworth's Pub London,1986
5. Textile Mechanics-Vol. 1&2, K Slater, Textile Institute Pub ,1979
6. An introduction to quality control for the apparel industry, Pradeep V. Mehta
7. Mechanics of Textile Machinery-W A Hanton, Langmans, Green and Co., London 195

Web links and Video Lectures (e-Resources):

NPTEL COURSES ON SPINNING, EVALUATION OF TEXTILE MATERIALS AND FABRIC FORMATION
https://archive.nptel.ac.in/courses/116/102/116102049/

Skill Development Activities Suggested. Preparation of spin plan, weaving shed plan and conducting case studies in various garment industries.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Conduct significance tests, variance analysis and find confidence limits	L3
CO2	Find correlation coefficient and do regression analysis	L3
CO3	Calculate various parameters in spinning and prepare spin plan	L3
CO4	Determine loom and fabric parameters	L3
CO5	Find various parameters in garment industry	L3

Semester - I

ADVANCED TEXTILE AND APPAREL TESTING			
Course Code	**22JTT12**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**03:02:00**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 Hours Theory + 10 Lab slots**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course objectives:

- Explain the importance of HVI and AFIS in fibre and yarn testing
- Demonstrate methods, standards, principles and working of KES ad FAST systems used for testing of fabrics.
- Explain influence of chemical and mechanical finishes on fabric handle.
- Demonstrate various in-process inspection of fabrics and garments
- Demonstrate various fabrics and garment testing equipment's and apparel care labelling standards
- Explain the use of modern quality control and quality management programmes in the textile industry

MODULE-1	
Advance Fibre and Yarn Testing Instruments: Study of High Volume Instrument (HVI). Advanced Fiber Information System (AFIS). Comparison of AFIS with HVI System, Yarn Hairiness and its measurement. Uster spectrograph and its analysis. Properties desired in export of yarns.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
MODULE-2	
Advance Fabric Testing Instruments: Objective evaluation of fabric handle by KAWABATA Evaluation system (KES), Fabric Assurance by Simple Testing (FAST) and fabric extractions force technique. The influence of chemical and mechanical finishes on fabric handle.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
MODULE-3	
Inspection: Introduction, raw material inspection, In-process Inspection - spreading, cutting, sewing, pressing and final inspection.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
MODULE-4	
Apparel Testing: Soil/Stain release testing, snagging, bonded and laminated apparel fabric, testing of fusible interlinings, buttons, zippers and sewing threads. Care labelling of apparel and textiles: American, International, British, Canadian and Japanese systems.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
MODULE 5	
Quality Control Program: Planning for the quality control program, inspection and analysis of data. Tools of quality control. ISO 9000 series standards. Total Quality Management concepts.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos

PRACTICAL COMPONENT OF IPCC

Sl.No.	Experiments
1	Collection and analysis of HVI test result sheets.
2	Collection and analysis of AFIS test result sheets.
3	Collection and analysis of KESF test result sheets.
4	Collection and analysis of FAST test result sheets.
5	Collection and analysis of Uster test result sheets.
6	Collection and analysis of Uster spectrograph result sheets.
7	Collection of Uster standards for fibres and yarns
8	Collection and analysis of fusible interlinings
9	Collection and analysis of buttons and zippers
10	Collection and analysis on 7 basic quality tools for process improvement

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

1. Two Tests each of **20 Marks**
2. Two assignments each of **10 Marks/One Skill Development Activity of 20 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **30 marks**.

CIE for the practical component of IPCC

1. On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.

2. The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

3. The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course(CIE+SEE)

Suggested Learning Resources:

Textbooks

1. Principles of Textiles Testing" - J.E. Booth.
2. Hand book of textile testing and quality control" -B. Glover, D.S. Hamby, Wiley Eastern Ltd.,
3. The measurement of Appearance" - Richard S. Hunter and Richard W. Harold, Wiley Inter science.
4. An introduction to quality control for the apparel industry" - Pradeep V Mehta.

Reference Books

1. International Apparel Quality Manuals – KESF and FAST Manuals
2. Progress in Textile Science and Technology – Vol.1 Ed.by V.K. Kothari, IAFL, India, 2000

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

Sl. No.	Description	Blooms Level
CO1	Explain the importance and necessity of modern textile testing of fibres, yarns and fabrics	L2
CO2	Test and analyze of low stress mechanical properties of fabrics and its effects on comfort properties and its application in apparel production	L3
CO3	Demonstrate the principle and working of modern textile testing instruments	L2
CO4	Evaluate and demonstrate the determination of apparel quality and the parameters involved	L5
CO5	Discuss various quality control programs, tools for quality control and TQM concepts.	L3

Web links and Video Lectures (e-Resources):

- NPTEL course and lecture series: https://nptel.ac.in/courses/
- Apparel quality assurance and control: https://textilelearner.net/?s=Apparel+quality+assurance
- https://textilelearner.net/quality-assurance-in-garment-industry/
- YouTube simulation videos, etc.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Students can collect fibre, yarn, fabric and garment test data's from testing, R & D centers, textile and apparel industry and studying the same.
- Seminars, quizzes, group discussions and report writing on modern textile testing concepts.
- Practical exposure to testing of structure and related properties of fibres, yarns and fabrics

Semester- I

ADVANCED FIBER PHYSICS			
Course Code	**22JTT13**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**03-00-02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**50**	**Total Marks**	**100**
Credits	**04**	**Exam Hours**	**03**

Course objectives: This Course aims at updating knowledge of students in fields of

- Advanced methods of characterization of fibres.
- 2. Various physical and mechanical properties of fibres and fibre reinforced composites.

Module-1	
Introduction to macromolecular physics: Modern concepts of fiber structure. Physical methods of structuralcharacterization of fibers, viz., DGC, TEM, SEM, WAXS, SAXS,FTIRS, NMR, DSC and DTA	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-2	
Deformation of elastic solid: Generalized Hook's Law, Component of Stress and strain. Linear visco-elasticbehavior of fibers. Elastic recovery of fibres, theory of weak link effect. Maxwell's, Kelvins and burgers model for explaining time dependent mechanical properties, factors affecting creep and stress relaxation.	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-3	
Boltzmann superposition principle. Study of dynamic mechanical properties and their application in understanding thermal relaxation in fibers. Measurement of dynamic mechanical properties. Temperature dependence of visco- elastic behavior. Time-Temperature Equivalence and Superposition. WLF equation. Study of fiber stiffness and torsion. Introduction to mechanical properties of fiber reinforced composites. Fracture mechanism of fiber reinforced composites, Axial and transverse modulus of CFRCS.	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-4	
Moisture in textiles- Effect of moisture on mechanical, electrical and other properties of fibres. Studies on heats of sorption, theories of moisture sorption, molecular theory of moisture Hysteresis and rate of absorption of moisture in textiles Theory of moisture sorption and moisture swelling of fibres.	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-5	
Study of optical properties, thermal, frictional, electrical, Di-electric and static properties offibers.	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Polymer characterization" - Hunt and James - Chapman and Hall, London,
2. Mechanical properties of polymers - I M Ward
3. Mechanical properties of polymers - Nielson – Vol. I, II
4. Physical properties of fibers - W.R. Morton and J.W.S Hearle.
5. Introduction to polymer visco-elasticity - Aklonis

Skill Development Activities Suggested: Study of fibre structure using various instruments available in nearby research centers, and analysis of various properties of fibres using different equipment and doing case study in nearby fibre manufacturing industries.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Investigate textile fibre structure using various instruments.	L3
CO2	summarize tensile behavior of fibres	L3
CO3	Explain time dependent mechanical properties and mechanics of FRCS.	L2
CO4	Demonstrate moisture relations in fibres	L2
CO5	Analyze thermal, optical, frictional and electrical behavior of fibres.	L3

Semester - I

ADVANCED WET PROCESSING			
Course Code	**22JTT14**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02:00:02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

- Explain the dye fibre interaction, diffusion coefficient and theories of dyeing
- Demonstrate methods, standards, principles and working of chromatographic techniques used for testing of dyes, chemicals and textiles.
- Explain influence of dyes and chemicals on textiles.
- Describe various dyeing machineries used for garment processing
- Demonstrate various methods of fabrics finishing with speciality dyes and chemicals
- Explain the modern developments in natural dyeing and their applications

Module-1	
Dye-Fiber Interaction: Kinetics of Dyeing. The diffusion of dye inside the fiber. Fick's laws of diffusion. Theoretical basis for dye absorption. Theories of dyeing of protein and other fibers using suitable dyes.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-2	
Regulations: Red listed textile chemicals, their sources and remedies. Pollution aspects of textile dyeing. Modern approaches to Eco-friendly wet processing of woven and knitted textiles. Ecofriendly dyes and their method of dyeing. Methods of analysis of formaldehyde, Pentachloro Phenol (PCP), chlorine compounds and heavy metals in processed and finished fabrics. Eco-labelling and Eco-standards.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-3	
Garment Dyeing: Modern developments in garment dyeing. Methods and machines. Low temperature dyeing of garments. Finishing of garments using different chemicals and auxiliaries.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-4	
Finishing: Modern developments in finishing of natural and synthetic textiles. Finishing of textiles with various specialty chemicals.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-5	
Developments: Modern developments in textile and garment printing, color measurement and computer colour matching concepts. Latest developments in natural dyes and their application on various fibers.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

3. Three Unit Tests each of **20 Marks**
4. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
   to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

6. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
7. The question paper will have ten full questions carrying equal marks.
8. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
9. Each full question will have a sub-question covering all the topics under a module.
10. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Textile Colouration - C.L. BIRD
2. Textile Printing – LWC Miles.
3. Chemical Technology of Textile fibers – ER Troatman.
4. Dyeing and printing with natural dyes - M.L.Gulrajani.
5. Eco-friendly Textile wet processing-coordinator, N CUTE Publication - Dr.R.Ashokan

Reference Books

1. Environment Problems in chemical processing of Textiles, NCUTE Publication – Dr.A.Asokan, Ms.Yogita
2. Finishing of Khadi Garments - Dr.R.B.Chavan, R.Chattopadhyay, R.P.Tewari, IIT Delhi
3. Instrumental Colour measurement and computer aided colour matching for textiles, H.S. Shah & Gandhi.

Web links and Video Lectures (e-Resources):

- NPTEL course and lecture series: https://nptel.ac.in/courses/
- You Tube simulation videos, etc.
- https://www.youtube.com/watch?v=uZN0iLLAaww
- https://www.youtube.com/watch?v=g8_GvRoASV0
- https://www.youtube.com/watch?v=9ND67gfwAyg

Skill Development Activities Suggested

- Students can collect fibres, yarns, fabrics and garments, dyed with eco-friendly dyes from textile and apparel industry and studying the same.
- Practical exposure in wet processing of fibres, yarns and fabrics with eco-friendly dyes and chemicals
- Students can visit and observe working of advanced fabric wet processing machineries in industries.
- Seminars, quizzes, group discussions and report writing on modern wet processing concepts.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain the importance and necessity of dye fibre interactions and theories of dyeing	L2
CO2	Demonstrate methods, standards, principles and working of chromatographic techniques used for testing of dyes, chemicals and textiles.	L2
CO3	Demonstrate principles and working of modern garment processing machineries and methods of dyeing	L2
CO4	Describe the modern developments in finishing of textiles with speciality dyes and chemicals	L2
CO5	Explain the advanced printing of fabrics and garments, modern developments in natural dyeing and their applications	L2

Semester- I

YARN ENGINEERING

Course Code	**22JTT15**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02-0-02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

This Course aims at updating knowledge of students in fields of

- Practical concepts involved in designing of Yarns
- 2. Application of yarn in various areas

Module-1

Importance of Yarns: Designing yarns for specific end-uses. Selection of fibre /filament, structure of Fiber/filament, spun yarns, multifilament yarns, textured yarns and micro denier multifilament. Yarn diameter derivation of Pierce, Grasberg and Dickson formulae. Functional properties of end products.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live model

Module-2

Yarn Structure and yarn Regularity: Geometrical properties of single and folded yarns. Derivations of related equations. Open &hexagonal packing and their merits and demerits. Twist contraction and retraction practical applications

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-3

Twist migration and segment length in spun and filament yarns -Theoretical analysis of yarn Irregularity blend irregularity.

Transfer of Force: Transmission of force from fiber to fiber in spun yarns - mechanism of yarn breakage

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-4

Relationship: Effect of fibre properties and their geometrical configuration on tensile properties of yarns. Concept of elongation

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-5

Blends: Effect of properties of constituent fibers and their composition on the behavior of blended Yarns.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Textile yarns - B.C. Goswamy, J.G. Martindale, Wiley Interscience
2. Structural mechanics of fibres, yarns and fabrics, J.W.S. Hearle, P Grosberg, S. Backer,Wiley Interscience.
3. Spun yarn technology – Oxtoby, Butter Worth.
4. Technology of short staple spinning – Vol I, II, III, W. Klein, Textile Institute.

Web links and Video Lectures (e-Resources):

- NPTEL courses on Theory of yarn structure, yarn manufacture -2
- http://nitttrc.edu.in/nptel/courses/video/116102051/L01.html

Skill Development Activities Suggested: Exposure of students to spinning industry to study the yarn formation in depth and analysis of different types of yarn for their structure and properties**.**

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Illustrate the method of Designing of Yarns	L1
CO2	Determine the Packing Coefficient I and air space in Yarn	L3
CO3	Explain the Migration of Fibres in to the core of Yarn	L2
CO4	Describe the Geometrical and Tensile Properties of Yarn	L2
CO5	Explain the Blend Composition in Blends of different fibres	L2

Semester - I

ADVANCED WET PROCESSING LAB			
Course Code	**22JTTL17**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P:S)	**01:00:02:00**	**SEE Marks**	**50**
Credits	**02**	**Exam Hours**	**03**

Course objectives:

- Explain the functional wet processed fabric samples
- Explain influence of dyes and chemicals on textiles.
- Describe various modern wet processing machineries used for textile processing
- Demonstrate various enzymes and softeners for finishing of fabrics
- Explain the modern developments in natural dyes and their applications

Sl.NO	Experiments
1	Collection and analysis of functional wet processed woven fabric samples
2	Collection and analysis of functional wet processed Knitted fabric samples
3	Collection and analysis of functional wet processed non-woven samples.
4	Dyeing of cotton and silk samples with natural herbal dyes
5	Hand painting on cotton and silk fabric samples
6	Design and developing of screen printing on cotton and silk fabrics with multi-colour
7	Tie and dye printing and Resist style of printing on fabrics.
8	Finishing of fabric with enzymes and softeners
9	Calculations and analysis of colour parameters - K/S Value, Delta value etc.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- The students will be able to tackle problems both in industry and business.
- Students can collect wet processed fabric samples from testing, R & D centres, textile and apparel manufacturing industry and studying the same.
- Explain the importance and necessity of modern wet processing of textiles
- Demonstrate the principle and working of modern colour measurement and colour matching
- Inspect performance properties of fabrics and show the parameters influencing
- Evaluate and demonstrate the determination of dyed and printed fabric samples

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination (SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Suggested Learning Resources:

- Students can collect wet processed fabrics and garments from testing, R & D centres, textile and apparel manufacturing industry and studying the same.
- Practical exposure to testing of finished fabrics and related properties
- Students can visit and observe working of advanced fabric wet processing industries.
- Seminars, quizzes, group discussions and report writing on modern wet processing concepts.

M.TECH. TEXTILE TECHNOLOGY (JTT)

SEMESTER – II

Semester- II

ADVANCED MANUFACTURED FIBER TECHNOLOGY			
Course Code	**22JTT21**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02-00-02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives: This Course aims at updating knowledge of students in fields of

- High performance fibres, high function fibres and developments in conventional man-made fibres
- Post spinning operations.
- Advanced concepts in MMF spinning.

Module-1

Structural principles of fibre forming polymers. Rheology and hydrodynamics in MMF spinning. Development of fibre structure during man-made fibre spinning. Study of various variables in melt spinning and effect of various parameters on linear density of fibres

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-2

High speed melt spinning: One step (SP) and two step spinning (TSP) process. Study of fluid flow in spin line. Modifications to be done in spinning, mechanism for high speed melt spinning. Recent developments in dry and wet technology. Study of various types of spinnerets, orifices used for MMF spinning. Mechanism of crystallization during MMF Spinning

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-3

Melt spinning of Hollow, Multicomponent, Ultra-fine and Nano fibres. Spin finish application: Composition ofspin finish, various methods of spin finish application, spin finish for staple fibre production.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-4

Detailed study of mechanism of heat setting of synthetic fibres. Study of property changes in synthetic fibres during heat setting. Study of various physical and chemical methods of modifications of PET, NYLON & Acrylic fibers.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-5

New fibres: Introduction to various high performance fibres, Kevlar-LCP behavior, dry jet spinning of Kevlar fibres, Carbon fibres, raw materials, chemistry of production, surface treatments. Recent trends in production of high performance fibres like Boron, Silicon, Glass, PBT, PBZO, PBZT and aromatic polyesters. High tech fibres, biomimetic chemistry and fibres, biotechnology and fibres, electronics and fibres, fibres in sports, fibres in ocean.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
   to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. High Speed Fibre Spinning" - Andrzej Ziabicki, Hiromichi Kawai, Krieger Publishing Company, 1991
2. Fundaments of fibre formation" - Andrzej Ziabicki, Wiley, 1976
3. Manmade fibres: Science and Technology", Vol. I, II and III – HF Mark, SM Atlas and E CerniaInterscience Publishers, NY
4. Manufactured Fibre Technology" – Ed.by V. B. Gupta and V K Kothari, Chapman and Hall, London, 1997
5. New Fibres - T. Hongu and G O Phillips, Ellis Horwood, New York 1990.

Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/116102006

Skill Development Activities Suggested

Analysis of fabrics made from special fibres, doing case studies in synthetic fibre production centres, reviewing literature on recent developments in fibre production.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Illustrate synthetic fibre production	L2
CO2	Demonstrate high speed spinning	L2
CO3	Explain ultra-fine,bicomponent and micro denier fibres	L2
CO4	Describe post spinning operations	L2
CO5	Explain various new functional fibres	L2

Semester- II

ADVANCED KNITTING AND NON-WOVENS TECHNOLOGY			
Course Code	**22JTT22**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**03-02-00**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 hours Theory + 10-12 Lab slots**	**Total Marks**	**100**
Credits;	**04**	**Exam Hours**	**03**

Course objectives:

- Student will have an in depth knowledge about warp knitting and non-woven fabric production. It will updatethe knowledge about modern aspects of warp knitting and non-woven production and application.

MODULE-1

Warp knit fabrics; warp knit v/s woven construction, Single needle bar structure and working mechanism, pattern mechanism. Five basic overlap / under lap variations, closed lap and open lap, direction of lapping at successive courses. Classes of warp knitting machinery, knitting cycle, Tricot, Raschel machines. Knitting elements in Raschel machine, knitting cycle in Raschel Knitting action of the single needle bar Raschel and compound needle.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

MODULE-2

Knitting elements of Tricot machines, knitting cycle in Tricot machine. Plain Tricot structures, knitted with two full set guide bars, two bar Tricot, Shark skin, Queenscord, Velour and Velvet structures, Satin, overfed pile structures, reverse lock knit. Differences between Tricot and Raschel machines and fabrics. Laying-in in warp knitting, rules governing, laying-in, fall-plate patterning, full width weft insertion, cut presser and miss press structures.

Teaching-Learning Process	. Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

MODULE-3

Modified warp knit machines and fabrics: Fall plate and chopper bar Raschel, co-we-nit, weft insertion in knitting. Pattern controlling mechanism, pattern wheels, electronic jacquards. Yarns for warp knitting: - Materials for warp knitting, filament and spun yarns, unconventional yarns, important yarn properties for warp knitting, winding and warping for warp knitting. Faults in warp knits. Warp knitting calculations.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

MODULE-4

Classification of non-wovens, preparatory machines for non-wovens fabric Production. Effects of fiber arrangements in the web. Methods and technique used in non-woven production, needle punched, stitch bonded,and adhesive bonded wet laid spun bonded, spun laced laminated and moulded fabrics. Classification of binders and their properties, effect of fiber properties on nonwovens. Modern developments in non-woven productions

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

MODULE 5

Structure of non-wovens: web geometry, fiber orientation curl factor, web density. Identification, properties and application of different non-wovens. Methods of tests: porosity, tear strength, air permeability, tensile strength, 3-point bending test, fatigue test, CBR Loading, cone puncture test, absorbency test, peeling test, pilling test, study of DIN standards.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Collection of special knit structure rib, purl interlock knitted fabrics and analysis of the same
2	Understanding relationship between knitted structure and geometry.
3	Analysis of single jersey, rib and purl structure.
4	Collection of nonwoven samples and their characterization
5	Analysis and loop diagram, feeder diagram and graphical notations.
6	Structural analysis of non- wovens, needle punching, hydro entanglement, spun lacing and spun bonding. Determination of tensile strength and tearing strength of nonwovens.

7	Determination of bursting strength of nonwoven fabrics
8	Determination of cone puncture test and abrasion resistance.
9	Analysis of various methods of web bonding structures of nonwoven fabrics.
10	Collection of different types of non wovens fabrics and determination of air permeability and moisture absorption of non-woven materials.

Assessment Details (both CIE and SEE) Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

1. Two Tests each of **20 Marks**
2. Two assignments each of **10 Marks/One Skill Development Activity of 20 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **30 marks**.

CIE for the practical component of IPCC

1. On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
2. The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
3. The laboratory test at the end /after completion of all the experiments shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

.**SEE for IPCC**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
4. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only.

Questions mentioned in the SEE paper shall include questions from the practical component).

The minimum marks to be secured in CIE to appear for SEE shall be the 15 (50% of maximum marks-30) in the theory component and 10 (50% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 40% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50. (Student has to secure an aggregate of 50% of maximum marks of the course(CIE+SEE)

Web links and Video Lectures (e-Resources):

NPTEL COURSES ON Weaving Technology and Non-Woven Technology.

https://nptel.ac.in/courses/116102005

https://nptel.ac.in/courses/116102014

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Demonstration of single jersy,rib knitting machines and knitting elements,
2. Demonstration of Interlock knitting machines, yarn feeding and cam on knitting machines
3. Analysis of knitted fabrics for WPI,CPI Stitch Density, Stitch Length, Loop Shape Factor
4. Analysis of knitted fabrics for loop design; loop diagram feeder diagram, and graphical motion.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

COs		**RBTL**
CO1	Define and explain the basic elements and structures of weft knitting	**L1**
CO2	Summarize and discuss weft knitting machines and their Ornamentation of weft knit structures	**L2**
CO3	Explain in depth derivatives of plain and rib structures and weft knit designs.	**L2**
CO4	Summarize and discuss the aspects of knitted fabric geometry.	**L2**
CO5	Explain warp knitting machine and their structures	**L2**

Semester - II

ENVIRONMENTAL MANAGEMENT FOR TEXTILE INDUSTRY			
Course Code	**22JTT231**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02:00:02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

- Explain the source of water and their characteristics, constituents of water and their effects on textile wet processing
- Demonstrate quality requirements of water for silk reeling and textile processing, conservation and reuse of water
- Explain textiles effluents, characteristics of textiles processing and methods and techniques used for effluent treatments.
- Demonstrate standard regulations for effluents testing parameters
- Explain environmental management in textile industry, environmental pollution control norms and Biotechnology and its application in textile industry

Module-1	
Water: Source of water and their characteristics- surface water, ground water, rain water etc. Constituents of water and their effects on textile wet processing. Colour, turbidity, suspended solids, dissolved solids, PH value, acidity, alkalinity, hardness, iron and manganese, copper, chlorine organic growth.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-2	
Quality requirements: Quality requirements of water for silk reeling and textile processing. Conservation and reuse of water. Processing chemistry - fibres, chemicals, type of chemical processing.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-3	
Textiles effluent: Introduction to textiles effluent, characteristics of textiles processing, dye manufacture and synthetic fibres formation industries, reduction and pollution control at mill state. Methods and techniques used for effluent treatments.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-4	
Standard regulations for effluents: Effluent testing parameters- colour and physical appearance, odour, temperature, PH value total suspended solids, total dissolved solids, BOD, COD.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-5	
Environmental management: Objectives, environmental impact assessment (EIA), elements of EIA process. Important environmental laws. Environmental pollution control norms. Biotechnology and its application in environmental industries. Plasma treatments.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
   to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Textile Effluents – Padma Vankar, NCUTE Publications, IIT, Delhi.
2. Eco friendly processing - NCUTE Publications.
3. Environmental problems in chemical processing of textiles - NCUTE Publications.

Reference Books

1. Waste water-An introduction to environmental pollution, Dr. B.K. Sharma, Krishna Prakashan, Media (P) Ltd., Meerut.
2. Water pollution - V.P. Kudesia, Pragathi Prakashan, Meerut.

Web links and Video Lectures (e-Resources):

- NPTEL course and lecture series: https://nptel.ac.in/courses/
- U Tube simulation videos, etc.
- https://nptel.ac.in/courses/116104045

Skill Development Activities Suggested

- Students can collect textiles effluents characteristics data's from testing, R & D centres, textile and apparel industry and studying the same.
- Seminars, quizzes, group discussions and report writing on modern textile processing concepts.
- Practical exposure to testing of textile effluent parameters- fibres, yarns and fabrics processing
- Students can visit and observe effluent treatment methods and techniques of textile processes.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain the source of water and their characteristics, constituents of water and their effects on textile wet processing	L2
CO2	Describe quality requirements of water for silk reeling and textile processing, conservation and reuse of water	L2
CO3	Demonstrate textiles effluents, characteristics of textiles processing and methods and techniques used for effluent treatments.	L2
CO4	Explain standard regulations for effluents testing parameters	L2
CO5	Explain environmental management in textile industry, environmental pollution control norms and Biotechnology and its application in textile industry	L2

Semester- II

ADVANCED TECHNICAL TEXTILES			
Course Code	**22TT232**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02:00:02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**3**

Course Learning objectives:

- To strengthen the understanding of technical textiles with the knowledge of latest textile materials used for technical textile applications.
- To understand and analyse the performance of technical textile products with respect to various functional performance requirements.
- To develop deep understanding for design and concepts to develop different technical textile products for various textile industrial applications.

Module-1

Global Technical Textiles: Present scenario and future prospects with respect to India. Classification of technical textiles. Requirements of fibres, yarns and fabrics for technical textiles. High performance fibres. Study of properties of various fibres used for technical textiles.

Teaching-Learning Process	Chalk and talk, power point presentation, videos

Module-2

Textile Reinforced Composites

Introduction to textile reinforced composites. Role of textile reinforcement, matrix and interface in composite materials. Classification, Structure and properties of the various textile reinforcements used for composite material preparation. Classification of resins; thermoset, thermoplastic and their properties. Testing of textile reinforced composites – density, fibre volume fraction, void content, tensile, bending and compression behaviour. Failure mechanism in textile composites.

Teaching-Learning Process	Chalk and talk, power point presentation, videos

Module-3

Technical Textile Sectors

Introduction to different application sectors of technical textiles: Agro-Tech, Build-tech, Geo-textiles, Home-Textiles, Indu-tech, Automobile Textiles, Pack-Tech, Sports-Tech & Mobil-tech. Structure and properties of the fibres, yarns and fabrics used for different application sectors of technical textiles. Functional requirements of technical textile products in different application sectors and their testing.

Teaching-Learning Process	Chalk and talk, power point presentation, videos

Module-4

Protective Textiles, Defence Textiles, Medical Textiles and Biomaterials Functional requirements of technical textile products in ballistic protection, chemical protection, thermal protection and defence sectors and their testing. Medical textile product classification and functional properties required. Biomaterials: Introduction, classification, applications and testing of implantable, non-implantable, extra corporal devices

Teaching-Learning Process	Chalk and talk, power point presentation, videos

Module-5

Nanotextiles, Smart Textiles and Wearable Electronics

Introduction to nanotechnology. Application of nanotechnology in textiles. Assessment of nanotextiles for physical and performance properties. Introduction & Classification of smart materials. Piezo-polymers, Magneto-strictive Materials, Electroactive Polymers, Shape Memory materials and Intelligent textiles based on smart materials. Integration of electronics in textiles and classification of Wearable electronic products. Working principle of different classes of sensors, wearable devices and systems.

Teaching-Learning Process	Chalk and talk, power point presentation, videos

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Hand book of Technical Textiles- Ed. A.R.Horrocks, S.C, Anand. Wood Head Pub., England, 2000.
2. Hand book of Industrial Textiles- Ed S.Adanur, Technomic Pub., Lancaster-Basel, 1995.
3. High Performance Fibres J.W.S. Hearle Woodhead UK 2005.
4. Smart Fibres- Fabris, & Clothig-Ed. Xiaoming Toa, Wood Head, England, 2001.
5. Design of Textiles For Industrial- Applications, ED P.W. Harrison, Pub Textile Institute 1977 Manchester.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc21_te09/preview

Skill Development Activities Suggested

- Each student given assignment to present case study on different technical textile products in different application sectors

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Demonstrate technical textiles with the knowledge of latest textile materials used for textile industrial applications.	L2
CO2	Describe fibre reinforced composite and test fibre reinforced composites	L2
CO3	Conceptualize different technical textile products for various textile industrial applications.	L3
CO4	Explain protective and medical textiles	L2
CO5	Illustrate nano and smart textiles.	L2

Semester- II

ADVANCED SILK TECHNOLOGY			
Course Code	**22JTT233**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02:00:02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

- To learn advances in silk fibre production, structure properties processing etc.
- To learn about biomedical applications of silk, spider silk and spun silk fibres

Module-1

Structure and Properties: Silk Composition of silk, amino acid composition, moisture regain, micro structure of silk, chained structure of silk, crystalline structure of silk, optical proportion of silk. Mechanical and thermal properties of silk: Tensile properties, stress-strain characteristics of silk. Visco-elastic behavior of silk, creep and stress relaxation inverse stress relaxation. Dynamic mechanical behavior and thermal behavior

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-2

Indian Silk Industry and Process: Production of silk, quality of silk, problems and prospects. Present Scenarioof Indian Silk Industry Production of silk produced by the other countries across the world and quality of silk produced by their Modern approach to silk cocoon production and cocoon characteristics evaluation. Recent developments in cocoon, stifling, sorting, grading, cooking and reeling. Technological developments in reeling machines and methods to increase the

Teaching-Learning Process	. Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-3

Production of Spun Silk: Conversion and modern approach, prospects and application, Production of Indian cottage silk and its suitability for producing traditional silk fabric with intricate designs. Production of soft silk, crepe, georgette, chiffon etc. Production of damasks and brocades and silk furnishing cloth

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-4

Dyeing and Finishing: Types of dye used, factors affecting dyeing behavior of silk, preparation of silk for dyeing. Recent developments in degumming, bleaching, dyeing. Dyeing of silk with reactive, direct and natural dyes. Finishing of silk fabrics: Types and methods, modern technologies involved to impart wrinkle resistant finish, stain repellent, antimicrobial finish and other specialty finishes applicable to silk and its blends. Developments in machineries, chemicals and auxiliaries used for silk dyeing and finishing

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-5

Developments: Processing of silk fibroin, filaments, hydrogels production of 3D sponges, membranes of silk, non-wovens, fluorescent silks. Biomedical applications of silk such as in sutures, would heeling, tissue engineering, drug delivery systems. Silk fibre reinforced composites. Spider silk and their applications: Types ofspider silk, chemical compositions, general properties, tensile properties and application of spider silk

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Silk Processing, Properties and Applications - K. Murugesh Babu, Woodhead Pub. Limited, UK, 2013
2. Silk wet processing - Dr. M. L. Gulrajani, IIT Delhi Publication
3. Silk Dyeing - Dr. V. A. Shenai, Sewak Publications
4. FAO Manual on silk.
5. Silk Dyeing, Printing and Finishing – G H Hurst, Summer Press Publications

Skill Development Activities Suggested

- Visit to various silk activity centres of Karnataka and study various processes used in production and characterization of silk fibres

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Demonstrate structure, composition and properties of silkfibres	L2
CO2	Summarise world production and recent developments in post cocoon operations	L2
CO3	Illustrate production and applications of silk fibres	L3
CO4	Explain dyeing printing and finishing of silk fibres	L2
CO5	Demonstrate various unconventional applications of silk fibres and their bi- products.	L2

Semester - II

HUMAN RESOURCE MANAGEMENT			
Course Code	**22JTT234**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02:00:02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

- Explain the Importance of job analysis and job specifications, different types of job evaluation programmes and basis of promotion, demotion, and transfers.
- Demonstrate methods of training personnel for higher performance and productivity.
- Explain modern methods of recruitment and selection and Industrial disputes and settlement
- Describe various welfare measures, bonus facilities, wage and salary administration and incentive schemes.
- Explain motivation and morale, Labour Management relations, objectives and functions of trade unions.

Module-1	
Introduction to human resource management with reference to objectives and policies. Functions of HRM, Scope, importance and impact on Textile Industry.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-2	
Importance of job analysis and job specifications. Different types of job evaluation programmes. Basis of promotion, demotion, transfers, Methods of training personnel for higher performance and productivity. Grievance Handling – procedure for grievance handling.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-3	
Modern methods of recruitment and selection. Industrial disputes, procedure for settlement of disputes.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-4	
Welfare measures, bonus facilities, Wage and salary administration and incentive schemes.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos
Module-5	
Motivation and Morale. Labour Management relations. Objectives and functions of trade unions. Factories act and their importance.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
   to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Human Resource Management – P Subba Rao, Himalaya Publishing, New Delhi
2. Human Resource Management – Gary Dessler and BijuVarkkey, Prentice Hall
3. Personnel Management" - Edwin B. Flippo, McGraw-Hill, 1986
4. Personnel Management" - Subratha Ghosh

Reference Books

1. Management of Personnel in Indian Enterprises - N.N. Chatterjee, Allied Book Agency, 1978
2. Personnel Management - Derek Torrington, Laura Hall, Prentice-Hall, 19 87

Web links and Video Lectures (e-Resources):

- NPTEL course and lecture series: https://nptel.ac.in/courses/
- You Tube simulation videos, etc.

Skill Development Activities Suggested

- Students can collect fibre, yarn, fabric and garment test data's from testing, R & D centers, textile and apparel industry and studying the same.
- Seminars, quizzes, group discussions and report writing on modern textile testing concepts.
- Practical exposure to testing of structure and related properties of fibres, yarns and fabrics

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain the Importance of job analysis and job specifications, different types of job evaluation programmes and basis of promotion, demotion, and transfers.	
CO2	Demonstrate methods of training personnel for higher performance and productivity.	
CO3	Explain modern methods of recruitment and selection and Industrial disputes and settlement	
CO4	Describe various welfare measures, bonus facilities, wage and salary administration and incentive schemes.	
CO5	Explain motivation and morale, Labour Management relations, objectives and functions of trade unions.	

Semester-II

DEVELOPMENTS IN FABRIC FORMATION Title of the subject			
Course Code	**22JTT241**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02- 00- 02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:
This Course aims at updating knowledge of students in fields of Shuttle less looms, multiphase looms, management of loom shed etc.,

Module-1

Pre requisites: Pre requisites for successful installation of shuttle less looms, yarn quality norms for unconventional weaving, preparatory process to unconventional weaving.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-2

Weft insertion methods: Weft insertion by projectile, rapier, air jet, water jet, weft insertion stages of different weaving machines. Weft insertion by other methods by multi-phase weaving. Study of unconventional selvedges, accumulators, shed geometry, weft consumption, weft unwinding tension.

Teaching-Learning Process	. Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-3

Multiphase weaving; flat multiphase, circulars looms. Narrow looms, Triaxial looms. Material handling equipment and its importance. Productivity- its measurement and control.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-4

Management of loom shed; Organization, Weaving plant layout, Ventilation and Humidification, Lighting. General information about maintenance. Management of loom shed, maintenance

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-5

Recent development in unconventional looms; projectile, rapier, air jet, water jet, QSC wider width machine. Techno economics of unconventional weaving machines.

Teaching-Learning Proces	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books:

1. Principles of Weaving-By ATC Robinson, R. Marks, 1976, Textile Institute, Manchester, London
2. Shuttle less Weaving Machine - OldrichTalavasek and Uladimin, Svaty, Elsevlin, 1981 ScientificPub. Co., New YORK
3. Modern Weaving Theory and Practice-,ISHIDA
4. Weaving, Machines, Mechanisms & Management- D.B.Ajgaonkar, Talukdar
5. Modern Preparation and weaving Machinery-A Ormerod, 1983, Butterworths London.

Web links and Video Lectures (e-Resources):

- NPTEL course on fabric formation.
- https://onlinecourses.nptel.ac.in/noc22_te06/preview

Skill Development Activities Suggested: Visit to shuttle and modern loom factory and observe the operation and conduct case study.

COs	Course outcomes	Blooms Level
CO1	Explain the requirements of shuttle less looms, yarn quality,weaving, and preparatory process to unconventional weaving.	L2
CO2	Explain Weft insertion stages on projectile, rapier, air jet, water jet. Weft insertion by other methods	L2
CO3	Explain Multiphase weaving, circulars looms,triaxial looms and narrow looms productivity control	L2
CO4	Summarize loom shed; Organization of loom shed, plant layout, Ventilation. And Humidification,	L2
CO5	Explain recent development in unconventional looms, QSC. Techno economics of unconventional weaving machines.	L2

Semester- II

FABRIC ENGINEERING			
Course Code	**22JTT242**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02:00:02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

- Explain the importance of engineering concepts and approach to textile Structure –Classification and standardization of fabrics.
- Learn Geometry of fabric structure, mathematical models, techniques, developed by various scientists and researches
- Demonstrate tensile deformations, load extension modules, bending, rational deformations etc.
- Explain the Geometry of knitted fabrics, various models and applications.

Module-1	
Engineering concepts: Textile properties and textile structure – engineering concepts and approach to textile Structure – classification of multi directional textile structure – laminar and orthogonal. Classification and standardization of fabrics.	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-2	
Geometry of fabric structure: Pierce's basis and modified models – Painter –Adom's and Love's technique descriptive and mechanistic models. Kemp and Hamalton: Twin arc, Olofson – Snow dens and other models.	
Teaching-Learning Process	. Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-3	
Tensile deformations: Tensile deformation – heaps solution – pierces solution – geometrical solutions duringextension of cloth – load extensional modules – tear – various Models.	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-4	
Other deformations: Bending and tensional deformations – buckling, shear and drape of fabrics –theory various Models – behaviour**.**	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models
Module-5	
Knit structures: Geometry of knitted fabrics – weft and warp knits – various models –applications. Mechanics of knitted fabrics – theory-behaviour**.**	
Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**

to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Text Books

1. Structural mechanics of fibres, yarns and fabrics**,** Vol.I - J. W. S. Hearle, P. Grosberg, Stanley Backer,Wiley Intersci. New York.
2. Textile fibres, yarns and fabrics - a comparative survey of their behaviour with special reference to wool – E R Kaswell, Pub. Reinhold, 1953
3. Textile Mathematics - Vol I, II, III – J. E. Booth, Textile Institute

Reference books

1. Woven Cloth Construction - A.T.C. Robinson & R. Marks, Textile Institute

Skill Development Activities Suggested

- Analysis of geometry and structure of various types of fabrcs.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Demonstrate the application engineering concepts of fabric construction. Classify and explain different complex fabric structure suitable for various applications	L2
CO2	Illustrate geometry of fabric structure, various mathematical models and techniques	L1
CO3	Summarise Tensile deformations Tensile deformation, geometrical solutions during extension of cloth, load extensional modules and various Models.	L3
CO4	Explain Bending and tensional deformations and various Models	L2
CO5	Demonstrate geometry of knitted fabrics, mechanics of knitted fabrics and various models, applications	L2

Semester - II

MARKETING MANAGEMENT			
Course Code	**22JTT243**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02:00:02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

- Explain the concepts of marketing, a model for consumer buying behaviour, factors influencing consumer behaviour concept, 'Product Life Cycle' and pricing.
- Demonstrate channel decisions, nature and characteristics of marketing channel, communication process, Steps in the development of effective communication.
- Explain the E-Business frameworks, organizational business types of electronic payments, E-governance and implications
- Demonstrate various Brand, conceptualization and measurement trends in brand management, classification of industrial products.
- Explain the modern developments in international marketing, trade groups, international regulations, exchange rate fluctuations on Imports and Exports.

Module-1	
Core concepts of marketing. Need, Want & Demand, Product, Value and satisfaction. Production concept, product concept, selling concept and Marketing concept. A model for consumer buying behaviour, factors influencing consumer behavior, buying decision process- Buying roles & stages in buying. New product development-Idea generation, Idea screening, Concept development and using, Product development. Marketing strategies in the various stages 'Product Life Cycle'. Pricing - Objectives, Influencing factors, methods, strategies for new products and existing products.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos

Module-2	
Channel Decisions Nature and characteristics of Marketing Channel Functions, channel dynamics, Channel Design and Management decisions. Communication process - Steps in the development of effective communication, Designing message, selection communication channels, deciding promotion mix, measuring results. Promotional Mix tools**.** Advertising, Sales promotion, personal selling, public relations, and direct marketing. Marketing organization & implementation: Evolution, ways of organizing the marketing departments, marketing relations with other departments**.**	
Teaching-Learning Process	Chalk and talk, power point presentation, videos

Module-3	
E-Business frameworks -media convergence -Anatomy of E-Biz applications - Internal and External applications and integration - organizational business – ED- Implementation –Managing technology – IT bills of various governments. Introduction to web applications - technologies for Web services –Internet tools relevant for E-Business Internet applications for E-business. Types of electronic payments -Digital token based payments-Smart cards credit cards based –other emerging payments technologies -E-governance and implications - Technical specification of digital currencies**.**	
Teaching-Learning Process	Chalk and talk, power point presentation, videos

Module-4	
Brand, Brand identity, Brand Image, Brand Personality, Brand Loyalty and the connected issues. Brand Positioning, Repositioning, Brand Equity: Conceptualization and measurement Trends in Brand Management: Brand cult, Brand alliances, Co-branding, Destination, Branding. Introduction to industrial marketing, Difference between consumer marketing and industrial marketing, classification of industrial products, Nature of demand, Industrial marketing system. Industrial buying behaviour.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos

Module-5	
The concept and the need for international marketing - the nature, scope and variety of international markets. International market Vs Local Markets, differences & Similarities. Trade groups, international regulations, trade bodies & Organization like IMF, World Bank & Conference e.g. GATT, UNCTAD, their impact on world trade Euro-dollar & Petro Dollar Market. Exchange rate fluctuations on Imports and Exports.	
Teaching-Learning Process	Chalk and talk, power point presentation, videos

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
   to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Textbooks

1. Retail Management-A Strategic Approach - Barry Bermans and Joel Evans, 8th edition, PHI private limited, New Delhi, 2002.
2. The Art of Retailing - A.J. Lamba, 1st edition, Tata McGraw Hill, New Delhi, 2003.
3. Marketing Management - Kotler Philip, 1st Ed., Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2004
4. Marketing Management - S. Jayachandra, 1st edition, Excel Publications, New Delhi, 2004
5. The Economics of Electronic Commerce - Soon-Young choi, Whiston, A.B., Macmillan Publishing Company, USA.
6. Electronic commerce-A manager's guide - Kalakota R &Whinston, A. B., Addition Wesley, USA.

Reference Books

1. Advertising and Promotion - Belch E. George & Belch A. Michael, 5th edition, Tata Megraw Hill, New Delhi, 2001.
2. Brand building advertising: concepts and cases - Parameswaran, Tata Mcgraw Hill, New Delhi, 2002 .
3. Strategic Brand Management - Jean Noel Kapferer, Global business press, Abhinav Publishing industry, 1st ed., New Delhi, 1994.
4. Industrial Marketing, AITBS - Hill, M Richard, Alexander S. Ralph, Cross James S, 4Ed. New Delhi 1991.
5. Direct Marketing: An Integrated Approach - William J. McDonald, McGraw Hill, Singapore, 1st edition,1998.

Web links and Video Lectures (e-Resources):

- NPTEL course and lecture series: https://nptel.ac.in/courses/
- https://onlinecourses.nptel.ac.in/noc19_mg48/preview
- YouTube simulation videos, etc.

Skill Development Activities Suggested

- Students can collect consumer buying behaviour data's from malls, retailers and apparel industry and studying the same.
- Seminars, quizzes, group discussions and report writing on imports and exports concepts.
- Practical exposure to various brands, types of electronic payments, E-governance and implications

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain the concepts of marketing, a model for consumer buying behaviour, factors influencing consumer behaviour concept, 'Product Life Cycle' and pricing.	L2
CO2	Demonstrate channel decisions, nature and characteristics of marketing channel, communication process, Steps in the development of effective communication.	L2
CO3	Explain the E-Business frameworks, organizational business, types of electronic payments, E-governance and implications	L2
CO4	Demonstrate various Brand, conceptualization and measurement trends in brand management, classification of industrial products.	L2
CO5	Explain the modern developments in international marketing, trade groups, international regulations, exchange rate fluctuations on Imports and Exports.	L2

Semester- II

THEORY OF YARN SPINNING			
Course Code	**22JTT244**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**02-00-02**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course Learning objectives:

- Understand the Quality aspects of Yarns spun in Industry
- Importance of Quality parameters on the Quality of fabrics in the next stage

Module-1

Fibre dispersion: Ginning of cotton; the necessity of fibre-individualization; fibre opening in blow- room machinery; the mechanism of fibre-dispersion during carding operation; the minimum requirements during carding and the new approaches to improve fibre-dispersion in carding operation. Neps formation and theory of hook formation. ■

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-2

Fibre processing: Methods adopted to clean the fibre from trash, short fibres and neps; role of blow-room, card and comber in fibre cleaning. Definition of fibre-extent; influence of fibre-extent on yarn quality; improvement of fibre-extent by straightening actions in carding, drafting and combing**.**

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-3

Attenuation: Principle of rollers drafting and its application in yarn production; drafting irregularities-their causes and remedies; the function of aprons in roller drafting; limitation of apron-drafting and the scope for improvement; mechanism of wire-point drafting and its application in yarn production; merits and demerits of wire-point drafting. Comparison of wire-point drafting with roller drafting.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-4

Twisting: Effect of twisting of staple-fibre strand on its strength ;meaning of twist multiplier and the basis of selection of required twist; fundamental requirement to create real twist in a strand; mechanism of different twisting principle-ring-twisting, open-end twisting, air-jet twisting, up-twisting, two-for- one twisting, hollow- spindle twisting.

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Module-5

Levelling and fibre blending: Influence of intermediate product uniformity on yarn uniformity; methods of levelling adopted during spinning processes. Important of fibre-mix homogeneity on yarn quality; types of mixing during spinning preparatory process; assessment of blend efficiency

Teaching-Learning Process	Chalk & Talk, Power point presentation, PDF notes, Video demonstration, live models

Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
   to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.

Suggested Learning Resources:

Books

1. Spun Yarn Technology" -Oxtoby E, Butterworth's, London, 1987.
2. The Technology of Short-staple Spinning" - Klein W, The Textile Institute, Manchester, 1998.
3. A practical Guide to Opening and Carding" - Klein W, The Textile Institute, Manchester, 1999.
4. A Practical Guide to Combing, Drawing and the Roving Frame" - Klein W, The Textile Institute,Manchester, 199

Skill Development Activities Suggested

Develop practical skills to understand the Quality aspects of yarn and their importance and influence on the quality of Fabrics

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain the Ginning Process and Fibre Dispersion	L1
CO2	Describe about the nep generation at ginning and blow room and nep removal in Carding	L2
CO3	Illustrate the Drafting Systems on Spinning Machineries	L1
CO4	Explain the basis for Selection of Twist factor and principle of Twisting	L2
CO5	Explain the Types of mixings during preparatory processes	L2

Semester - II

ADVANCED APPAREL PRODUCTION AND QUALITY CONTROL LAB			
Course Code	**22JTTL26**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P:S)	**01:00:02:00**	**SEE Marks**	**50**
Credits	**02**	**Exam Hours**	**03**

Course objectives:

- Explain the importance of care labelling of apparels and standards
- Demonstrate methods, standards, principles and working of sewing thread quality testing.
- Explain influence of chemical and mechanical finishes on sewing threads.
- Demonstrate various methods of inspection of fabrics and garments
- Demonstrate various quality assurance of garment accessories and trims
- Explain the method of sewing thread and seam calculations

Sl.NO	Experiments
1	Collection of care labelling of apparels and their comparisons
2	Collection and analysis of sewing threads quality
3	Collection of fabric inspection reports from industry and its analysis
4	Collection of garment inspection reports from industry and its analysis
5	Pre testing and quality assurance of garment accessories and trims
6	Selection of apparel packing and packaging materials and their analysis
7	Calculations of sewing thread consumptions per garment
8	Study on seam properties and their calculations
9	Study on pattern efficiency and fabric consumptions

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- The students will be able to tackle problems both in apparel industry and business
- Students who have studied this subject can confidently work in QC dept. and research institutions
- Explain the importance and necessity of modern textile testing of sewing threads and apparels
- Test and analyze the seam properties and calculations
- Demonstrate the modern apparel packing and packaging materials and their analysis
- Evaluate and demonstrate the determination of apparel quality and the parameters involved

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination (SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and the second test shall be conducted after the 14^{th} week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Suggested Learning Resources:

- Students can collect fabric and apparel inspection reports, care labelling from testing, R & D centers, and apparel manufacturing industry and studying the same.
- Practical exposure to testing of sewing threads, seams and related properties of apparels.
- Students can visit and observe working of apparel manufacturing industries.
- Seminars, quizzes, group discussions and report writing on modern apparel testing concepts.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M.Tech. TEXTILE TECHNOLOGY (JTT)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Mini–Project/ Internship	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22JTT31	Advanced Apparel Production Technology	03	00	02	03	50	50	100	4
2	PEC	22JTT32X	Professional elective 3	03	00	00	03	50	50	100	3
3	PEC	22JTT33X	Professional elective -4	**03**	**00**	**00**	**03**	**50**	**50**	**100**	**3**
4	PROJ	22JTT34	Project Work phase -1	00	06	00	--	100	--	100	3
5	SP	22JTT35	Societal Project	00	06	00	--	100	--	100	3
6	INT	22JTTI36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6
TOTAL				**09**	**12**	**03**	**12**	**400**	**200**	**600**	**22**

Note: PCC: Professional core courses, PEC: Professional Elective Courses. **L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities**(Hours are for Interaction between faculty and students)

Professional elective-3		Professional elective- 4	
Course Code under 22JTT32X	**Course title**	**Course Code under 22JTT33X**	**Course title**
22JTT321	Financial Management	22JTT331	Geo-Textiles in Geo-Technical Engineering
22JTT322	Industrial Engineering	22JTT332	Nano Fibre Technology
22JTT323	Variability and its Control	22JTT333	Medical Textiles
22JTT324	Product Development	22JTT334	Biotechnology Applications in Textile Industry

Note:

1. Project Work Phase-1: The project work shall be carried out individually. However, if a disciplinary or interdisciplinary project requires more participants, then a group of not more than three shall be permitted.

Students in consultation with the guide/co-guide (if any) in a disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any), and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

2. Societal Project: Students in consultation with the internal guide and the external guide (much preferable) shall be involved in applying technology to work out/propose viable solutions for societal problems.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a department's senior faculty. The CIE marks awarded, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

Those, who have not pursued /completed the Societal Project, shall be declared as failures in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. Internship: Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M.Tech., intitle of the Programme (XXX) (Font 09Capital, Calibri)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	22XXX41	Project workphase -2	--	08	03	100	100	200	18
			TOTAL	--	**08**	**03**	**100**	**100**	**200**	**18**

Note:

1. **Project Work Phase-2:** Students in consultation with the guide/co-guide (if any) in the disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work on Project Work phase -1to complete the Project work. Each student/batch of students shall prepare a project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any), and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -2, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

SEE shall be at the end of the IV semesters. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M.Tech. TEXTILE TECHNOLOGY (JTT)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Mini–Project/ Internship	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22JTT31	Advanced Apparel Production Technology	03	00	02	03	50	50	100	4
2	PEC	22JTT32X	Professional elective 3	03	00	00	03	50	50	100	3
3	PEC	22JTT33X	Professional elective -4	**03**	**00**	**00**	**03**	**50**	**50**	**100**	**3**
4	PROJ	22JTT34	Project Work phase -1	00	06	00	--	100	--	100	3
5	SP	22JTT35	Societal Project	00	06	00	--	100	--	100	3
6	INT	22JTTI36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6
TOTAL				**09**	**12**	**03**	**12**	**400**	**200**	**600**	**22**

Note: PCC: Professional core courses, PEC: Professional Elective Courses. **L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities**(Hours are for Interaction between faculty and students)

Professional elective-3		Professional elective- 4	
Course Code under 22JTT32X	**Course title**	**Course Code under 22JTT33X**	**Course title**
22JTT321	Financial Management	22JTT331	Geo-Textiles in Geo-Technical Engineering
22JTT322	Industrial Engineering	22JTT332	Nano Fibre Technology
22JTT323	Variability and its Control	22JTT333	Medical Textiles
22JTT324	Product Development	22JTT334	Biotechnology Applications in Textile Industry

Note:

1. Project Work Phase-1: The project work shall be carried out individually. However, if a disciplinary or interdisciplinary project requires more participants, then a group of not more than three shall be permitted.

Students in consultation with the guide/co-guide (if any) in a disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any), and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

2. Societal Project: Students in consultation with the internal guide and the external guide (much preferable) shall be involved in applying technology to work out/propose viable solutions for societal problems.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a department's senior faculty. The CIE marks awarded, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

Those, who have not pursued /completed the Societal Project, shall be declared as failures in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. Internship: Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2022
M.Tech., intitle of the Programme (XXX) (Font 09Capital, Calibri)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

IV SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	Project	22XXX41	Project workphase -2	--	08	03	100	100	200	18
			TOTAL	--	**08**	**03**	**100**	**100**	**200**	**18**

Note:

1. **Project Work Phase-2:** Students in consultation with the guide/co-guide (if any) in the disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work on Project Work phase -1to complete the Project work. Each student/batch of students shall prepare a project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any), and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -2, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

SEE shall be at the end of the IV semesters. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms.

Semester- III

ADVANCED APPAREL PRODUCTION TECHNOLOGY			
Course Code	**22JTT31**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:02	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	03

Course Learning objectives:

Course aims at developing knowledge in advanced aspects of garment manufacturing including pre and post processing techniques

Module-1

The nature and scope of apparel manufacturing: Types of apparel manufacture-fundaments of apparel production. Basic types of apparel production process - major function of apparel manufacturing – engineering functions, management functions- apparel tradeassociation. Computerized pattern making in garment production. Principle of pattern making, garment balance, Size charts, pattern grading, computerized made to measure system, Technological advances in pattern making, Gerber technology, Lectra systems, material utilizations, application/developments in computer aided apparel systems, Future trends. Computerized cutting, marker quality and geometric principle for calculating optimum marking design, principles of stitch, seam and their analysis, seam quality, computerized sewing, pressing and moulding.

Module-2

Advances in apparel product development: Industrial change process model for clothing product development, models of new product development, product development tools and application area product life time management (PLM) Demand Led new product development future trends. Technological advances in sewing garment: History of sewing development of the industrial saving, machine advances in sewing needle design, advances in sewing thread technology, Advances in sewing machine automation, semi-automatic sewing equipment, machineusing computer numerical control. Future trends in cloth technology.

Module-3

Development in pressing technology for garment finishing: The pressing process, pressing with pressure pressing without pressure, crease resistant finishes and permanent creasing future trends. Packaging and ware housing: Type of packing and packing materials, quality specification, merchandise packing and shipping packing. Intra transport, ware housing, computerized storage systems.

Module-4

Production control: Production analysis, distribution of documents and records, types of control forms, producing many styles in one line and determining supervisory sections in production lines. Production control charts, reports, production grid principle for assigning partial production, line operators

Module-5

Indian apparel industry: Overview of technology in apparel manufacturing technology, usage, regional features and structures of the industry, Indian apparel export and important product category, domestic market and domestic brands, technology status and outlook. Apparel productivity- Apparel productivity in India and Western world, global comparison characteristics of low, medium and high productivity manufacturers and factors associated with productivity actions towards higher productivity.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1) Apparel Manufacturing Hand book: Analysis, Principles and Practice – Jacob Solinger, Van NostrandReinhold Company 1981.
2)Managing Productivity in the Apparel Industry – Rajesh Bheda, CBP Publisher
3) The Technology of Clothing Manufacture, Harold Carr and Barbara Latham, John Wiley & Sons
4) Seams Productions and Analysis -Radh D Clock
5) Advances in Apparel Production -Ed. by Catherine Fair Hurst, Textile Institute, Wood head PublicationsLimited, Cambridge

Skill Development Activities Suggested Skill Development Activities Suggested: visit to garment industries to study various aspects of modern garment manufacturing techniques

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain different types of apparel manufacture systems, Principle of pattern making, pattern grading, L2computerized made to measure system	L2
CO2	Explain Product development tools product life time management (PLM) Demand Led new product development future trends.	L2
CO3	Summarize the pressing process, Merchandise packing and shipping packing. Intra transport, ware housing, computerized storage systems	L2
CO4	Summarise Production control charts, reports, production grid principle for assigning partial production, line operators	L2
CO5	Explain Indian apparel export and importance of product category domestic market, Apparel productivity.	L2

FINANCIAL MANAGEMENT			
Course Code	**22JTT321**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- To familiarize the students with basic concepts of financial management.
- To understand time value of money and cost of capital.
- To analyze capital structure, capital budgeting and dividend decision.
- To understand the short term and long term financing and working capital management

Module-1

Financial Management: An overview, function and goals of financial management, financial planning andmajor financial decision areas.

Module-2

Capital structure: Theories of capital structure, NI and NOI approaches, capital structure decision, EBIT – EPSanalysis. RO – ROE analysis, cash flow analysis.

Module-3

Capital Budgeting: Methods of capital budgeting, investment criteria, NPV, IRR, Pay Back Period, Riskanalysis in capital budgeting.

Module-4

Working Capital Management: Current assets, Cash and Inventory management, EOQ, ABC analysis.

Module-5

Financial Analysis and Planning: Financial ratios, Break – even analysis and Leverages, application of financial analysis

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. . Financial Management – Theory and Practice, 8th Edition" – Prasanna Chandra, Tata McGraw Hill, New Delhi
2. Fundamentals of Financial Management – James C. Van Horne, John Martin Wachowicz, FinancialTimes/Prentice Hall, 2008
3. Financial Management – Keown Scott
4. Financial Management –M.Y. Khan and Jai

Web links and Video Lectures (e-Resources):

- https://youtu.be/WNm_ez1h7Tc
- https://youtu.be/qrs3taWpuD8
- https://ebooks.lpude.in/commerce/bcom/term_6/DCOM307_DMGT405_DCOM406_FINANCIAL%20MANAGEMENT.pdf
- https://youtu.be/_4i0jNDzCOE
- https://youtu.be/Vd0j6DxLL_A
- http://www.marciniak.waw.pl/NEW/120201/FM6.pdf

Skill Development Activities Suggested

- State the importance of Subject through related videos
- Seminars & Quizzes may be arranged in respective topics to develop skills
- Inspire the students by giving present day financial management in various Textile activities.
- Have the exposure to on line trading (NSE & BSE)
- Support and guide the students for Self-study.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Understand the basic financial concepts.	L2
CO2	Apply time value of money.	L3
CO3	Explain the Capital Budgeting.	L2
CO4	Estimate working capital requirements.	L5
CO5	Analyze the Financial Planning.	L4

INDUSTRIAL ENGINEERING			
Course Code	**22JTT322**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	

Course Learning objectives:

- To understand the role of Industrial engineers.
- Importance of industrial engineering department in Textile and Garment Industry.
- This course will enable the students to get familiarized with plant location, layout, work study and time study concepts

Module-1

Productivity

Scope of Industrial Engineering – industrial engineering concepts – Productivity indices –production per spindle – HOK – OHS – calculations – workloads – work assignments – Work content – added work content – reduction of work content –ineffective time – improving productivity – causes for low productivity in Spinning, Weaving, Wet Processing and garment industries. Remedial measures for low productivity.

Module-2

Work Study

Definition – Purpose – Techniques of work study – Procedure for work study Method Study

Definition – Procedure – Process chart and symbols – process sequence chart – outline process chart, flow process charts (man type –material type – equipment type), charts using time scale – multiple activity charts. Diagrams: string diagram – cycle graph, chrono cycle graph – travel chart. Textile and garment industry examples. Flow diagram for Textile and Garment Industry.

Module-3

Motion Study

Operation analysis – motion analysis – motion economy – two handed process chart – micro motion study – Therbligs – SIIMO chart – Textile and garment industry examples.

Time Study Procedure – Equipment's – Techniques of time study – Stop watch method – Predetermined Motion Time Standards (PMTS) – Rating. Allowances – Standard Time – Standard data – Textile and garment industry examples. Calculation of Standard Minutes Value (SMV)

Module-4

Layout

Layout planning – Types of layout – process, product, combination and fixed.Line Balancing

Objectives – Procedure – Techniques – Applications in Textile and garment units. Layout for Textile andgarment units

Module-5

Material Handling

Objectives – principles of material handling – relationship of material handling to plant lay-out – material handling equipment's – Descriptions and characteristics – Specialized material handling Equipment's for Textile and garment units.

Work Environment and Services

Lighting – Ventilation – Temperature Control and Humidity Control – Noise Control – Safety – Ergonomics. Hygiene – Feeding and Convenience related services ffinancial analysis

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. O. P. Khanna, Industrial Engineering and Management, Dhanpat Rai Publications (P) Ltd., New Delhi,2004.
2. Johnson Maurice, Introduction to Work Study, International Labour Organization, Geneva, 1995.
3. Jacob Solinger, Apparel Manufacturing Hand Book-Analysis, Principles and Practice, Boblin Media Corp,Columbia, 1991.
4. Rajesh Bheda, Managing Productivity of Apparel industry, CBS Publishers and Distributors, New Delhi2002
5. W. G. Ireson and E. L. Grant, Handbook of Industrial Engineering and Management, Prentice Hall of India,New Delhi, 1988.
6. Kiell B. Zandin and Maynard's Industrial Engineering Hand Book, Mc Graw Hill, Inc., New York, 2001.
7. James M. Apple, Plant Layout and Materials Handling, John Wiley & Sons, 1997.
8. Ralph M. Barnes, Motion and Time Study Design and Measurement of Work, John Wiley & Sons, NewYork, 1992
9. Elwood S. Buffa, Modern Production and Operations Management, Wiley Eastern, 1991.
10. A. J. Chuter, Introduction to Clothing Production Management, Blackwell Publishing, Oxford, 2004.

Web links and Video Lectures (e-Resources):

- https://gcekbpatna.ac.in/assets/documents/lecturenotes/POM_Module_1_Part2.pdf
- https://www.engineeringenotes.com/industrial-engineering/materials-handling/materials-handling-in-industries-equipment-and- types-engineering/23400
- https://www.managementstudyguide.com/material-handling.htm

Skill Development Activities Suggested

- Students may be asked take a case study of any industry and can analyze & submit the report.
- They can compare the different layouts and Line balancing activities and can suggest the alternate methods to improve the productivity

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Understand the Basics of Productivity	
CO2	Apply Work Study & Method Study	
CO3	Explain Motion Study & Time Study	
CO4	Understand Layout & Line Balancing	
CO5	Understand Material Handling Equipments	

VARIABILITY AND ITS CONTROL			
Course Code	**22JTT323**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- To understand the irregularities of spinning products.
- Importance of instruments used to assess the irregularities of spinning products.
- This course will enable the students to get familiarized analysis and interpretation of data and graphs remedial measures.

Module-1

Lap formation and control of lap uniformity. Irregularities of carded, drawn and combed Silver and their control.Irregularities in roving, yarns and their control

Module-2

Influence of different materials and their blends on irregularity. Index of blend irregularity and its influence onthe quality of end product

Module-3

Influence of ambient conditions on the irregularity of material at various stages of processing restricted tospinning of cotton and its blends

Module-4

Irregularities of yarns produced on ring, rotor, friction and air jet spun systems.

Module-5

Instruments used for measurement of irregularity – analysis and interpretation of data and graphs remedial measures.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
- to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

- Textile yarns, B.C. Goswamy, J.C. Martindale-Willey Interscience.
- Manual of cotton spinning, Vol IV. Part -1-Foster Textile Inst.
- An Introduction to the Study of Spinning - W E Morton, Lightning Source Incorporated, 2008
- Roller Drafting - Nogeera.

Web links and Video Lectures (e-Resources):

- https://textiletutorials.com/faults-in-blow-room-section-causes-and-remedies/
- https://texnoteblog.wordpress.com/2013/09/02/defects-in-blow-room-causes-for-defects/
- https://textilelearner.net/problems-of-carding-in-spinning/#:~:text=Main%20Problems%20%2F%20Defects%20in%20Carding%20Process%3A&text=High%20card%20waste,Bul ky%20sliver
- https://www.researchgate.net/publication/349233877_Determination_of_limiting_fibers_blend_irregularity
- https://core.ac.uk/download/pdf/236413134.pdf.

Skill Development Activities Suggested

- Students may be asked take a case study of any industry and can analyze & submit the report.
- They can compare the different layouts and Line balancing activities and can suggest the alternate methods to improve the productivity.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Understand the irregularities of spinning products	
CO2	Summerize the Blending & its irregularities	
CO3	Understand the Influence of ambient conditions on the irregularity of cotton and its blends.	
CO4	Evaluate the Irregularities of yarns produced on ring, rotor, friction and air jet spun systems	
CO5	Demonstrate and interpretation of data and graphs & apply remedialmeasures	

PRODUCT DEVELOPMENT			
Course Code	**22JTT324**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- Overview of product developments in textiles, clothing and industrial applications.
- Demonstrate Product improvement and product innovations in textiles, demand estimation and product development objectives.
- Demonstrate product development process, conceptual design, and technology and material selection.
- Describe design logic, specifications, costing, manufacturing strategies and evaluation of new products.
- Describe standards, testing and specifications for new products and case studies on developing textile products for selected end use applications.

Module-1

Overview of product developments. Scope of product development in textiles and clothing. Designing for functions aesthetics. Designing for apparel, clothing and industrial applications.

Module-2

Product improvement and product innovations in textiles. Demand estimation and product development objectives. Interaction between properties of fibre, yarn, fabric and garments properties.

Module-3

The product development process - requirements, key characteristics, recourses, conceptual design, technology selection, material selection, sampling, design and evaluation.

Module-4

Design logic, specifications, costing, manufacturing strategies and evaluation of new products.

Module-5

Standards, testing and specifications for new products. Case studies from the point of view of developing textile products for selected end use applications.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks**
- to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Fashion Design and Product Development, Harold Carr, John Pomeroy, Wiley-Blackwell, 1993.
2. Apparel Product Development, Maurice J. Johnson and Evelyn C. Moore, Pearson Education, 2001..
3. Apparel Product Development, 2nd Edition, Maurice J. Johnson and Evelyn C. Moore, Fashiondex Incorporation (Editor), Publisher: Dave Garza.
4. New Product Development: from Initial Idea to Product Management, Marc A. Annacchino, Publisher:Butterworth-Heinemann.
5. Handbook of Developments in Consumer Behaviour (Elgar Original Reference), Victoria Wells, Gordon Fox all.
6. The Apparel Design and Production Hand Book: A Technical Reference, Fashiondex Incorporation | Jan 1, 2000. Reference Books
1. Apparel Production Terms and Processes, by Janace E Bubonia, Fairchild Books, 2017
2. The Technology of Clothing Manufacture, 4th Edition, David J Tyler, Wiley 2008.
3. Garment Manufacturing Technology, By Rajkishore Nayak and Rajiv Padhye, Woodhead Publishing 2015. Design of Clothing Manufacturing Processes: A Systematic Approach to Planning, Scheduling and Control, By Jelka Geršak, Woodhead Publishing, 2013.

Web links and Video Lectures (e-Resources):

- NPTEL course and lecture series: https://nptel.ac.in/courses/
- U Tube simulation videos, etc..

Skill Development Activities Suggested

- Students can collect information on product development data's from apparel and textile industry and studying the same.
- Seminars, quizzes, group discussions and report writing on modern textile and apparel product development concepts.
- Case study on new product development for selected end use applications..

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Overview of product developments in textiles, clothing and industrial applications.	
CO2	Demonstrate Product improvement and product innovations in textiles, demand estimation product development objectives.	
CO3	Demonstrate product development process, conceptual design and technology and material selection.	
	Describe design logic, specifications, costing, manufacturing strategies and evaluation of new products.	
	Describe standards, testing and specifications for new products and case studies on developing textile products for selected end use applications.	

GEO-TEXTILES IN GEO-TECHNICAL ENGINEERING			
Course Code	**22JTT331**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	

Course Learning objectives:

- Course learning objectives: This Course aims at updating knowledge of students in fields of Designing, production, properties, applications and testing of geo textiles in geo technical engineering.

Module-1

An Overview of Geotextiles in Geotechnical Engineering, Historical development, Mechanism of geotextiles insoil as reinforcement, "How-Beam Analogy", Types of geosynthetics: geotextiles, geogrids, geonets, geomembranes, geocomposites. Applications of geosynthetics in civil engineering, Recent uses in India and abroad.

Module-2

Manufacturing: Materials and Process. Raw materials: polyamide, polyester, polyethylene, polypropylene, poly vinyl chloride. Different type of geosynthetics based on manufacturing, woven, monofilament, multifilament, slit filament, non-woven. Different bonding process: Mechanically bonded, chemically bonded, and thermally bonded. Use of natural fibres in geotextiles

Module-3

Properties of Geotextiles: Physical Properties: Mass per unit area, Thickness, Specific gravity. Hydraulic properties: Apparent open size, Permittivity, Transmissivity. Mechanical Properties: Uniaxial Tensile Strength, Biaxial tensile strength test Trapezoidal shear strength test, Bursting and Puncture Strength, Soil Geosynthetic friction tests. Durability: Abrasion resistance, Ultraviolet resistance

Module-4

Functions of Geotextiles: Reinforcement, Separation, Filtration, Drainage, Barrier Functions, Confinement. Concept about Randomly distributed fibres in soil. Effect of Bio – degradability of fibres or geosynthetics on thestrength behaviour of soil reinforcement. Applications of fin-drain the embankments

Module-5

Applications of Geotextiles: Use of geotextiles in roads, Use of reinforced soil in Retaining walls, Improvement of bearing capacity, Geotextiles in environmental control and landfills, Ground Improvement by guardians, Use of Geotextiles in lining of canals. Optimization of fibers/geogrids/genets/geosynthetics in the stabilization of soil using UCS test and model footing test. Effect of geosynthetics on the stabilization of sloped ground in hilly areas. Design of Reinforced retaining wall.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- Three Unit Tests each of **20 Marks**
- Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying equal marks.
- Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
- Each full question will have a sub-question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Geo Textile by NWM John.
2. Designing with Geo synthetics by R. M. Koerner
3. Geosynthetics in civil engineering, Edited by R. W. Sarsby, Published by Wood head Publishing Limited inassociation with The Textile Institute, 2007
4. Engineering with Geosynthetics by G.Venkatappa Rao and G.V.S Suryanarayana Raju – Tata McGraw Hill,New Delhi, 1990
5. Construction and Geotechnical Methods in Foundation Engineering by Robert M. Koerner – McGraw Hill,New York, 1985
6. Geosynthetics and Geotextile – Swamy sharan
7. Handbook on Geosynthetics and their applications, Sanjay Kumar Shukla, Thomas Telford, 2002. Reinforced soil structure – G.L.Shiva kumar Babu

Web links and Video Lectures (e-Resources):

- NPTEL course on Technical textiles and Geo Synthetics and reinforced soil structures.

Skill Development Activities Suggested

- Exposure of students to various geotextiles and testing of geotextiles

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Summarise concepts geotextiles	
CO2	Explain raw materials and production of geo textile products	
CO3	Conduct testing of geotextiles	
CO4	Describe applications of geotextiles	
CO5	Illustrate applications of geotextiles	

NANO FIBRE TECHNOLOGY			
Course Code	**22JTT332**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

Learn Nano fiber production by different methods and techniques, Types and processing of structured functional nanofibers Demonstrate properties of nanofibers, effects of different spinning conditions, controlling the morphologies of electro spun nanofibres:

Module-1

- Nano fiber production: Introduction, principles of electrostatic atomization, Electrospraying and electrospinning by the capillary method, Electrospraying and electrospinning by the charge injection method, Solution electrospinning, Melt electrospinning.
- Types and processing of structured functional nanofibers: Core-shell, aligned, porous and gradient nanofibers, Core-shellnanofibers, Aligned nanofibers, Porous nanofibers Gradient nanofibers, Applications of
- Structured functional nanofibers.
- Explain synthesis and properties of carbon nanotube and nanofibre reinforced polymer fibres. Analysing the rheological properties of nanotube/nanofibre polymer composites, microstructure of nanotube/nanofibre polymer composites, Mechanical, electrical and other properties.
- Learn the use of Nanofilled polypropylene fibres, Nanosilica filled polypropylene nanocomposites and their Applications

Module-2

Continuous yarns from electrospun nano fibers: Using electrospun nanofibers: background and terminology, controlling fiber orientation, producing noncontiguous or short yarns, producing continuous yarns.

Producing polyamide nanofibers by electrospinning: Introduction, the electrospinning process, Properties of electrospun nanofibers, measuring the effects of different spinning conditions and the use of high molecular weight polymers on the properties of electro spun nanofibers, Improving the properties of electrospun nanofibers.

Module-3

Controlling the morphologies of electrospun nanofibres: Introduction, the electrospinning process and fibre morphology, Polymer concentration and fibre diameter, Fibre bead formation and fibre surface morphology, Controlling fibre alignment and web morphologies, Bicomponent cross-sectional nanofibres, Future trends. Processing of composite functional nanofi bers: Formation of polymer and polymer composite nanofibers, Formation of polymer and nano particle composite nanofibers, Formation of polymer and inorganic salt composite nanofibers, Examples and applications of composite functional nanofibers.

Module-4

Carbon nanotube and nanofibre reinforced polymer fibres: Introduction, Synthesis and properties of carbon nanotubes, developing nanotube/nanofibre–polymer composites, Adding nanotubes and nanofibres to polymer fibres, Analysing the rheological properties of nanotube/nanofibre–polymer composites, Analysing the microstructure of nanotube/nanofibre polymer composites, Mechanical, electrical and other properties of nanocomposite fibres, Future trends.

Module-5

Nanofilled polypropylene fibres: Introduction, Polymer layered silicate nanocomposites, the structure and properties of layered silicate, polypropylene nanocomposites, Nanosilica filled polypropylene nanocomposites, Calcium carbonate and other additives.

Applications: Filtration applications, drug delivery applications, tissue engineering, in lithium-ion batteries, sensor applications, clothing for protection against chemical and biological hazards, food processing, sound absorption, electromagnetic wave attenuation and bioreactor, water purification, microelectronics.

Developments in nanofibers: Background, Nanotechnology, materials and nanofiber, Creation of new industries, Researches and global developments of nanofiber

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

3. Three Unit Tests each of **20 Marks**
4. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

6. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
7. The question paper will have ten full questions carrying equal marks.
8. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
9. Each full question will have a sub-question covering all the topics under a module.
10. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Nanofibers and nanotechnology in textiles, Edited by P. J. Brown and K. Stevens, Wood head PublishingLimited Cambridge,England, 2007.
2. Functional nanofibers and their applications, Edited by Qufu Wei, Wood head Publishing Limited, 2012. Handbook of Nanofibers, Edited by Ahmed Barhoum, Mikhael Bechelany, Abdel Salam HamdyMakhlouf Springer, 2019.
3. Nanofibers: Production, Properties and Functional Applications, Edited by Hua Fen Han, Scitus Academics 4. LLC, 2017.
5. Advances in Nanofibres, Edited by Russel Maguire, Intech Open, 2013.
6. Electrospun nanofibes, Edited by Mehdi Afshari, Woodhead Publishing, 2017.

Skill Development Activities Suggested

Skill Development Activities Suggested: Visit to Nano textile manufacturing units and study various aspects of nano fibre manufacturing.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Illustrate Nano fiber production by different methods, types and processing of structured functional nano fibres and application	L2
CO2	Explain background and terminology related Continuous yarns from electrospun nano fibers: producing polyamide nanofibres by electrospinning, properties of electrospun nanofibrees effects of different spinning conditions	L3
CO3	Demonstrate the electrospinning process and fibre morphology, Fibre bead formation and fibre surface morphology, processing of composite functional nanofibres and applications	L1
CO4	Analysing synthesis and properties of carbon nanotubes, rheological properties of nanotube/nanofibre polymer composites, microstructure of nanotube/nanofibre polymer composites, mechanical, electrical and other properties of nano composites fibres.	L2
CO5	Illusatrate polymer layered silicate nanocomposites, the structure and properties of layered silicate and other additives, applications and developments	L2

MEDICAL TEXTILES			
Course Code	**22JTT333**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

Course Learning objectives: Course aims at developing knowledge in various applications of textiles in medical field

Module-1

Biomaterials–introduction, types; natural, polymeric and biological biomaterials

Module-2

Textile based healthcare and hygiene products; application of Nano technology in medical hygiene textiles; advanced textile materials inhealthcare; infection control and barrier materials; plasma treated barrier materials.

Module-3

Bandages and pressure garments - elastic and non-elastic compression bandages, support and retention bandages; bandaging textiles; evaluationof bandages; bandages for various end uses.

Module-4

Wound – types, healing process; requirements of wound dressing; wound care materials – types, advantages and limitations; Testing of wound dressings; advanced wound dressings

Module-5

Implantable products; sutures – requirements, classifications, specifications, materials and their applications; vascular grafts, artificial ligaments, artificial tendons; scaffolds for tissue engineering; intelligent textiles for medical applications

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

5. Three Unit Tests each of **20 Marks**
6. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

11. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
12. The question paper will have ten full questions carrying equal marks.
13. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
14. Each full question will have a sub-question covering all the topics under a module.
15. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

(1) Allison Mathews and Martin Hardingham ., "Medical and Hygiene Textile Production – A hand book", Intermediate Technology Publications,1994

(2) Anand S.C., Kennedy J.F. Miraftab M. and Rajendran S., "Medical Textiles and Biomaterials for Healthcare", Wood head Publishing Ltd. 2006

(3) Joon B. Park. and Joseph D. Bronzino., "Biomaterials – Principles and Applications",CRC Press BocaRaton London, NewYork, Washington ,D.C. 2002

(4) Anand S., " Medical Textiles", Textile Institute, 1996, ISBN: 185573317X

(5) Horrocks A.R. and Anand S.C, "Technical Textiles", Textile Institute, 1999, ISBN: 185573317

Skill Development Activities Suggested Visit to nearby hospitals to demonstrate medical applications of textiles and to industries producing medical textiles

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Explain Biomaterials, types; natural, polymeric and biological biomaterials	L2
CO2	Summarise Healthcare and hygiene products, infection control and barrier materials, plasma treated barrier materials	L2
CO3	Explain Bandages and pressure garments, bandages for various end uses	L2
CO4	Summarize requirements of wound dressing; wound care materials and Testing of wound dressings;	L2
CO5	Implantable products; sutures artificial ligaments, artificial tendons; scaffolds for tissue engineering	L2

BIOTECHNOLOGY APPLICATIONS IN TEXTILE INDUSTRY			
Course Code	**22JTT334**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	03:00:00	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	

Course Learning objectives:

- Classify different types of enzymes and their industrial application. Learn genetics & biotechnology, current trends, principlesof microbial, plant, animal & environmental biotechnology, safety, social, moral & ethical aspects of biotechnology.
- Learn the production of cellulose-free polygalacturonase, enzymatic modification of hemp fibres, Enzyme-retted flax combined bioscouring and bleaching of cotton fibres.
- Expalin the effects of ultrasound on the performance of industrial enzymes
- Demonstrate enzymatic scouring for better textile properties of woven and knitted cotton and blended fabrics.

Module-1

Enzymes: Catalytic mechanism of few enzymes: Lysozyme, Chymotrypsin and serine protease, different classes of enzymes and their industrial application, application of enzymes in solution and in immobilized state, use of enzyme inhibitors as therapeutic agents.
Biotechnology: Biotechnology-an interdisciplinary pursuit, conventional & modern biotechnology, various natural raw materials for biotechnology, genetics & biotechnology, current trends and underlying principles of microbial, plant, animal & environmental biotechnology; safety, social, moral & ethical aspects of biotechnology.

Module-2

Production of cellulose-free polygalacturonase preparation by sclerotium rolfsii for bioscouring of cotton. Enzymatic modification of hemp fibres for sustainable production of high quality materials. Enzyme- retted flax using different formulations and processed through the USDA flax fibre pilot plant. Influence of enzymatic pre- treatment on the colours of bleached and dyed flax fibres. Combined bioscouring and bleaching of cotton fibres.

Module-3

The effects of ultrasound on the performance of industrial enzymes used in cotton bio-preparation/bio-finishing applications. Survey and recent report on enzymatic processing of bast fibres. Optimization of enzymatic scouring.

Module-4

Enzymatic scouring for better textile properties of woven and knitted cotton and blended fabrics. Recent developments in enzymatic scouring. Applications of enzymes in cotton cultivation and other types of fibre developments/productions.

Module-5

Integrated enzymatic pre-treatment of cotton fabrics. Enzymatic finishing of wool fabrics: Effects of different Treatments with a protease on physical and chemical parameters of the fabric. Application of enzymes in textileeffluent treatments.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

16. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
17. The question paper will have ten full questions carrying equal marks.
18. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
19. Each full question will have a sub-question covering all the topics under a module.
20. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Biotechnology in Textile Processing, George M Guebitz, Artur Cavaco-paulo, Ryszard Kozlowski.Published by food productspress, 10 Alice street, Binghamton, NY, USA..
2. Textile Processing with Enzymes, Editors: A Cavaco-Paulo G Gubitz, Woodhead Publishing, 2003
3. Bioprocessing of Textiles, C. Vigneswaran, M. Ananthasubramanian, P. Kandhavadivu, WoodheadPublishing, India, 2014.
4. Advances in Textile Biotechnology, 2nd Edition, Editors: Artur Cavaco-Paulo Vincent Nierstrasz QiangWang, Wood head Publishing, 2019.
5. Enzymes-Biochemistry, Biotechnology & Clinical Chemistry, 2nd Edition, By Trevor Palmer and Philip LBonner, Wood head Publishing, 2007.

Skill Development Activities Suggested : Demonstration of applications of Bio – Technology in textiles and visit to laboratory of biotechnology department for observations of biotechnology related phenomenon.

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Demonstrate catalytic mechanism of few enzymes, different classes of enzymes and their industrialapplication, conventional & modern biotechnology, genetics & biotechnology, current trends, safety, social, moral & ethical aspects of biotechnology.	L2
CO2	Illustrate production of cellulose-free polygalacturonase, preparation, production by different formulations and processed through the USDA flax fibre pilot plant.	L2
CO3	Explain the effects of ultrasound on the performance of industrial enzymes used in cotton bio-preparation/bio-finishing applications and Optimization of enzymatic scouring.	L3
CO4	Summarize Enzymatic scouring and its effects on properties of cotton and blended fabrics. Recent developments, applications	L3
CO5	Demonstrate integrated enzymatic pre-treatment of cotton fabrics. Enzymatic finishing of woolfabrics, effects and Application	L2

Project Phase-I			
Course Code	**22xxx34**	CIE Marks	100
Teaching Hours/Week (L:P:SDA)	00:06:00	SEE Marks	
Total Hours of Pedagogy		Total Marks	100
Credits	03	Exam Hours	

Course Learning objectives;

Review of literature related to project work

Defining the objectives of project work

Proposing methodology of the project work

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Review literature of the project work	
CO2	Prepare a consolidated report of the literature reviewed	
CO3	Prepare the presentation and present the reviewe of the literature	

Societal Project			
Course Code	**22xxx35**	CIE Marks	100
Teaching Hours/Week (L:P:SDA)	00:06:00	SEE Marks	
Total Hours of Pedagogy		Total Marks	100
Credits	03	Exam Hours	

Course Learning objectives: Identify the problems created by the Textile and allied activities to the society in terms of health, safety legal and cultural issues and find possible solution for the same

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum mark. The minimum passing mark for SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

Sl. No.	Description	Blooms Level
CO1	Identify the problems created by the textile industry to the society and conduct a case study	
CO2	Write technical repot related to the issues created by textile industry to the society in terms of health, safety legal and cultural issues	
CO3	Work out possible solutions and implement it for nearby textile industry	