VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

B.Tech.in Textile Technology

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

III SEMESTER

FIBRE TECHNOLOGY		Semester	III
Course Code	**BTX301**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

Course objectives:

This course aims at updating the knowledge of students in the following fields of fibre technology:

1. Different types of natural fibres, their production, grading etc.
2. Fundamental aspects of manufactured fibres and production of commodity fibers like regenerated fibres, PET, Nylon, PP PAN and high performance fibres.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills. Seminars and Quizzes may be arranged for students in respective subjects to develop skills. Encourage the students for group learning to improve thir creativity and analytical skills. Support and guide the students for self-study. Encourage students to observe working of various textile machineries to understand mechanisms Actual production ofnatural fibres can be demonstrated to students by taking them to agricultural fields. Arrange industrial visits to manufactured fibre industries.

Module-1

Introduction to textile fibres and essential requirements of textile fibres. Classification of textile fibres. **Cotton fibres** – Origin, History, Cultivation, Grading, organic and BT cotton. **Bast fibres -** Introduction,Types of bast fibres, method of extraction of bast fibres, Introduction to Banana, coir fibres. Flow chart for the conversion of fibres to yarn and fabric. Position of India with respect to world in fibre production.

Module-2

Protein fibres: - Introduction to natural protein fibres. **Silk fibre-** Study of life cycle of Silk worm. Extraction of silk fibre, Different verities of silk yarns and brief introduction to wild silk, and spun silk. **Wool** – origin, different types of wool, grading of wool

Introduction to manufactured fibres.- Types of manufactured fibres, comparison of manufactured fibres with natural fibres. Concepts of manufactured fibres spinning, Spin ability concept of polymeric fluids. Brief out line on melt, dry and wet spinning. Comparison of these spinning methods. Process variables in melt spinning. Instabilities in melt spinning, High speed melt spinning. Introduction to post spinning operations i.e. drawing, heat setting, texturing and tow to top conversion.

Module-3

Brief outline on special shaped fibres, micro denier, ultrafine and Nano fibres. **Spin finish applications**- objectives, formulations and methods of applications. **Regenerated fibres** - types of fibres, Chemistry and production of regular Viscose rayon, Di-acetate, Tri acetate, Cuprammonium and Eco-friendly rayon fibres. Studies on modification of viscose rayon. Studies on regenerated Bamboo fibres

Module-4

PET fibres. Raw materials for production of PET. Study of production of PET by DMT & TPA routes - study of side reactions, degradation reactions during PET production. Modification of PET fibres Biodegradable polyester fibres. **Polyamide fibres**, Discussion on Production of polyamides, study of semi-continuous & integrated continuous process for Production of nylon-6, Production of nylon-66. Modification of nylon fibers. **PAN fibers** – introduction, Types, different methods of Production of PAN polymer & Spinning of PAN fibers. **Polypropylene fibres**: Brief outline on production of isotactic polypropylene fibres.

Module-5

Introduction to high performance fibres. Classification of high performance fibres. Study of production and properties of carbon, boron, silicon carbide, alumina & glass fibres. Study of Production of UHMWHDPE by GEL Spinning. LCPS, Types of LCPS. Study of Production of aromatic polyamides viz. Nomex, Kevlar. Concept of liquid crystal, thermo tropic & leo tropic polymers fibres. Production and properties of PBZT and PBZO and aromatic polyester fibres. Elastomeric fibres- origin, definition and production details

Course outcome (Course Skill Set)

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

Course outcome (Course Skill Set)

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

1. Illustrate and recall history and growth of textile fibers, textile industry and explain productionand properties of cotton and bast fibers
2. Demonstrate production and properties of natural protein fibers and concepts of manmade fibre spinning
3. Classify regenerated bio based fibers and explain production of regenerated fibres and ecofriendly for bio based fiber and summarize different shapes of fibres.
4. Demonstrate concepts synthetic fibers, their effect on environment and explain about mostcommonly used synthetic fibres.
5. Summarize and compare production of inorganic high performance fibers, LCPs, polyethyleneand their applications in various field of engineering.

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books Suggested Learning Resources:

Text Books:

1. **Hand book of Textile fibre,** Cook J. Vol.1 & II, Marrow Wat Ford, England.
2. **Textile fibres,** Shenai V.A., Sevak Bombay, 1980.
3. **Manufactured fibre technology,** Gupta V.B, Kothari V.K., Chapman Hall, London, 1997.
4. **Introduction to Textile fibres,** Srinivasa Murthy H.V, T.A.I., Mumbai
5. **Handbook of natural fibres**. Vol. - I R.M.Kozlowski Wood-Head. London- 2012.

References

1. **Manmade fibre science and Technology,** Mark Atlas, Vol.I& II, Wiley, NT 1967.
2. **Fundamentals of fibre formation,** Ziabicki A. Wiley NY 1976.
3. **Formation of synthetic fibres,** Walczalk.K. Gordon & Sci. London 1977.
4. **High speed fibre spinning,** Ziabicki A. Wiley NY., 1985.
5. **Manmade fibres,** Moncrief R.W. John Wiley and sons, N.Y. 1966
6. **High Performance fibres**, J.W.S.Hearle, Wood Head,UK-4005.
7. **Gohl E P G and Vilensky LD**, "Textile Science", CBS Publishers, Delhi, 1983.

Web links and Video Lectures (e-Resources):

1. NPTEL course on Textile fibres
2. NPTEL course on Manufactured Fibre Technology
3. NPTEL course on High Performance and Specialty Fibres

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

Quizzes, group discussions, seminars and report writing on various aspects of textile fibres.
Practical exposure to various natural and manufactured fibres and demonstrating environmental effect of synthetic fibres.

CHEMICAL PROCESSING OF TEXTILES - I		Semester	III
Course Code	**BTX302**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

- This subject helps the student to acquire knowledge of Chemical preparatory process
- This subject prepares the student work in chemical processing industry.
- Students are exposed to research field in chemical processing technology.
- Learn the chemistry of the various dyes and dyeing processes carried out in chemical processing department.
- Exposed to actual mechanisms involved in various dyeing operations and processes carried out in the industry.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

- Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching methods may be adopted to develop the outcomes.
- Use PowerPoint/Videos/Animations to explain various concepts.
- Encourage group discussion in the classes.
- Ask some creative and higher-order thinking questions in classes which helps critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it
- Support and guide the students for self-study.

MODULE-1

Introduction to Chemical processing, preparatory operations and sequences, Chemicals and auxiliaries used and their functions. Shearing and cropping - objects and working. Singeing–objects, methods and working of various singeing machines, Desizing– objects, mechanism, and various methods of Desizing. Scouring-objects, mechanism, method of scouring of cotton and synthetic textiles. Degumming of silk, Scouring of wool and jute.

Modern developments in Desizing and scouring.

MODULE-2

Bleaching mechanism and methods of various bleaching. Optical whitening and method of application of OBA on various textiles. Quality control methods used for determination of degradation of cotton during scouring and bleaching. Machineries used for Preparatory Process, Batch, Semi-continuous and continuous processes. Objects of mercerization, physical and chemical changes in cotton due to mercerization, various factors affecting mercerization, degree or efficiency of mercerization process. Modern developments in Bleaching.

MODULE-3

Various methods and Machines used for yarn and fabric mercerization, Principle of hot mercerization, Modern developments in mercerization. Brief study on eco-friendly processes. Water and energy management in preparatory processes. Classification of dyes and principles of dyeing. Chemicals and auxiliaries used for textile dyeing and their functions. Chemical constitution of dyes. Effect of fibre structure on dyeing behaviour.
MODULE-4
Theories of dyeing. Action of electrolytes, effect of dye bath temperature, material to liquor ratio, dye bath pH. Modern concepts of dyeing and selection of dyes for specific end uses. Evaluation of fastness properties of dyed materials. Direct dyes – Classification, properties, application, and after treatments. Reactive dyes – Classification, properties, dyeing conditions, and applications.
MODULE-5
Vat dyes - Classification, properties, dyeing conditions, application. Sulphur dyes - Classification, properties, dyeing conditions, application. Azoic dyes - Classification, properties, dyeing conditions, application. Acid dyes - Classification, properties, dyeing conditions and application. Metal Complex Dyes - Classification, properties, dyeing conditions and application. Basic dyes - Classification, properties, dyeing conditions and application.

PRACTICAL COMPONENT OF IPCC

Sl.No	Experiments
1	Desizing of cotton fabric using acid and enzymes
2	Scouring and Bleaching of cotton and wool
3	Degumming of Silk and Mercerization of cotton yarn
4	Dyeing of cotton and silk using Direct and Acid dyes
5	Dyeing of cotton using reactive and vat dyes
6	Dyeing of cotton using Sulphur dyes
7	Dyeing of cotton using Azoic dyes
8	Dyeing of cotton and silk using basic dyes
9	Demonstration of Dyeing of cotton fabric using winch and jigger machine

Course outcomes (Course Skill Set):

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

- Explain the fundamental concept of chemical preparatory process, chemicals used and their functions, shearing and cropping, singeing, Desizing, Scouring and Degumming of silk
- Explain the bleaching process of various textile fibres, Basic concepts of optical whitening, Summarize the various machineries used, Mercerization of cotton, degree or efficiency of mercerization
- Explain the methods and machines used for mercerization. Test methods, water energy consumption, eco-friendly preparatory process, Classification of dyes, illustrate the use of chemicals and auxiliaries used in dyeing and their functions.
- Apply theories of dyeing and understand various parameters influencing dyeing process, Explain chemistry, properties and application of Direct and Reactive dyes on Cellulosic fibres
- Illustrate the chemistry, properties and application of Vat, Sulphur, Azoic, Basic and acid dyes on cotton and protein fibres.

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 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 the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- 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**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

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**)

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored by the student shall be proportionally scaled down to 50 Marks

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 may include questions from the practical component.

Suggested Learning Resources:

Books

1. Technology of Textile Processing-Vol. III-A Shenai-Sevak Publications-1975
2. Technology of Bleaching and Dyeing of textile fibres-Chakraborthy, -Coxtown Publications-1972
3. Chemical Processing of Textiles-Preparatory, Processing and Dyeing-Dr. C.V.Koushik- Mr.Antao-Irwin Josico NCUTE, IIT, New Delhi 2003
4. Fundamentals and Practices in Colouration of Textiles J.N. Chakraborty-Wood head Publishing India Pvt. Ltd. 2009

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/116102016
- https://www.cbse.gov.in/publications/vocational/Textile%20Design/CBSE%20CIT%20Textile%20Chemical%20Processing-XII%20text.pdf
- http://www.nitttrc.edu.in/nptel/courses/video/116102052/lec1.pdf

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

- Quiz/Group discussion.
- Practical demonstration of preparatory process and dyeing of all five modules content.
- NCUTE and YouTube videos

WEAVING TECHNOLOGY -I		Semester	III
Course Code	**BTX303**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

This course aims at updating the knowledge of students in the fields of weavingpreparatory and waving technology.

- Fundamental aspects of warp and weft winding machines. Uster classimat systems and autowinding machines.
- Studies on sizing, sizing ingredients, sizing machines and various aspects of sizing and recenttrends in sizing.
- Fundamentals of weaving and basic motions of weaving.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, working models, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Hands on training may be arranged for students to learn practical aspects.
3. Encourage the students to learn machinery operations various settings and maintenance.
4. Support and guide the students for self-study

MODULE-1

Necessity, Objects and principles of winding. Classification and general features of winding machines, electronic yarn clearers. Clearing efficiency. Uster classimat systems. Classification of auto winding machines. Salient features ofAutoconer, Uniconer, and Schlrofhast B.C Spooler etc.

Practical component.

Passage of material through winding machines, setting of tensioners, yarn clearers, production and efficiency calculations on winding machines.

MODULE-2

Objects and systems of warping. Study of different types of creels. Study of different types of sectional warping& beam warping machines and their salient features. Special requirements of yarn preparatory for shuttle less weaving machines. Introduction to weft preparation, weft winders. Study of different types of weft winding machines.

MODULE-3

Objects of sizing. Study of Ingredients used for size preparation. Size formulation, study of mixing vessels such as pressure cookers, injection cookers, Techniques of sizing, types of Sizing. Sizing recipes for different fibre yarns. Salient features of modern sizing machines, Drying principles – multi-cylinder drying, hot air drying, radiation drying. Concept of single-end sizing.
MODULE-4
Controls in sow box - stretch and its control, moisture measurement and temperature control. Recent trends in sizing i.e. foam sizing, solvent sizing, hot melt sizing. High pressure squeezing, migrating behaviour of warp end. Post sizing operations - Drawing-in, leasing, knotting, automatic drawing in machine.
MODULE-5
Introduction to weaving and looms. Basic motions of weaving. Shedding - Different types of shed. Positive and negative tappet shedding. Merits and demerits of tappet shedding, timing, setting, early andlate shedding. Picking - Objectives of picking. Types of picking, picking accessories. Timings & setting methods to alter the timing & strength of picking mechanism. Shuttle checking devices for over & under picking mechanism. Beat-Up- Objects: Crank Beat up. Eccentricity of slay. Factors affecting the sley eccentricity. Cam beat-up mechanism. Different types of reed, reed count.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Passage of material through non-automatic and automatic winding machines. Study of the salient features, speed, production and efficiency calculations
2.	Working on double flanged bobbin winder. Speed, production and efficiency calculations of double flanged winding machine
3	Passage of material through non-auto pirn winding machine. Adjusting the bunch length, speed, production and efficiency calculations
4	Passage of material through automatic pirn winding machine. Adjusting the bunch length, speed, production and efficiency calculations
5	Passage of material through sectional &beam warping machine. Calculation of machine
6	Passage of material through sizing machine. Calculations related to speed, production and efficiency
7	Dismantling, assembling, setting and timing of tappet shedding mechanism.
8	Dismantling, assembling, setting and timing of cone over pick.
	Dismantling, assembling, setting and timing of Beat-up mechanism
9	Preparation of warp on sectional warping machine and related calculations
10	Plan of warp patterns for stripes and check fabrics
11	Study of different types of sizing ingredients, cooking and mixing beck
12	Knotting, drawing - in and denting of weavers beam.

Course outcomes (Course Skill Set):

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

1. Explain warp preparation, non-auto and auto winding machines and Demonstrate Winding operations.

2. Summarize warping &weft winding operation and requirements of yarn for shuttle less weaving.
3. Illustrate Sizing processes, ingredients, and post sizing operations
4. Classify and explain basic motions of weaving.
5. Determine production of winding, warping machines and power looms and dismantle and assemble of power loom parts and production of fabrics.

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

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- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- 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**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

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 have ten questions. Each question is set for 20 marks.
2. 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.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

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 may include questions from the practical component.

Suggested Learning Resources:
Books

1. **"An Introduction to Winding and Warping", Talukdar M K, Talukdar, Bombay Pvt. Circulation.**
2. **"Warp sizing mechanisms", Ramsbottom Columbia press, Manchester, 1965.**
3. **Weaving tablets, Textiles Association of India, Bombay, 1985.**
4. **Yarn preparation, Sengupta R. –Vol I & II Mahajan Pub. Ahmedabad, 1970.**
5. **Modern Preparation and weaving, Ormerod A. Butterworth publication Co. 1983**
6. **Textile Sizing by B.C.Goswamy**
7. **Principles of weaving mechanism by Robinson &Marks**

Weaving machines, mechanisms, Management.M.K.Talukdar. Mahajan Pub. Ahmedabad

Web links and Video Lectures (e-Resources):
NPTEL Courses on weaving preparatory

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

1. Demonstration of winding machines, accessories setting of winding machines.
2. Demonstration and setting of pirn winding and warping machines.
3. Collecting various sizing ingredients nearby industries and study their suitability for differentyarns.

4.Visiting nearby Textile industries to learn various aspects of weaving preparatory

SPINNING TECHNOLOGY -I		Semester	III
Course Code	**BTX304**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

The objective of this Course is to describe

- The basic spinning processes in Textile Industry
- To understand the various spinning operations such as Blow Room, Carding and Drawing.
- Students acquire theoretical knowledge about the machineries used.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Use the related videos of Textile machineries so that student can understand more easily.
2. Show the students the working of these machines, by arranging to visit to spinning mills.
3. Inspire the students to have collaborative learning in the class.
4. Support and guide the students for Self-study.

Module-1

Importance and need of Ginning. Explanation of working of different types of gins. Defects, causes and remedies of ginning. Baling process and bale weights Impurities in the cotton and remedies to minimize impurities in cotton. Important cotton types and trash in those cottons. Grading of cottons Definition and objects of mixing and blending. Types of blending and common blends. Influence of fibre parameters namely length, fineness, strength, elongation, chemical deposits and neps on spinning performance

Module-2

Objects of Blow room and identification of its components. Types of opening action in blow room. Brief study Of bale pluckers and bale grabbers. Study of design features and different types of openers and beaters on the Present day Blow room. Modern developments in Blow room. Evaluation of Blow room performance - Hank calculation, production and efficiency calculation. Process Modification required in blow room to process blends of Polyester/cotton and polyester/viscose. Study of blow room line required for processing different types of blends.

Module-3

Definition and objects of revolving flat card. Study of design features and different types of clothing on licker in, cylinder and doffer and their specifications. Passage of material through revolving flat card. Auto leveller on card and its importance. Types of auto leveller, Setting of different parts of card and gauges used for setting. Definition of draft in card and study of different types of draft and its calculation. Objects of stripping and grinding and their importance.

Module-4

Modern developments and salient features of modern cards. List out specification of the present day cards. Calculation of hank of sliver, production and efficiency in carding. Objects and principle of draw frame. Study of different drafting systems through sketches and name the types of draft in the drafting zone. Types of loading systems. Roller setting and procedure of roller setting. Auto levellers on draw frame

Module-5

Study of long and short creel draw-frames and their advantages and limitations. Brief study on bercolisation, scouring, buffing, roller eccentricity, shore hardness, calculations of draw frame such as production. Modern developments in draw frame and specifications of the present day draw frame

Course outcome (Course Skill Set)

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

1 Explain the Importance of Ginning and Cotton Grading

2.Demonstrate the Working of Openers and Cleaners in Blow room

3 Demonstrate the Working of Carding Machine and its latest updates

4.Explain Working Principle of Draw Frame

5. Demonstrate the different types of draw frames and draw frame calculations.

Assessment Details (both CIE and SEE)

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Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1 **Manual of Cotton Spinning** Coulson Textile Institute,Manchester 1958

2 **Series on Textile processing** Zaloski. S Institute of Textiles Technology USA, 1983

3 **Technology of short-staple spinning** Klein. W Textile Institute Pub., Manchester**,** 1989 4 **Spun Yarn Technology** Oxatoby Butterworths, London 1987.

4 **Contemporary Textile Engineering** Happey. F Academic Press Inc 1981.

5 **Cotton Spinning Calculations** Pattabhiraman. T.K Soumya Pub., Bombay 1979

6 **Cotton Opening & Carding** Merril G.R G.R. Merill, Lowell Mass 1955

7 **Blowroom and carding** --- NCUTE 2000

Web links and Video Lectures (e-Resources):

NPTEL courses on spinning technology.
Activity Based Learning (Suggested Activities in Class)/ Practical Based learning **Students can be taken to spinning industry to learn the actual process of spinning.** **Case studies can be done to understand the quality of lap, sliver etc.**

SPINNING TECHNOLOGY LAB-I		Semester	III
Course Code	BTXL305	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03
Examination nature (SEE)	Practical		

Course objective:

- To understand the various spinning operations such as Blow Room, Carding and Drawing. Students acquire theoretical knowledge about the machineries used.

Sl.NO	Experiments
1	Passage of material through the blow room and different openers and beaters of blow room and calculations of speeds of different parts of each machineries
2	Calculation of cleaning efficiency at all beaters and openers. Working on Trash Analyzer and related Calculations
3	Study of piano feed regulating motion and calculation of cone drum speed, feed Roller speed and beats/inch
4	Calculation of Shell roller speeds at normal & doffing time. Calculation of Tension draft at Scutcher
5	Speed and draft calculation of different parts of carding with the help of gearing and driving
6	Draft constant and its calculation of card. Draft change pinion calculation and machine operation to get different hank of slivers.
7	Break draft, main draft and total draft calculation Drawframe.
8	Production, delivery speed, calculation of hank of sliver, efficiency calculation of draw frame
	Demonstration Experiments (For CIE)
1	Driving arrangements and demonstration of all machineries of Blow room
2	Settings of different parts and gauges used setup the machines
3	Passage of material through draw frame and list the parts and their functions.
4	Setting of drafting zone and processing of material as per the hank required in Draw frame.

Course outcomes (Course Skill Set):

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

1. Explain the Passage of Material and Working of Various Machines in Blow Room Line

2.Determine the Speeds of Various parts of Blow Room Machineries

3. Demonstrate settings and Quality Studies in Blow room and explain the Working of Carding Machine, draw frame and their settings

4. Determine the speeds and draft in of carding and draw frame

5.Produce sliver from draw frame and carding machines and determine production , sliver linear density of card and draw frame

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

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

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are 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 down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a 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 marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of 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 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 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources: Spinning manuals, charts and hand-outs on spinning, visit to spinning industry.

SERICULTURE AND SILK TECHNOLOGY		Semester	III
Course Code	**BST306A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

- Status of sericulture and growth of silk industry in India & abroad.
- Principles of Rearing silk worms, environmental condition of rearing, grainages.
- Physical and commercial characteristic of cocoon reeling machine and technology advancements.
- Silk by products, wet processing and recent developments in wet processing.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
3. Encourage the students for group learning to improve their creativity and analytical skills.
4. Support and guide the students for self-study.
5. Actual production of mulberry plants can be demonstrated to students by taking them to agricultural fields.
6. Arrange Sericulture fields to visit mori-culture and sericulture cottage industries.
7. Encourage students to observe growth of mulberry plants to understand moriculture and sericulture.
8. Students can be taken to research laboratories to demonstrate about modern tools and techniques used for the production of silk.

Module-1

Introduction to sericulture and silk industry. Status of sericulture and silk industry in India and abroad. Mulberry cultivation practices, environmental conditions, types of mulberry plants. Silkworm rearing and Environmental conditions for silkworm rearing, various methods. Chawki rearing, Late age silkworm rearing, recent developments in rearing. Seed production & grainage activities. Silkworm diseases, pests & their control.

Module-2

Introduction to Mulberry and Non-mulberry (wild) silks and their applications. Different types of cocoons, Physical and commercial characteristics, sorting and testing of cocoons. Stifling of cocoons & Cocoon storage: objectives. Cocoon cooking: process and various methods: open pan, three pan, Conveyor cooking etc. Merits & Demerits of silk reeling, systems of reeling, charka, cottage basin, multi-end filature, automatic reeling machine, re-reeling process, recent developments in silk reeling.

Module-3

Silk throwing: Objectives. Winding, Doubling, Rewinding and Twisting, Manufacture of silk yarns for ordinary, Soft, Chiffon, Crape, Georgette and Voile silk fabrics. Recent developments in silk throwing machines. Silk weaving preparatory for warp & weft yarns. Silk handloom & power looms special features, modifications required to weave silk fabrics.

Module-4

Introduction to spun silk industry, Different source of silk waste, Sequence of operations in spun silk production. Italian & Japanese silk spinning systems. End uses of spun silk yarns. Noil yarns. Seri plane testing of silk yarns. Testing & Grading of silk yarns.

Module-5

Dyeing of silk yarns & fabrics. Advantages and disadvantages of loom finished silk fabrics in India. Printing & finishing of silk fabrics. Recent developments in wet processing of silk fabrics, silk by-products: properties and application. Silk Sericin: extraction, characterization and applications.

Course outcome (Course Skill Set)

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

- Explain status of Sericulture & Silk industry in India and World and Classify and explain the mulberry cultivation and silkworm rearing
- Explain the physical and commercial characteristics of silk and stifling, cooking an dressing of silk
- Demonstrate the silk throwing and manufacture of silk fabrics.
- Explain the spun silk production and Test, and grade the silk and illustrate chemical processing of silk.
- Explain dyeing of silk fabrics and silk by-products, their 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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Hand Book of Practical Sericulture, S R Ullal and M N Narasimhanna, Central Silk Board, India, 1987
2. Manuals on Sericulture, Vol – I, &II, Various Authors, FAO Publication, 1976

3. Handbook of Sericulture Technologies, S.B. Dandin, Central Silk Board, 2003
4. Mulberry Silk Reeling Technology, D. Mahadevappa, V G Halliyal, D G, Shankar, Ravindra, Bhandiwad, Oxford and IBH Publishing Company Pvt. Ltd, 2000
5. Handbook of Silk Technology, T N Sonwalkar, Taylor and Francis, 1993
6. Silk Wet Processing, Dr. M. L.Gulrajani, IIT Publication
7. Silk Weaving Compiled by Zhejiang Silk Engineering Institute, Science Pub Inc. 2002

Web links and Video Lectures (e-Resources):

- Central Silk Board: https://csb.gov.in/publications/
- Karnataka State Sericulture Research and Development Institute: https://kssrdi.karnataka.gov.in/english
- Food and Agriculture Organization of the United Nations (FAO): https://agris.fao.org/agris-search/search.do?recordID=XF7601187

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

- Collection of various silk properties from literature and studying their properties
- Collecting various silk cocoons, filaments and fabrics from silk industries/R&D centres and studying their appearance, feel etc.
- Seminars, quizzes, group discussions, seminars and report writing on various silk cultivation & productions.
- Finding out various parameters of cocoons and silk filaments in textile testing laboratory / textile committee

SUSTAINABLE TEXTILE TECHNOLOGIES		Semester	III
Course Code	**BTX306B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

This course aims at updating the knowledge of students in the following fields sustainable textiles

1. Sustainability and its significance in the pretext of textile industries.
2. Energy efficient processes Waste reduction techniques,
3. Modified technologies for chemical processes
4. Recycling of textiles and its waste

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills. Seminars and Quizzes may be arranged for students in respective subjects to develop skills. Encourage the students for group learning to improve the creativity and analytical skills. Support and guide the students for self-study. Encourage students to observe sustainable technologies. Make students to create awareness about sustainable technologies among publics.

Module-1

Introduction: Present scenario in various sectors of textile industries and its consequences on growth of industry. Sustainability and its significance in the pretext of textile industries Approaches to different forms of sustainable procedures, logistics systems, value chains and Green technology in textiles.

Module-2

Modified technologies for chemical processes: Modified technologies of colouration, Processing with low liquor ratio, Mass coloration of textiles, Continuous application techniques, Dyeing of blends, Bioprocessing of textiles, Controlled application techniques, Combination of various processes like, desizing - scouring, scouring – bleaching etc. Dyeing at room temperature, viz. vat, reactive and direct dyeing of cotton.

Module-3

Energy efficient processes: Various techniques to reduce wastage of energy. Ascertaining boiler capacity with production volume, Precautions to reduce wastage of steam and electricalenergy.

Module-4

Waste reduction techniques: Need for solid and hazardous waste management in textile industry, types and sources of solid and hazardous waste management in textile industry. Wastewater management, Norms of using water in processing and discharge to public sewage. Various technical approaches to reduce waste water load. Analysis of effluent, Zero Dischargeof Hazardous Chemicals (ZDHC).

Module-5

Recycling of textiles and its waste: Life cycle of textile products, Recycling of polymer and fibre waste, Recycling of waste fibres and fabrics for nonwoven fabric production.

Course outcome (Course Skill Set)

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

1. Recognize the importance of sustainable technologies in textiles
2. Summarize modified technologies for chemical processes with respect to sustainability and compare conventional chemical process with modified processes
3. Interpret energy efficient process in textile processes
4. Classify and explain waste reduction techniques in textile industry.
5. Recognize the need for recycling and illustrate recycling of textiles and its waste

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Books:

1. Youjiang Wang, "Recycling in Textiles", Woodhead Publishing Limited, Cambridge 2006.

2. Sabit Adanur, "Wellington Sears Handbook of Industrial Textiles", Technomic Publications Co. Inc., Lancaster, 2006.

3. Miraftab M and Horrocks R, "Eco-Textiles", Woodhead Publishing Limited, Cambridge 2007.

4. Schindler W D and Houser P J, Chemical finishing of textiles, Woodhead Publishing Co, Chembridge, 2004

5. Smethwurst G, " Basic water treatment", IBT Publications, Delhi, 1989

6. Cavaco-Paulo A and Gubitz G M, Textile processing with enzymes, Woodhead Publishing, Cambridge, UK. 2003,

7. Nierstrasz V A and Cavaco-Paulo, Advances in textile Bio-technology, Woodhead Publishing, Cambridge, 2010

8. Gardetti, M.A., Torres, A.L. Sustainability in fashion and textiles: Values, Design, Production and Consumption, Greenleaf Publishing (latest edition). Pal, R.Managing fashion apparel value chains (latest edition).
Web links and Video Lectures (e-Resources):
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Activity Based Learning (Suggested Activities in Class)/ Practical Based learning Quizzes, group discussions, seminars and report writing on various aspects of sustainable technologies in textiles. Case studies on benefits of sustainable technologies in textiles.

FIBRE REINFORCED COMPOSITES		Semester	III
Course Code	**BTX306C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

This course aims at updating the knowledge of students in the following fields textile technology

1. Raw materials for composites
2. Production of composites
3. Properties and applications of composites

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
3. Encourage the students for group learning to improve their creativity and analytical skills.
4. Support and guide the students for self-study.
5. Encourage students to observe working of various moulding machines

Arrange industrial visits to composite manufacturing sectors

Module-1

Introduction to composites. Basic nomenclatures – reinforcing phase, continuous phase, matrix, interface etc. Classification of composites with respect to fibre used, matrix used, limitations of engineering metals.

Meaning of bio composites, advantages of bio composites. Different forms of fibres for composites, 3D fabrics for composites

Module-2

Study of mechanical & thermal properties various fibres Viz. Carbon, glass, silicon carbide, boron, Kevlar, polyethylene, thiozole etc. used in the production of fibre reinforced composites.

Matrix materials for composites Classification of resins, thermoset, thermoplastic metal matrix and their production properties, advantages, disadvantages (phenolic, epoxy, polyester, vinyl esters) Meaning of bio composites, advantages of bio composites.

Module-3

Composites manufacturing techniques-Introduction-Meaning of interphase, types of bond set interphase, meaning of lamina, laminates, and representation of laminates. Pre-peg technology, Hand lay-up-spray-up -filament winding.

Compression moulding, injection moulding, poltrusion techniques. Brief outline of mechanical and thermal properties of various composites viz. Glass, boron, carbon, aramid.

Study of various applications of composites mainly in the field like Aero plane, aerospace, medical, sports, ship building automobiles and industries

Module-4

Brief outline on testing of composites - Characterization of physical constituents of composites - composite density, fibre volume fraction, void content.

Testing of tensile strength of composites, 3 & 4 point bending of composites, comparison testing of composites. NDT tests of composites.

Composite mechanics-failure mechanism in composites. Derivations of various equations related to composite structures viz. Axial modulus, transverse modulus, breaking strength of continuous

filament reinforced composites, effect of volume of fibres on mechanical properties of fibre reinforced composites.
Fatigue and creep process in fibre reinforced composites

Module-5

Applications of composites: Study of various applications of composites mainly in the field like Aero plane, aerospace, medical, sports, ship building, automobiles and industries. Brief introduction to use of Nano-fibres in composite production and their applications.

Course outcome (Course Skill Set)

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

1. Describe basic concepts of fibre /textile reinforced composite materials and the raw materials for composites and
2. Explain the properties of fibres and resins used for composite production
3. Demonstrate methods of manufacturing of composites and list the properties of composites n
4. Test and analyse the composites for physical and mechanical properties
5. Explain the applications of composites

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. **Fibre Reinforced Material Technology-**N.J.Parratt Van Nostrand Reinhold Co, Inc 1972
2. **High Performance Fibre Composites-** J.H.Morely, Academic Press
3. **Composite materials**:- Krishan K. Chawla, Springer 2005
4. **High Performance Fibres:-** J.W.S. Hearle, Woodhead UK 2005

5. **Composites Engineering Hand Book** - Ed. Mallik P.K., Marcell Dekker, N.Y., 1997

Web links and Video Lectures (e-Resources):

NPTEL Courses on textile fibres,
NPTEL Course on Technical textiles,
NPTEL Course on composite technology, composite processing.

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

- Students can be taken to fibre and composite manufacturing industry and can be made to do case study on composite materials using ready available data
- Hands on training on composite production by hand lay-up techniques can be practiced

CHARACTERIZATION OF FIBRES AND POLYMERS		Semester	III
Course Code	**BTX306D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives: This course aims at updating the knowledge of students in characterizing structural parameters and thermal characteristics of fibres and polymers.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills. Seminars and Quizzes may be arranged for students in respective subjects to develop skills. Encourage the students for group learning to improve the creativity and analytical skills. Support and guide the students for self-study.

Module-1

Introduction to fibres and polymers. Requirements of fibre forming polymers, Requirements of a good textile fibre. Need for characterization of fibres and polymers.

Analysis of polymers for molecular weight: concept of molecular weight in polymers, importance of molecular weight of polymers. Effect of molecular weight on processing and properties of polymers and fibres, concept of molecular weight averages.

Module-2

Determination of molecular weight of polymers and fibres: End group analysis and its limitations, principal of osmometry and working of osmometry for determination of Mn, different types of viscosity and their importance in conversion of fibres to polymers, determination of intrinsic viscosity and Mn of polymers using viscometry.Detremination of Mw and Mn by GPC techniques detailed working of GPC. Light scattering techniques for determination of molecular weight.

Module-3

Historical details of X- Rays, brief outline on principle of working of WAXS and SAXS,detrmination of cristallinity, crystal size, crystal density fc, fa, using WAXS.Principal of working of DGC, determination of density crystallinIty using DGC and comparison of DGC and WAXS.

Module-4

IR spectroscopy; quantitative and qualitative Characterization of structure of polymers and fibres using IR spectroscopy, principal of working of FTIR. Detailed studies on electron microscopy (SEM and TEM) Methods of preparation of fibre and polymer samples for SEM and TEM,. Applications of UV and NMR spectroscopy in characterizing fibre and polymer structure.

Module-5

Thermal analysis of polymers : Importance of thermal characterization of polymers**,** Tg, Tm of polymers, Factors affecting Tg and Tm. Characterization of polymers and fibres using DSC,DTA,TGA,TMA,DMTA and Dilatometer.

Determination of sonic modulus of fibres,

Non-destructive methods of characterization of fibre reinforced polymeric composites.

Course outcome (Course Skill Set)

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

1.Identify the need for characterization of polymers and explain the concept of molecular weight in polymers

2.Analyse polymers and fibre and polymers for molecular weight

3. Characterize polymers and fibres using WAXS, SAXS and DGC

4. Explain the working of IRS, TEM, SEM, UVS and NMR.

5. Summarize the working of thermal characterizing instruments i.e. Dilatometer, DTA, DSC, TMA, TGA, DMTA.

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. "Polymers; Polymer characterization and analysis", ED., J I Kroschwitz, John Wiley andSons, 1990.
2. "Thermal characterization of polymeric materials", Ed., E A Turi, Vol I and II, AcademicPress, 1997.
3. "Text book of polymer science", Billmeyer F W, John Wiley and Sons, 1984.
4. **Manufactured fibre technology,** Gupta V.B, Kothari V.K., Chapman Hall, London, 1997

Web links and Video Lectures (e-Resources):

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

Quizzes, group discussions, seminars and report writing on various aspects of textile fibres.
Students can be taken to research centers of polymers and fibres/textiles to learn about various characterization techniques.

INTRODUCTION TO POLYMERS		Semester	III
Course Code	**BTX358A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01
Examination type (SEE)	Theory(MCQ TYPE)		

Course objectives: Course objectives:

- As the basic building block of all textile products is polymers, acquiring knowledge in this subject is necessary for all undergraduate Textile Technology students.
- This subject deals with basics of polymer science & Technology, general aspects of polymer production and applications

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. These are sample Strategies, which teacher can use to accelerate the attainment of the various courseoutcomes.
2. Quizzes, group discussions ,seminars and report writing on various mathematical concepts oftextiles

3. Effect of polymers on environment can be discussed.

Module-1

Introduction and definition of monomers and polymers. History and Classification of polymers. Characteristics of fibre forming polymers and their general applications

Module-2

Study of synthesis of polymers by chain, step and co-ordination polymerization. Techniques of polymerization, comparison of various Techniques. Study of various types of initiators for addition polymerization

Module-3

Comparison of different types of polymerization methods and techniques. Co-polymerization - Concept of co-polymerization.

Module-4

Kinetics of polymerization - estimation of kinetic chain length, illustration of effect of various parameters on kinetics of polymerization. Functionality in polymers. Carothers equation and extentof polymerization.

Module-5

Concept of molecular weight and molecular weight distribution and determination of molecular weight.

Course outcome (Course Skill Set)

1. At the end of the course the student will be able to: Define the basic concepts in polymers with special reference to textile polymers and classifydifferent types of polymers.
2. Explain about synthesis of polymers and polymerization methods and techniques
3. Interpret and compare polymerisation techniques and methods, copolymerization
4. Illustrate kinetics of polymerization

5.Analyse of polymers for molecular weight

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

- The question paper will have ten questions. Each question is set for 10 marks.
- There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
- The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books

1. **Text book of polymer Science**, Billmeyer.W., Wiley Int.Sc. New York 1984.
2. **Polymer Science,** Gowarikar V.R., Vishwanathan N.V., Jayadev Sridhara, Wiley Eastern Ltd., New Delhi, 1995.
3. **Principles of polymerization,** Odian G., John Wiley & sons, NY, 1976
4. **Manufactured fibre technology,** Gupta V.B, Kothari V.K., Chapman Hall, London, 1997

Web links and Video Lectures (e-Resources):

Quizzes, group discussions ,seminars and report writing on various aspects of polymers

Practical exposure to production of polymers and discussion on harmful effects of synthetic polymers

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

Quizzes, group discussions ,seminars and report writing on various aspects of polymers

Practical exposure to production of polymers and discussion on harmful effects of synthetic polymers

IDENTIFICATION OF FIBRES - LAB		Semester	III
Course Code	**BTXL358B**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03
Examination nature (SEE)	Practical		

Course objectives:

- This subject helps the student to acquire knowledge of various fiber identification by different techniques
- This subject helps to students identify the blend and its percentage of fibers in textile manufacturing industry.
- Students are exposed to research field in different fibers and their applications in various industries.

Sl.No.	Experiments
1	Identification of Natural fibers by physical, microscopically and burning tests
2	Identification of Natural fibers by chemical tests
3	Identification of protein fibers by physical, microscopically and burning tests
4	Identification of protein fibers by chemical tests
5	Identification of regenerated fibers by physical, microscopically and burning tests
6	Identification of regenerated fibers by chemical tests
7	Identification of synthetic fibers by physical, microscopically and burning tests
8	Identification of synthetic fibers by chemical tests
9	Analysis of blend ratio of cotton and polyester fibres by chemical method
	Demonstration Experiments (For CIE)
1	Analysis of binary and tertiary blend ratio of different fibres by chemical methods

Course outcomes (Course Skill Set):

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

1. Identifying of Natural textile fibers by standardt methods
2. Summarize the Identification of various Protein textile fibers .
3. Explain the Identification of various Regenerated textile fibers .
4. Explain the concept of Identification of various synthetic textile fibers .
5. Illustrate the various blend analysis of textile fibers .

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

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

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are 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 down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a 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 marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of 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 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 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

Books

1. Textile fibers by BITRA
2. Textile Fibers by by James Gordon Cook
3. Identification of Textile Fiber by Max M Houck

ENGINEERING WITH MICROSOFT OFFICE-LAB		Semester	III
Course Code	**BTXL358C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03
Examination nature (SEE)	Practical		

Course objectives:

This course offers the students an insight into:

CLO 1 Understand the basics of computers and prepare documents and small presentations.

CLO 2. Attain the knowledge about spreadsheet/worksheet with various options.

CLO 3. Create simple presentations using templates various options available.

CLO 4. Demonstrate the ability to apply application software in an office environment.

CLO 5. Use MS Office to create projects, applications.

Sl.NO	Experiments
1	MS-Word -Working with Files, Insert and formatting text and paragraphs, Moving, copying and pasting text
2	Modifying a document- Bulleted and numbered lists, Nested lists
3	Controlling page appearance- Page formatting - Header and footers, page numbers, Mail Merge, Macros – Creating & Saving web pages, Hyperlinks.
4	Printing documents- selection paper, margins, print preview
5	Tables, formatting tables -Table Manipulations
6	Inserting graphic objects - Adding clip Art, add an image from a file, editing graphics
7	Use paint brush and Adobe Photoshop for development of textile designs
8	Excel Basics: Spread sheet concepts and exploring the Microsoft Office Excel environment. Create, open and view a workbook.
9	Save and print workbooks. Enter and edit data. Modify a worksheet and workbook.
10	Work with cell references. Learn to use functions and formulas. Create and edit charts and graphics. Filter and sort table data.
11	Work with pivot tables and charts. Import and export data. Using Excel Help
12	MS-Power Point -Create a Presentation from a template- Working with Slides – Insert a new slide
13	applying a design template, changing slide layouts – Resizing a text box, Text box properties, delete a text box
14	Video and Audio effects, Color Schemes & Backgrounds Adding clip art, adding an image from a file
15	MS-Access - Using Access database wizard, pages and projects. Creating Tables – Create a Table in design view.
16	Datasheet Records – Adding, Editing, deleting records, Adding and deleting columns Resizing rows and columns, finding data in a table & replacing, Print a datasheet. Queries - MS-Access.
17	Microsoft Outlook- Introduction, Starting Microsoft Outlook, Outlook Today, Different Views In Outlook, Outlook Data Files
	Demonstration Experiments (For CIE)
1	Use of textile design software for creating woven designs and fabric production
2	Use of textile design software for creating printing designs

3	Use of computer graphics for garment designing and manufacturing

Course outcomes (Course Skill Set):

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

1. Know the basics of computers and prepare documents, make small presentations with audio, video and graphs
2. Create spreadsheets, navigating the Excel user interface, entering, manipulating and formatting data
3. Demonstrate the creation of formulas and functions to perform calculations on data. Create charts and tables that effectively summarize raw data.
4. Create a Presentation from a template- Working with Slides, applying a design template, changing slide layouts. Demonstrate the ability to apply application software in an office environment.
5. Use Access database wizard, pages and projects. Use Google Suite for office data management tasks. Use of graphic software to develop woven designs and printing designs.

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

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

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are 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 down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a 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 marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of 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 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 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

Excel for Scientists and Engineers: Numerical Methods, E. Joseph Billo, Wiley Online Library, November 2006, ISBN:9780471387343 2. Excel for Engineers and Scientists, S. C. Bloch, Wiley, 2000, ISBN, 0471321699, 9780471321699.

MEDICAL TEXTILES		Semester	III
Course Code	**BTX358D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	02
Examination type (SEE)	Theory (**general question paper pattern)**		

Course objectives:

- To provide the introductory knowledge about textile materials and medical textiles.

To impart the knowledge of various properties of Medical Textiles as per different domains of health care.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Acquire the knowledge of biocompatibility and related characterization methods of Medical textiles.
2. 2.Use PowerPoint/Videos/Animations to explain various concept

Module-1

BIOPOLYMERS: Classification of biopolymers used in medicine – Natural biopolymers - properties and applications. Synthetic biopolymers - raw material, synthesis, properties, storage stability and sterilization of biopolymers. Evaluation of biopolymers - In vitro tests- direct contact, agar diffusion, elution methods, In vivo assessment of biopolymers to tissue compatibility.

Module-2

Healthcare and Hygiene Products:

Classification of medical textiles, Functional requirements, materials used, design procedure. Antimicrobial finishing of medical textiles: Need for antimicrobial finishing, antimicrobial agents and their working mechanism, Antimicrobial test methods. Surgical Gowns, masks, wipes, Antibacterial Textiles, Super absorbent polymers.

Module-3

Implantable Textiles

Implantable textiles: hernia mesh – vascular prostheses – stents. Vascular textiles, Knitted cardiac biological valves, hollow fibres as dialysis membrane, Tissue engineering: properties and materials of scaffolds- relationship between textile architecture and cell behaviour – applications of textile scaffolds in tissue engineering.

Module-4

Extra-corporeal materials: Cartilage nerves – liver ligaments, kidney, tendons, cornea; Drug delivery textiles: classification – mechanism various fabrication methods – characterization – applications.

Module-5

Smart Medical Textiles and Legal Issues

Smart textiles – types, characteristics – smart textiles in wound care; applications of phase change and shape memory materials –mobile health monitoring; electronics in medical textiles; Smart textiles in rehabilitation and applications. legal and ethical values involved in the medical textile materials.

Course outcome (Course Skill Set)

- At the end of the course the student will be able to: Identify the requirement of medical textiles and explain the raw material requirement for the medical textiles
- Explain properties, types, applications of healthcare and hygiene products
- Summarize different types of Implantable and non-implantable textiles
- Illustrate the various extra-corporeal materials and devices

Demonstrate and compare the characteristics of different smart medical textiles and its 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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

- The question paper will have ten questions. Each question is set for 10 marks.
- There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
- The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books

1. Manufactured Fibre Technology, Gupta, V.B., Kothari, V.K., Springer, 1997.
2. J B. Park, Roderic S. Lakes: Biomaterials: an Introduction, Plenum Press, New York, 1992.
3. Manmade Fibers – Moncrief, R.W., Halstead Press, New York, 1975.
   Donald L. Wise...[et al.] eds. :Encyclopedic handbook of biomaterials and bioengineering (4 vols.), Marcel Dekker, New York,1995

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

Students can be taken to nearby hospitals to demonstrate the application of textiles in medical field and industrial visit may be arranged to show the production of medical textiles.

IV SEMESTER

CHEMICAL PROCESSING OF TEXTILES - II		Semester	IV
Course Code	**BTX401**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

- This subject helps the student to acquire knowledge of Textile Chemical process
- This subject prepares the student work in chemical processing industry.
- Students are exposed to research field in chemical finishing technology.
- Learn the chemistry of the various finishing and dyeing processes carried out in chemical processing department.
- Exposed to actual mechanisms involved in various dyeing and finishing operations and processes carried out in the industry.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

- Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching methods may be adopted to develop the outcomes.
- Use PowerPoint/Videos/Animations to explain various concepts.
- Ask some creative and higher-order thinking questions in classes which helps critical thinking.
- Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyse information rather than simply recall it.
- Support and guide the students for self-study.

Module-1

Disperse dyes - Classification, properties, dyeing conditions and application. Various after treatments given to synthetic dyed goods. Concepts in cross dyeing. Method of dyeing of P/C, P/V and P/W blends. Introduction to natural dyes and their methods of application. Mordant dyes - Classification, properties, dyeing conditions and application. Preparatory process for garment dyeing, specialty chemicals and dyes used for garment dyeing.

Module-2

Different types of dyeing practices for various types of garments, precautions to be taken for effective dyeing of garments. Quality control in garment dyeing and garment dyeing machines. Working principles of dyeing machines for yarns and fabrics such as Winch, Jigger, Jet dyeing, HTHP dyeing machines etc. Modern developments in dyeing machinery. Introduction to colour measurement and computer colour matching concepts. Spectrophotometers and determination of K/S value, Yellowness, Whiteness and Brightness indices. Modern developments in garment dyeing.

Module-3

Introduction to Textile Printing. The constituents and characteristic of printing paste. Brief study of different binders, thickeners, solvents, discharging agents and other ingredients of printing paste. Styles of Printing-Chemicals and mechanisms used for the various Styles of Printing. Methods of Printing-Hand block, Roller, Development of screens, hand screen, semi -automatic screen, flatbed and rotary screen printing methods. Transfer Printing-Principle, mechanisms of transfer printing and various methods. Methods of Print Fixation-Drying, curing by dry heat, steam fixation etc. Introduction to Textile Digital Printing. Modern developments in printing of textiles

Module-4

Introduction to Textile Finishing. Need of textile finish. Classification of various finishes based on Functional, Aesthetic, Chemical, Mechanical and degree of performance. Classification of Various

finishing chemicals and their properties. Calendaring-Need and its Principle, various types of calendaring machines used based on its end uses and their working principle. Sanforization-Need and its principle, working of Pre-shrinking machine Wrinkle Recovery Finish-Selection of fibres, Mechanism of Crease formation, various types of cross linking agents and its suitability, types of catalyst used, Method of application on various types fabrics.

Module-5

Water repellence finish-Principle, various types chemicals used and method of application. Water proof finishes- Principle, various types chemicals used and method of application. Fire retardant finishes- Limiting Oxygen Index and its importance. Finishing of silk-Various finishing treatment given to silk fabric, Heat setting-Need of heat setting, Heat setting of various synthetic fiber and its mechanism. De-lustring of various regenerated textiles. Soil release finish-Reasons for textile fibers attracted by soil, relation between soil release and anti-static finish, types of fabric need soil release finish and method of application. Modern developments in finishing of textiles

Course outcome (Course Skill Set)

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

- Explain the application and properties of dye class viz. disperse, Natural dyes and concept of blend dyes
- Summarize the various dyeing machineries, Garment dyeing and computer colour matching concept.
- Explain the method of application styles and methods of printing, transfer printing and after treatment to printed goods.
- Explain the concept of textile finishing, finishing chemicals, Sanforization and other finishes
- Illustrate the various chemical finishes viz. water proof, flame retardant and synthetic fiber finishes

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Textile Chemistry, Vol. III- The physical chemistry of dyeing-R. H. Peters Elsevier, Amsterdam, The Netherlands 1975
2. Chemical Processing of Cotton, Polyester Cotton Blends J.R.Modi and A.R. Garde TAI Publications 1960
3. Textile printing V.A.Shenai Sevak publications 1996
4. Textile printing L.W.C. Miles Society of Dyers & Colourists 1981
5. An Introduction to Textile Finishing J T Marsh Butterworths publications 1979
6. Principles of Textile Finishing A K Roy Choudhury Woodhead Publishing 2017

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/116102054
- https://archive.nptel.ac.in/courses/116/102/116102054/
- https://www.slideshare.net/RuchiSardana1/textile-finishes-38312735

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

- Quiz/Group discussion.
- Practical demonstration of dyeing process and finishing of all five modules content.
- NCUTE NPTEL and YouTube videos.

WEAVING TECHNOLOGY-II		Semester	IV
Course Code	**BTX402**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

This course aims at updating the knowledge of students in the fields of, dobby,Jacquard and unconventional methods of weaving.

- Fundamental aspects of Secondary and auxiliary motions of weaving.
- Demonstrate weft patterning, automatic looms, fabrics defects; causes and remedies
- Principle of working of different types of dobby and jacquards.
- Interpret and explain unconventional methods of weaving.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

. **This** course aims at updating the knowledge of students in the fields of, dobby,Jacquard and unconventional methods of weaving.

- Fundamental aspects of Secondary and auxiliary motions of weaving.
- Demonstrate weft patterning, automatic looms, fabrics defects; causes and remedies
- Principle of working of different types of dobby and jacquards.
- Interpret and explain unconventional methods of weaving.

MODULE-1

Introductions to Secondary motions –Objectives, Take up motion - Objects - types of Take up motions, 5 wheel take up and 7 wheel take up motions, comparisons and dividend calculations. Anti-crack motion. Let-off motions – Types of let- off motions. Negative and positive let off: construction & working, Positive let off motions. Roper, Bart let let-off Construction & working. Electronic let off motion.

MODULE-2

Auxiliary Motions- Objects, Necessity & different types. Warp protector motions, types - loose reed and fast reed. Electromagnetic warp protector. Warp stop motions, Weft stop motions - side weft fork and centre weft fork motions. Construction, working& comparisons. Study of temples, Functions, different types of temples, choice & suitability.

MODULE-3

Multiple box motions: weft patterning, 2x1, 4x1, 4x4 motions - construction & working. Automatic Looms- Different types - Cop changing, feelers, types of feelers, shuttle eye cutters, temple eye cutters, construction & working. Dobby shedding, working of different types of dobbies, keighly dobby, cam dobby, paper controlled dobby, cross border dobby, electronic dobby, lattice preparation for left and right dobby.

MODULE-4

Jacquard shedding, Principle and working of different types of jacquards, cross border jacquard, special jacquards, tie ups, Open shed jacquards, electronic jacquard, card cutting, Fabric defects causes& remedies. Introduction to unconventional looms, classification of shuttle less looms,weft accumulators ,Introduction to projectile looms, Weft insertion by Projectile, salient features, Weftinsertion stages. Torsion bar picking.

MODULE-5

Classification of Rapier looms salient features. Weft insertion stages in Dewas &Gabbler systems rapier. Air quality requirements for Air Jet looms, system of air jet weaving, method of weft insertion in Air jet, water Jet looms, water quality requirements. Comparisons of air jet and water jet looms.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Dismantling, assembling, setting and timing of Take-up mechanism, calculation of dividend, PPI and pick spacing, anti-crack motion & Let-off mechanism
2	Dismantling, assembling, setting and timing of Loose-reed mechanism and Fast- reed mechanism
3	Dismantling, assembling, setting and timing of side weft fork, centre weft form motion& warp stop motion.
4	Study of different types of box motions. Preparation of weft patterns and drop box chains to control box motions.
5	Study of working of dobby& jacquard mechanism.
6	Demonstration, setting, timing of cop changing mechanism on automatic looms. Setting of feeler mechanism, shuttle eye cutter, and temple eye cutter.
7	Pattern preparation for dobby loom by using pegs and lags.
8	Study of harness and harness tie-ups. Preparation of squared paper design for 100 hooks jacquard and card punching.
9	Preparation of weft patterns and drop box chains to control box motions
10.	Working on unconventional loom and Study of weft insertion mechanism on unconventional loom
11	Study of features various types of shuttle less looms, weft accumulators, and unconventional selvedges.

Course outcomes (Course Skill Set):

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

1. Demonstrate the secondary motions of weaving, settings, constructions.
2. Explain the importance of various auxiliary motions, working &settings.
3. Demonstrate the different types of box motions, dobby mechanisms
4. Summarize the different jacquard mechanisms and a weft insertion stages of projectile looms rapier, jet looms
5. Produce fabrics on power loom, simple designed fabrics on dobby.

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 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 the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- 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**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

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**)

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scoredby the student shall be proportionally scaled down to 50 Marks

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 may include questions from the practical component.

Suggested Learning Resources:

Books

1. **Weaving machines, mechanisms, Management.**M.K.Talukdar. Mahajan Pub. Ahmedabad.
2. **Principles of weaving mechanism** by Robinson &Marks
3. **Weaving Mechanism,**Fox
4. **Weaving mechanism**, BannerjeeN.N
5. **Weaving tablets,** Textiles Association of India, Bombay,1985.
6. **Cotton weaving**, Gordev. V and Volkov. P., Mir Pub., Moscow1987.
7. **Automatic weaving,** Aitken, Colombia press, Manchester1969.
8. **An Introduction to Automatic weaving,** Bennet G.A. - Bennet G.A. 1958.

Modern preparation and weaving machinery, Orme rod. A., Butterworth publication Co.1993

Web links and Video Lectures (e-Resources):

NPTEL course on weaving Technology-1

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

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

- Apart from conventional lecture methods various types of innovative teaching techniques through videos, working models, animation
- Hands training may be arranged for students to learn practical aspects.
- Encourage the students to learn machinery operations, various settings and maintenance of weavingmachines
- Students can visit nearby weaving industries to learn more of loom operations.

Support and guide the students for self-study.

SPINNING TECHNOLOGY-II		Semester	IV
Course Code	**BTX403**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

The objective of this Course is:

- To explain the students the basic spinning process in Textile Industry
- To understand the various spinning operations such as Combing, Speed frame ring frame, doubling, rotor and unconventional spinning techniques.
- Students will acquire theoretical knowledge about the machineries used.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Use the related videos of Textile machineries so that student can understand more easily.
2. Show the students the working of these machines, by arranging to visit to spinning mills.
3. Inspire the students to have collaborative learning in the class.
4. Support and guide the students for Self-study.

MODULE-1

Hook theory and preparatory processes to comber. Objects of combing and study of combing cycle with the help of sketches and also index numbers. Detachment setting and its importance. Gauges used for setting the comber. Calculations in comber. Modern developments at comber and salient features of the present day comber.

MODULE-2

Objects of speed frame, study of different drafting systems and importance of apron drafting system. Principle of twisting and winding in speed frame. Study of different types of flyers, building mechanism, lift, chase length and their importance. Study of differential gearing mechanism and its importance. Different types of change point at speed frame. Modern developments in speed frame and salient features of the modern speed frame .Speed frame calculations.

MODULE-3

Objects of ring spinning, study of different drafting systems and type importance. Principles of twisting, factors affecting the twist Calculation, Difference between Actual and Practical TPI. Principal of winding. Types of builts Roller setting, draft and its calculation. Rings and Travellers. Different types of rings, selection of rings and manufacture of rings. Types of travellers, traveller numbering both in direct and indirect system. Manufacture of travelers. Forces acting on traveller.

MODULE-4

Faulty packages of Ring frame and remedial measures. Modern developments of Ring frame and salient features of the present day ring frame. Calculations of Ring frame such as production, efficiency, Traveller speed and count etc.

Doubling frame – objects of doubling and conditions to get balanced double yarn. Preparation of doubling, Types of doubling systems. Study of Two for one twister. Threading through different types of wet doubling systems. Defects in doubling and remedies Study of Types of Sewing threads and their applications. Fancy yarns and their production and applications

MODULE-5

Open-end spinning – principle and objects of open-end spinning. Classification of open-end spinning. Principle and Technique of rotor spinning and detailed study of rotor spinning such as initial drafting, transport zone, twisting and yarns formation Types of opening rollers and rotors and their effect on the performance of OE machine. Calculations of Open end spinning machines. Modern developments in OE machine. Study of, Air jet spinning.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Production, speed, efficiency, draft calculation of comber
2	Break draft, main draft, total draft and draft constant calculations. Spindle speed drafting rollers speed calculations of Speed frame
3	TPI and twist constant calculations. Bobbin speed calculation with the help of differential gear mechanism. Building mechanism.
4	Production, delivery speed, hank of roving and efficiency calculations of speed frame and their demonstration
5	Calculation of spindle speed, front roller speed TPI through gearing diagram and also by changing the pulleys and concerned change wheels.
6	Calculation of Twist constant through gearing and also TPI calculation for different TCP. Break Draft, Main Draft and Total draft calculation through gearing diagram
7	Calculation of Spindle Speed, TPI through gearing on doubling frame.
8	Demonstration and calculation on O.E. Spinning machine.
9	Demonstration of comber working
10	Demonstration of Speed frame working
11	Demonstration of Ring frame working
12	Procuring different types of Fancy yarns and study of their constructional details.

Course outcomes (Course Skill Set):

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

1. Demonstrate the Working of Comber & Explain the Latest Developments in Combing Technology
2. Explain & Demonstrate about the Processing and developments in Speed frame
3. Demonstrate & Explain the Working Principle of Ring Spinning Technology
4. Demonstrate the Working Principle of Doubling Machine & O.E.Spinning and air jet spinning.
5. Determine the speeds of parts draft, production of comber, speed frame and ring frame.

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 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 the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two

Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- 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**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

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**)

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scoredby the student shall be proportionally scaled down to 50 Marks

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 may include questions from the practical component.

Suggested Learning Resources:

Books

1 **Manual of Cotton Spinning** Coulson. A.F.W.(Ed.),Vol. I to IV Textile Institute, Manchester,1958

2 **Series on Textile processing** Zaloski.S ,The Institute of Textile Technology, USA1983

3 **Technology of short-staple spinning,** Klein.W. Vol .I, II, III and IV**,** Textile Institute Pub., Manchester**,**1989

4 **Spun Yarn Technology** Oxtoby Butterworths, London 1987

5 **Contemporary Textile Engineering** Happy. F. (Ed.), Academic Press, Inc 1981

6 **Hand Book of Cotton Spinning,** TaggartWilliam Universal Pub. Cor 1979

7 **Essential Facts of Practical cotton spinning** Pattabhiraman T.K Soumya Pub., Bombay 1979

8 **Cotton Spinning Calculation** Soumya Pub., Bombay 1979

9 **Cotton Opening & Carding** Merril. G.R. G.R. Merril, Lowell Mass 1955

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/116/102/116102055/#watch
- https://archive.nptel.ac.in/courses/116/102/116102038/

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

1.Gathering catalogues of recent textile machines and can have group discussion on comparison of different make & model.

2. Procuring different types of Fancy yarns and study of their constructional details.

CHEMICAL PROCESSING OF TEXTILES LAB - II		Semester	IV
Course Code	**BTXL404**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03
Examination nature (SEE)	Practical		

Course objectives:

- The students will be able to get hands on experience of dyeing and printing of different classes of fibres, fabrics and garments.
- They will get experience on various dyeing equipment, settings and handling.
- The students will be exposed to work on computer colour matching instruments and related software.
- They will get experience on various types of finishing process

Sl.No.	Experiments
1	Dyeing of polyester using disperse dyes by carrier and HTHP method
2	Dyeing of cotton, silk and wool using important natural dyes.
3	Dyeing of garments with reactive class of dyes.
4	Preparation of colour charts by light, pigment, chromatic circle and Brewster's theory.
5	Printing practice using Hand blocks and screens with various classes of dyes.
6	Preparation of screens for screen-printing.
7	Resist style (batik) of printing on fabrics.
8	Discharge style of printing on cotton, PET and silk.
9	Anti-crease finishing of cotton using non-formaldehyde based chemicals.
10	Softening of cotton fabric using softeners
	Demonstration Experiments (For CIE)
1	Determination of K/S and matching of shades using spectrophotometer.
2	Evaluation of washing / rubbing fastness of dyed and Printed goods.

Course outcomes (Course Skill Set):

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

- Demonstrate dyeing of acrylic and polyester using basic and disperse dyes
- Explain the basics of printing of fabrics. Outline various dyes/pigments used,
- Demonstrate print paste preparation, constituents, their characteristics and suitability.
- Explain the styles of printing and methods of printing and outline the parameters involved
- Apply finishes on fabric outline the concepts of computerized colour measurement and colour matching

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

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

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are 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 down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a 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 marks scored shall be scaled down to **20 marks** (40% of the maximum marks).
- The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedules mentioned in the academic calendar of 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 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 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 02 hours
Suggested Learning Resources: 1. https://www.youtube.com/watch?v=uZN0iLLAaww 2. https://www.youtube.com/watch?v=g8_GvRoASV0 3. https://www.youtube.com/watch?v=9ND67gfwAyg

TEXTILE FIBRE PHYSICS		Semester	IV
Course Code	**BTX405A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives: This course aims at updating the knowledge of students in the following fields of fiber physics:

1. Basic concepts of fiber structure, properties and investigation of fiber structure
2. Basic concepts various mechanical, thermal, moisture, optical, electrical and frictional behavior of fibers.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
3. Encourage the students for group learning to improve their creativity and analytical skills.
4. Support and guide the students for self-study.
5. Encourage students to observe working of various textile machineries to understand mechanisms
6. Students can be taken to research laboratories to demonstrate about modern tools used for characterizing fibre structure.

Module-1

Introduction to structure of fibers. Approaches to polymer fiber structure. List of parameters for reasonable specification of fiber structure analysis of solid state structure of textile fibres using DGC, X-rays, IRS, SEM and TEM. Study of two phase and one phase model of fibre physical structure

Module-2

Descriptive studies on of physical structure of Cotton, Wool, Silk, PET, Nylon and Acrylic fibres. Moisture relations: Concept of moisture equilibrium, moisture hysteresis, moisture regain, heat of absorption, swelling of textile fibres. Effect of moisture on various properties of fibres. Calculations of MR and MC of fibres, correct invoice weight calculations.

Module-3

Mechanical properties: Analysis of Stress and strain behaviour, Expression of results of tensile properties, factors affecting tensile behavior, structure and tensile property correlation, Elastic recovery and weak-link effect. Stress relaxation, creep, factors affecting stress relaxation and creep.

Module-4

Dynamic mechanical properties and their applications. Boltzmann super position principal. Maxwell and kelvin models, Burgers four element model .Directional effects- Bending of fibers, Twisting of fibers, Shear modulus, Shear stresses and compression of fiber masses. Frictional properties, Amonton's laws of friction, deviation of these laws in fibre friction. Nature of fiber friction, the friction in wool fibers

Module-5

Introduction of Optical properties, measurement of birefringence, lustre. Importance of optical properties Electrical properties: Electrical resistance, static electricity, dielectric properties and measurement of these properties. Thermal properties: Tg, Thermal conductivity, specific heat, thermal expansion and directional dependence of thermal properties. Thermal characterization of fibres using Dilatometer, TGA, DTA, DSC and TMA.
TMA.

Course outcome (Course Skill Set) At the end of the course, the student will be able to :

1. Demonstrate about fundamental concept of fiber structure and characterization of fine structural details of textile fibers.
2. Summarize and explain physical structure of textile fibers and importance of moisture absorptions in textiles
3. Analyse stress/strain behavior of fibers and behavior of fibers in actual usage
4. Analyse of behavior of fibers for multidirectional and cyclic forces
5. Classify & demonstrate secondary properties of fibers viz. electrical, optical, thermal and frictional

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. **Physical properties of Textile fibres,** Morton & Hearle, J.W.S., TI, London.
2. **Manufactured fibre technology,** V.B.Gupta and Kotari V.K., Chapman & Hall,London.
3. **Mechanical properties of polymers,** Ward I.M., John wiley & sons, NY1971.

References:

1. **Mechanical properties of polymer,** Neilson L.E., VolI,II, III, Marcel Dekkar, NY, 1974.
2. **Polymer Characterization,** Cambel and White, Chapman & Hall, London1989.
3. **Moisture relations in textiles,** Hearle J.W.S., Textile Institute, London.

Web links and Video Lectures (e-Resources):

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

1. Quizzes, group discussions, seminars and report writing on various aspects of fibre physics.

2. Practical exposure to testing of structure and related properties of fibres.

SPECIALITY YARNS AND FABRICS		Semester	IV
Course Code	**BTX405B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

This course aims at updating the knowledge of students in various types, methods of manufacturing, and applications of special types of yarns and fabrics.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
3. Encourage the students for group learning to improve their creativity and analytical skills.
4. Support and guide the students for self-study.
5. Arrange industrial visits to industries in which special type of yarns and fabrics are produced.

Module-1

Introduction to specialty yarns and fabrics **Specialty yarns:** Design, manufacture, characterization and applications of specialty yarns. Hybrid yarns. High bulk yarns. Electro-conductive yarns. Technical sewing threads. Coated yarns. Reflective yarns. Elastomeric yarns. Yarn quality requirement for these yarns.

Module-2

Compound yarns. Core spun yarns types - production methods using conventional ring spinning and SIRO system applications, future trends.

Hybrid yarns: - Different production methods, structure and properties of hybrid yarns, Hybrid yarns for textile preforms used in thermoplastic composites.

Developments in rope structure -double partial, parallel –Strand and wire ropes, properties and applications.

Developments in fancy yarns: basic fancy yarn structures and recent methods of producing fancy yarns.

Module-3

Developments in 3-D knitted structures. Multi axial warp knitted 3D fabrics, space fabrics, full faced 3-D fabrics, properties and applications of different 3D knitted fabrics. Developments in 3Dwoven fabrics.

Production of leno weave fabrics, characteristic of leno weave fabrics, Applications, New technologies in leno fabric productions.

Production and application of lappet and swivel fabrics

Module-4

Pile carpets: Pile fabrics for home textiles, tufting in carpet manufacturing. Production on techniques and applications.

Developments in Jacquard woven fabrics: Recent developments in jacquard shedding systems, Flexibility in producing intricate designs.

Triaxial woven fabric: manufacturing technique and applications of triaxial weaving. Interwoven fabrics 2D-3D interwoven fabrics methods of production and applications, 3D solid woven structures and 3Dcelullar fabrics.

Module-5

Jacquard shedding for smart textiles, industrial textiles. Shaped seam less garments Developments in 3D nonwovens -development of 3D Non-woven, 3D shell structures, applications.

Flocked fabrics and structures: flocking techniques, application.

Knotted fabrics: types of producing, applications.

Developments in braided fabrics, applications, Contour fabrics. Polar fabrics. Spiral fabrics. Multi-functional fabrics, Spacer fabrics. Profiled fabrics.

Course outcome (Course Skill Set)

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

1. Recognize the need for specialty yarns and fabrics and summarize the production of specialty yarns
2. Explain production methods and applications of compound , hybrid, fancy yarns and ropes
3. Demonstrate production, properties and applications of 3D Knitted, woven and leno fabrics.
4. Illustrate production , properties and applications of Pile carpets, Jacquard woven fabrics Triaxial woven fabric
5. Summarize speciality of flocked, Jacquard woven smart fabrics,3D Non –Wovens,knotted

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

R.H. Hong. Specialist yarn and fabric structure Wood Head publishing-2011

Klein W, Manual of Textile Technology: New Spinning Systems, 1st Ed; The TextileInstitute, Manchester, UK 1993

Lawrence C A, Fundamentals of Spun Yarn Technology, 1st Ed; CRC Press LLC, Florida,USA(2003)

Chattopadhyay R and Ishtiaque S M, Advances in Yarn Manufacturing Process,Department of Textile Technology, IIT Delhi 1991.

AdanurSabit, "Handbook of Weaving ",CRC Press Fancy yarns R.H

Gony and RM Wright. wood Head Publishers -2002

X-Chen. Advances in 3D textiles Elsevier-2015

B.C.Goswami- Textile Yarns wood Head Publishers-2010

Web links and Video Lectures (e-Resources):

- .

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

- Students can be made to collect various types of fabrics and yarns and compare them for various characteristics.
- Students and be taken to spinning and weaving industries to demonstrate production special types of yarns and fabrics.

INTELLIGENT AND FUNCTIONAL TEXTILES		Semester	IV
Course Code	**BTX405C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

- To impart knowledge of intelligent systems of incorporating the sensor, processor and the actuator into textiles.
- To educate the concept of Intelligent and Functional Textiles

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Use PowerPoint/Videos/Animations to explain various concepts.
- Encourage group discussion in the classes

Module-1

Definition of smart and intelligent textiles, Passive and active functionality, Textile with high protection and comfort properties, Extreme winter clothing with low heat transmission, heat absorbing, heat storing systems. Phase change materials, incorporation of PCMs in fibres and fabrics.

Module-2

Shape memory polymers - Concepts, SMAs, SMPs, Principle of temperature dependent shape memory polymers, Applications of shape memory polymers. Introduction to Intelligent textile for personal protection, safety, environment protection etc.

Module-3

Breathable textile. Multifunctional textiles with incorporated electronics for integrated communication, music, health monitoring, defence support functions, wearable computers. Environmentally sensitive textiles- photochromic and thermochromics (chameleonic) fabrics, camouflage (radar shielding) fabrics, variable heat absorption surfaces, stimuli sensitive polymers such as temperature, pH, ionic, magnetic sensitive materials, design and their applications to textile.

Module-4

Introduction to plasma processing – The potential of plasma technology in the textile industry, Plasma reactors, Low-pressure plasmas, Atmospheric pressure plasmas, Effect of plasma on fibres and polymers, Plasma finishing of textiles. New high-tech fibres: Various categories of high-tech fibres, Development of Shingosen, Design of specialist fibres, Fabrics for relaxation using 1/ f fluctuations, new arrivals.

Module-5

Fibres for the next generation: High-tenacity and high-modulus fibres, micro denier (ultra-fine) fibres and biomimetic, the next stage: technological improvements, new frontier fibres (super-function fibre materials, etc.), super-biomimetic fibre materials, super-natural materials, resources recycling, fibres for health.

Smart technology for textiles and clothing – a brief introduction and overview. Smart clothing technology – interface technology, communication etc., applications like body monitoring, entertainment etc.

Course outcome (Course Skill Set)

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

- Illustrate the various properties of smart and intelligent textiles.
- Summarise the shape memory polymer concepts and applications to textile
- Explain the various functions and applications of smart and intelligent textiles
- Discuss various plasma technology in the textile industry
- Analyse the Smart and intelligent technology for textiles and clothing

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. New millennium fibers by Tatsuya Hongu, Glyn O. Phillips and Machiko Takigami
2. Plasma Technologies for Textiles by R L Shishoo
3. Shape memory polymers and textiles by Jinlian HU
4. Smart Clothing: Technology and Applications by Gilshoo Cho
5. High technology Fibres: Handbook of Fibre Science and Technology, Vol.III, Ed. by Lewin and Preston.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=o91f2wmpJRQ&t=9s&ab_channel=Datacube%3Awesomefactsandinterestingtoplists
- https://www.youtube.com/watch?v=CzD9nz38l-E&t=2s&ab_channel=FASHIONTECHBerlin
- https://www.youtube.com/watch?v=sRZBS5wRm6A&ab_channel=Stuff

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

Students can be given mini projects to produce prototype smart textile materials.

Working of Smart textile materials may be demonstrated for students

EMERGING TRENDS IN APPAREL DESIGN, PRODUCTION AND RETAILING		Semester	IV
Course Code	**BTX405D**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40-45	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

- Introducing to apparel industry, challenges & future trends in Apparel Production.
- To understand advances in apparel product development & Future product development (PD) trends.
- Understanding smart clothes and wearable technology-based apparel products
- To understand high performance technical textiles-based Clothing
  Understanding sustainable apparel retail concepts, Apparel disposal and reuse & Apparel recycling.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in theoretical, applied and practical skills.
2. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
3. Encourage the students for group learning to improve their creativity and analytical skills.
4. Support and guide the students for self-study.
5. Arrange industrial visits to garment manufacturing industries.

Module-1

Apparel Industry: Introduction, Global scenario of apparel manufacturing, Challenges in apparel production, Role of various organisations, Future trends

Module-2

Advances in apparel product development: Introduction, Industrial change, Process model for clothing product
Development, Models of new product development, Product development tools and application Areas, Product lifetime management (PLM), Demand-led new product development.
Future product development (PD)trends: Compressing the PD cycle time, Fit customization and

Module-3

Smart clothes and wearable technology: Introduction, Definition, Smart wearable systems: Current status and future challenges.
End-user based design of innovative smart clothing: Introduction, Identification of design requirements – form & function. The technology layer: the impact of emerging smart technologies on the design process - Enhancing and changing the aesthetic, the culture of wearable technology,

Revisiting the demands of the body, Enhancing the functionality. Hybrid design process smart textiles and wearable electronics. Fashion & Artificial Intelligence Technology.
Module-4
High performance technical textiles Clothing: High Performance Applications – Sportswear. **Personal Protective Textiles and Clothing**: Protection Against Cold, Mechanical Cut Hazards, Flame and Heat. Global Brands dealing with personal protective garments
Module-5
Sustainable apparel retail: Introduction, The retail model, Sustainable retail, Retail impacts, Retail supply chains, Traceability and transparency, Consumer behaviour, Sustainable retail futures. **Apparel disposal and reuse**: Introduction, Fate of discarded apparel, Apparel reuse, Future trends. **Apparel recycling**: Introduction to the problem, Fashion and overconsumption, the root cause of the waste problem, the apparel recycling process, the future of retail using 3D models, Global examples
Course outcome (Course Skill Set) At the end of the course, the student will be able to : 1. Describe global scenario of garment industry and future of garment industry 2. Illustrate advances in apparel product development and future trends in product development. 3. Demonstrate smart cloths and wearable technology **4.** Explain High performance technical textiles Clothing 5. Describe Sustainable apparel retail and Apparel disposal and reuse

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

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

- The question paper will have ten questions. Each question is set for 20 marks.
- 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.
- The students have to answer 5 full questions, selecting one full question from each module.
- Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Fairhurst, C. ed., 2008. Advances in apparel production. Elsevier.
2. Nayak, Rajkishore, and Rajiv Padhye, eds. Garment manufacturing technology. Elsevier, 2015.
3. McCann, Jane, and David Bryson, eds. "Smart clothes and wearable technology." (2009).
4. Blackburn, Richard, ed. Sustainable apparel: Production, processing and recycling. Woodhead Publishing, 2015.
5. Paul, Roshan, ed. High performance technical textiles. John Wiley & Sons, 2019.
6. Wong, Wai Keung. "Artificial Intelligence on Fashion and Textiles." In Conference proceedings AITA, p. 301. 2018.

Web links and Video Lectures (e-Resources):

- Challenges in Apparel Merchandising | garments industry, https://youtu.be/-hDGp_h00n8
- The Complete Fashion Design to Production Process, https://youtu.be/E5jH5T63I2s
- The Future of Product Development is Model-Based, https://youtu.be/jX3YOwzScLI
- op 10 Technology Trends Reshaping the Fashion Industry in 2022 and Beyond, https://youtu.be/rZNsFx8Czjc
- What is the clothing of the future: SMART wearables & e-textiles, https://youtu.be/o91f2wmpJRQ
- Technical Textile - Types and Application of Technical Textile,

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

- Demonstrate apparel production and fashion fundamentals
- Hands on training in apparel manufacturing
- Case studies on apparel retailing. Sustainable retailing and apparel recycling.

PROCESSING OF MMMFs AND BLENDS		Semester	IV
Course Code	**BTX456A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	02
Examination type (SEE)	Theory(general question paper pattern)		

Course objectives:

Course helps students understand the concepts of processing of MMFs and their blend in various systems, and their analysis

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- Student can acquire the knowledge in synthetic fibres their processing on cotton system.
- Study of various blends and their manufacturing technique.

Module-1

Objectives of blending, ,Introduction to processing of synthetic fibre and their blend, tow to top conversion, importance and their methods, Blending principle and methodsDetailed study of the changes required in processing short and long staple man-made fibres on cotton system,

Module-2

Selection of blend constituents, Mechanics of blending, T Sequence of blow room machines and their specifications.Modification of carding machine for blends.

Module-3

Draw frame blending, roller setting and their specifications.
Modification in roving frame for blends.

Module-4

Ring frame modification for processing of synthetic fibers, spinning of dyed fibers.Open end spinning for blends. Properties of ring spun blended yarns. Assessment of blending at different stages of a spinning line.

Module-5

Properties of blended yarn with yarn tenacity and elongation. Blend migration, index of blend irregularity. Common yarn faults in blends, End use of linen blended and linen yarn and fabrics

Course outcome (Course Skill Set)

1. At the end of the course the student will be able to: Explain the basics processing of synthetic fibre and their blend.
2. Demonstrate sequence of blow room & carding machines.
3. Demonstrate Draw frame blending with Modification in roving frame for blends.
4. Explain the Ring frame modification for processing of synthetic fibers
5. Summarize Properties of blended yarn.

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.
- **Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

Semester End Examinations (SEE) SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE

OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

- The question paper will have ten questions. Each question is set for 10 marks.
- There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
- The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

1. **Books** Salhotra K R, "Spinning of Manmades and blends on cotton system", 2nd Ed; The textileAssociation, India, 1989.
2. Lawrence C A, Fundamentals of Spun Yarn Technology, 1st Ed; CRC Press LLC, Florida,USA (2003)
3. Richards R T D and Sykes A B, "Manual of Textile Technology: Woollen YarnManufacture", The Textile Institute, Manchester 1994.
4. Chattopadhyay R, "Advance in Technology of yarn Production", 1st Ed; Nodal Centre forUpgradation of Textile Education, IIT, Delhi, 2002.

Web links and Video Lectures (e-Resources):

NPTEL Courses on spinning

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

Visit to spinning industries to demonstrate blended yarn production.

Case studies on comparisons of blended yarn and 100% cotton/polyester/viscose yarns

TEXTURED YARN TECHNOLOGY		Semester	IV
Course Code	**BTX456B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	02
Examination type (SEE)	Theory(general question paper pattern)		

Course objectives:

To enhance the ability of students in post spinning operations of manufactured fibres, especially in texturization

Teaching-Learning Process (General Instructions)

1. These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. Quizzes, group discussions ,seminars and report writing on concepts of texturing
2. Teaching can be enhanced by creating awareness on subject using NPTEL course

Module-1

Introduction and history of texturing, general principles involved in manufacture of textured yarns, Broad classification of texturing process and textured yarns.

Module-2

False twist texturing- Principals, mechanism, process and material parameters, characterization and optimization.

Module-3

Draw texturing, sequential and simultaneous draw texturing, process parameters and their effects, Friction draw texturing, friction texturing NCV drives, Positorque system.

Module-4

Air texturing, principle, mechanism, texturing jets, process parameters and characterization.

Module-5

Interlacement-need and principals, bulked continuous filament yarns (BCF), High bulk yarns, Texturing of spun yarns, solvent texturing. Introduction to edge crimping, Stuffer box crimping, Knit-de-knit texturing gear crimping, turbo-du-twist texturing, bi-component and bi- constituent yarns

Course outcome (Course Skill Set)

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

1. At the end of the course the student will be able to: Demonstrate the concept of texturing
2. Summarize false twist texturing and determine characteristics of FTT
3. Illustrate draw and friction texturing methods
4. Summarize air texturing principles and process
5. Explain various minor texturing techniques

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE. OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

- The question paper will have ten questions. Each question is set for 10 marks.
- There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
- The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books

1. **Yarn Texturing Technology. D.K. Wilson, J.W.S. Hearle and L. Hillock**
2. **False Twist textured Yarns- Principle, Process and applications- C. Atkinson**

Web links and Video Lectures (e-Resources):

NPTEL course on Textured Yarn Technology

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

Quizzes, group discussions, seminars and report writing on various techniques involved intexturing.

ECO-FRIENDLY PROCESS OF TEXTILES		Semester	IV
Course Code	**BTX456C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	02
Examination type (SEE)	Theory((general question paper pattern)		

Course objectives:

- To introduce students, understand eco-friendly processing of textiles aspects in textile and apparel industries.
- To understand environmental management aspects in textile Industries.
- To understand the significance of pollution control measures, quality of water and water treatments

Teaching-Learning Process (General Instructions)

1. These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes. Apart from conventional lecture methods various types of innovative teaching techniques through videos, animation films may be adopted so that the delivered lesson can progress the students in the theoretical, applied and practical skills.
2. Seminars and Quizzes may be arranged for students in respective subjects to develop skills.
3. Encourage the students for group learning to improve their creativity and analytical skills.
4. Support and guide the students for self-study.
5. Arrange industrial visits to textile processing industries.
6. Students can be taken to research laboratories to demonstrate about modern equipment's, auxiliaries and Chemicals used for the production of eco-friendly fibers, yarns and fabrics.

Module-1

Modern approaches to eco-friendly preparatory process to dyeing:-Desizing, Scouring, Degumming, bleaching and Mercerizing process of woven and knitted fabrics.

Module-2

Eco-friendly dyes and their method of dyeing of cellulosic, protein and synthetic fabrics. Red listed textile chemicals, their sources and remedies. Pollution aspects of textile dyeing.

Module-3

Eco friendly printing of natural, protein and synthetic fabrics. Finishing of textiles with various specialty chemicals and auxiliaries.

Module-4

Eco friendly finishing of natural, protein and synthetic fabrics. Eco-labelling and various Eco-standards.

Module-5

Methods of extraction of natural dyes. Latest developments in natural dyes and their application on various fibers

Course outcome (Course Skill Set)

1. At the end of the course the student will be able to: Identify the need for eco-friendly process.
2. Demonstrate functions of the chemicals used for eco-friendly textile processing.
3. Summarize speciality chemicals used for production of textiles
4. Illustrate methods of manufacturing of eco-friendly processing.
5. Demonstrate eco-friendly natural dyes on textiles.

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

- The question paper will have ten questions. Each question is set for 10 marks.
- There will be 2 questions from each module. Each of the two questions under a module may or may not have the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
- The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books Text Books:

1. Dyeing and printing with natural dyes - M.L.Gulrajani.
2. Eco-friendly Textile wet processing-co-ordinator,N CUTE Publication - Dr.R.Ashokan
3. Shenai V A, "Technology of Printing", Sevak Publishers, Mumbai, 1990.
4. 4.. Shore J, "Colorants & Auxiliaries", Vol. I & II, Society of Dyers and Colourists, UK, 1990.
5. Schindler W D and Hauser P J, "Chemical Finishing of Textiles", The Textile Institute, Wood head Publishing Ltd., Cambridge, 2004.
6. Heywood D.," Textile Finishing", Wood head Publishing Ltd.,2003

Reference books:

7. Environment Problems in chemical processing of Textiles, NCUTE Publication – Dr.A.Asokan, Ms.Yogita
8. Finishing of Khadi Garments - Dr.R.B.Chavan, R.Chattopadhyay, R.P.Tewari, IIT Delhi

9. Holme L, “New developments in chemical finishing of textiles”, Journal of Textile Institute, UK, 2008.
10. Tyler D, “Textile Digital Printing Technologies”, Textile Institute Publication UK, Vol.37, No.4, 2005.

Web links and Video Lectures (e-Resources):

- NPTEL course on Textile effluent and its measurement: https://nptel.ac.in/courses/
- NPTEL course on Textile finishing, Textile wet processing, Textile printing and natural dye

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

- Collection of textile processing effluents data’s from literature and comparing with the various standards
- Collecting textile processing effluents data’s from nearby industries (case study) and studying the same
- Seminars, quizzes, group discussions, seminars and report writing on eco parameters concepts.
- Finding out various textile processing effluents parameters of fibre, yarn and fabrics.
- Practical exposure to various eco-friendly dyes and chemicals used for textile processing

EVALUATION OF TEXTILES FIBRES USING MODERN TOOLS –LAB		Semester	IV
Course Code	**BTXL456D**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Credits	01	Exam Hours	03
Examination nature (SEE)	Practical		

Course objectives:

- Learn the use of modern tools for the measurement of fibre properties accurately
- Apply the knowledge of quality textile fibres using digital technology
- New methods of analysis of test results using statistical tools
- Interpretation of test results using computer software

Sl.NO	Experiments
1	Identification of textile fibres by using CARL ZEISS modern microscope with digital camera
2	Determining maturity of cotton fibres by using CARL ZEISS modern microscope with digital camera and polarised light
3	Evaluation of cotton fibre length and length uniformity using HVI
4	Evaluation of cotton fibre strength and elongation using HVI
5	Evaluation of cotton fibre fineness using HVI
6	Evaluation of cotton fibre maturity using HVI
7	Evaluation of cotton fibre moisture relations using HVI
8	Evaluation of cotton fibre colour using HVI
9	Analysis of trash content in cotton fibres using trash analyser
10	Analysis of trash content in cotton fibres using HVI
11	Evaluation of cotton fibre properties using AFIS
12	Determination of single fibre strength by using Electronic Universal Tester
	Demonstration Experiments (For CIE)
9	Effect of fibre length and length uniformity on yarn quality
10	Effect of fibre strength and elongation on yarn strength
12	Effect of fibre fineness and maturity on yarn quality
11	Analysis of nep data by AFIS test results

Course outcomes (Course Skill Set):

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

- Evaluate the properties of cotton fibres using modern tools
- Analyse the test results accurately using modern instruments and computer
- Interpret the test results and conclude precisely
- Relate the fibre properties with yarn and fabric properties

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 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

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

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are 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 down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a 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 marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedules mentioned in the academic calendar of 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 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 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

1. **Principles of Textiles testing** J.E. Booth.
2. **Hand book of textile testing and quality control,** B. Glover, D.S. Hambi-Pu Wiley Estern.Ltd., Bangalore.
3. **Physical testing of textiles** – B.P. Soville, Wood Head – 1999
4. **Textile Testing,** James Lomak, Longmans, Green and Co. London.
5. **B.I.S. Handbook,** BIS publications, 1985.
6. **B.S. Handbook**, B S Publications 1985.
7. **ASTM standard** ASTM publication 1985.
8. **Handbook of Methods of tests for cotton fibres, yarn and Fabrics,** CTRL, Bombay
9. **Kock, Chemical Testing of Textiles**, Chapman and Hall, London.
10. **Cotton assessment and appreciation**, SITRA, Coimbatore.