VII SEMESTER

TEXTILE TESTING-II		Semester	VII
Course Code	**BTX701**	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 make students to

- Explain the importance of yarn and fabric testing and quality control in textile industry.
- Demonstrate different methods, standards, principles and working of instruments used fortesting of evenness of yarns and various fabric properties.
- Evaluate evenness of yarns and fabric properties, calculate and analyse the test results. Compare and draw suitable conclusions
- Evaluate and analyse the effects of various parameters affecting test results
- Demonstrate various settings and calibration of testing equipment
- Explain the use of modern technology in the measurement of yarn evenness and properties of fabrics.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that 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, working models, animation films may be adopted so that the delivered lessoncan progress the students in theoretical, applied and practical skills.
- Hands on training may be arranged for students to learn practical aspects.
- Encourage the students to learn machinery operations various settings and maintenance.
- Support and guide the students for self-study.

MODULE-1

Evenness of various textile strands such as sliver, roving & yarns – random variation, periodic variation, Index of irregularity, Variance-length curves and their importance, Methods of measurement of evenness, principles of various evenness testers & measurement of evenness. Mass variation diagram & spectrogram & its importance. Causes & effects of irregularity in textile strands. Yarn hairiness and its measurements.

MODULE-2

Determination of fabric length, width, thickness, weight, thread density and crimp. Determination of air permeability, water vapour permeability, thermal conductivity and thermal comforts. Flammability of fabrics-Definitions, parameters and measurement. Fabric shrinkage- importance and measurement.

MODULE-3

Determination of fabric tensile, tearing and bursting strength. Determination of stiffness, crease, drape of fabrics. Fabric hand and its importance, determination and interpretation of fabric hand test results. Measurement of fabric hand by KES and FAST system and its application in apparel production.

MODULE-4

Water & fabric relationship. Study of water penetration, wetting of apparels, water repellence of industrial fabrics. Penetration of fabrics by water under pressure. Serviceability, wear, abrasion resistance and Pilling resistance.

MODULE-5
Apparel testing and quality control - Fabric inspection, estimation of colour fastness of fabrics. Sewability formability, tailor ability of fabrics. Seams, stitches and determination of seam strength and seam slippage and seam efficiency. Quality control in apparel industry and quality management tools.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Determination of yarn evenness by visual examination.
2	Determination of geometrical properties of fabrics.
3	Determination of Air Permeability of fabrics.
4	Determination of crease recovery property of fabrics.
5	Determination of drape co-efficient of fabrics.
6	Determination of fabric stiffness and its parameters.
7	Determination of fabric strength and elongation.
8	Determination of fabric tearing strength.
9	Determination of fabric bursting strength.
10	Determination of abrasion resistance of fabrics.
11	Determination of colour fastness of dyed and printed fabrics for washing.
12	Determination of colour fastness of dyed and printed fabrics for perspiration.

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:
- Explain the importance and necessity of determination of evenness of yarns and properties of fabrics
- Use of suitable equipment for the measurement of yarn evenness and properties of fabrics using appropriate method, standard and techniques. Demonstrate the principle and working of testing instruments
- Show the calculations, tabulation of test results, and analysis of test data and interpretation of test results.
- Explain the test parameters and their effects on quality parameters of textile materials
- Analyse the causes for poor quality of yarns and their effects on end products and the effect of them on performance of fabrics.

- Evaluate and demonstrate the determination of apparel quality and the parameters involved.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 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. Physical testing of textiles B.P. Soville Wood Head 1999
2. Principles of Textile Testing Booth J. E Butterworth, Wendon III Edition 1996
3. Handbook of Textile Testing and Quality Control Grover and Hamby Wiley Eastern Pvt. Ltd., New Delhi 1969
4. Physical Properties of textile fibres Morton and Hearle The Textile Institute, Manchester. 2008
5. Textile Testing John H Skinkle New York, N.Y., Chemical Pub. Co. 1949

Reference Books
1. B.I.S. Handbook BIS BIS publications 2000
2. B.S. Handbook G. Weston BS publications 2009
3. Textile Testing James Lomak, Longmans Green and Co. London 2002
4. ASTM standard ASTM USA ASTM publication 1985
5. Cotton assessment and appreciation SITRA Norms and procedures SITRA, Coimbatore 1017

Web links and Video Lectures (e-Resources):
- NPTEL lecture series
- YouTube simulation videos

KNITTING AND NON-WOVEN TECHNOLOGY		Semester	VII
Course Code	**BTX702**	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 the course gives the knowledge to the students in Production technology of knitted fabric, structure, machines and their parameters.
- It also helps acquire the knowledge in nonwoven fabric, production, uses and processing parameters

Teaching-Learning Process (General Instructions)

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

1. Student can able to work in knitting industry as production engineer, quality controller, industrial engineer, managers etc.

MODULE-1

Knitting industry position in India, basic terms and principles used in knitting technology, knitting elements, fundamentals of knitted structure, comparison between warp and weft knitting. Primary weft knit structures-plain, pearl and interlocks production and their properties.

MODULE-2

Types of knitting machines-circular and flat bed machine. Study of knit, float and tuck stitches- effects and there uses. Ornamentation of basic weft knit structure.

MODULE-3

Double knits, needle selection devices like pattern drum. Knit fabric geometry, tightness factor, robbing back and needle bounce. Types of positive feeders and their importance. Introduction to warp knitting.

MODULE-4

Introduction to nonwoven fabric and other fabric forming methods. Classification of nonwoven fabric, fibres used. Manufacture of nonwoven fabric, needle punched fabric, spun-bonded fabric.

MODULE-5

Applications of nonwoven fabric, stitch bonded fabric and their characteristics, testing of nonwoven fabric.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Study of passage of material through circular single jersey knitting machine and their important parts
2	Study of knitting elements like needle , sinker, cam positive feeder
3	Driving arrangement to cylinder, positive feeder to calculate the production and efficiency
4	Study of structure and notaions of plain, rib, pural and interlock structure
5	Practice of knit, tuck, float structure with loop diagram
6	Analysis of plain and rib knitted fabric and their geometrical parameters
7	Identification of different nonwoven fabric like needle punched, spun bond
8	Study of bursting strength for knitted and nonwoven fabric

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:
- Explain in depth about knitted fabric and their properties, uses.
- Demonstrate different types of knitting machines.
- Define and explain the basic elements and structures knitting.
- Explain in depth about non woven production methods.
- Summarize and discuss the Applications of nonwoven fabric.

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**)

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. Knitting technology- David Spencer.
2. Essentials of knitting- D B Ajagoankar.
3. Nonwovens manufacture – Proof. N N banerjee.
4. Nonwoven manufacture Encyclopedia of Textiles, Textile institute London.

Web links and Video Lectures (e-Resources): NPTEL   course on knitting technology

TEXTILE MATHEMATICS-II		Semester	VII
Course Code	**BTX703**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:2:0:0	SEE Marks	50
Total Hours of Pedagogy	50-55 Hours	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory		

Course objectives:

1. To make students to understand basic concepts of mathematics involved in textile technology.
2. This subject deals with major mathematical operations involved in textile technology.

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

Module-1

Conversion of units from one basic system to other basic system, Area and volume of regular and irregular shapes, Ratios, proportions, proportional division percentages – machine efficiency, running efficiency, overall efficiency, Application of elemental trigonometry for understanding yarn packages. Plotting of graphs w.r.t textile operations, law of graphs and integration of gradient of graph. Application of vectors in understanding parallelogram, triangle of force. Nomo grams.

Module-2

Fibers: Calculation of length parameters from sorter diagram, weight distribution technique for length measurement. Relation between fineness and linear density. Calculation of linear density from diameter of fibre and use of proportionality in fineness calculation. Calculation of tenacity, elastic recovery, work of rapture, initial modulus, moisture regain, moisture content and moisture swelling of fibres Definition and calculation of denier and Tex of the filament using melt spinning variables, definition of trash and lint content in raw cotton.

Module-3

Basic kinematics, The equations of motion, motion in a circle, Frictional drives, Chain and sprocket drives, driving by gears, planetary mechanisms, Draft calculation in yarn production, different types of drafts, Winding calculation in speed frame, ring frames. Production calculations in yarn spinning, determination of twist in roving, ring spinning, and OE spinning yarn.

Module-4

Yarn numbering, conversion of count from one system to other system, resultant count, number of fibres in yarn cross section, yarn diameter, calculation related to CV of double yarn, calculation of average count. Calculation of index of irregularity, U%, and Limit irregularity etc., Calculations related to cone and cheese winding. Winding rate wind and traverse ratio; yarn tension calculations yarn clearer settings warp and warping calculations, calculation related to size percentage, size pickup, sizing machines speed, Efficiency calculation related to warp and weft. Weft consumption on a loom, pirn shape, cheese length, cheese angle, wind of pirn.

Module-5

Calculation on weaving machine, (both shuttle and shuttle less) Time required to weave a known length of fabric, warp length, required per loom, reed count, reed width, production calculation on different types of loom, fabric areal density calculations, fabric cover. Calculations w.r.t primary and secondary variation on loom, Loom efficiency, loom production.

Course outcome (Course Skill Set)

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

1. Define and apply basic concepts of mathematics involved in textiles
2. Solve numerical related fibre properties and interpret fibre geometrical parameters
3. Interpret and explain mechanics and calculations involved in yarn spinning/ weaving
4. Determine various parameters related to yarn and weaving preparatory
5. Analyse mathematical concepts related to weaving and woven cloths

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).**

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 shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Textile Mathematics Volume 1,2,3 by J.E. Booth
2. Textile Mechanics by Textile Institute Volume 1 & 2
3. Weaving calculations by Sengupta.
4. Mechanics and calculations of textile machinery N.Gokarneshan, Wood Head –New Delhi-2015

References:

1. Basic Textile Mathematics by A.K. Khare
2. Hand book of Cotton Spinning, William Taggart., and Universal Publ. Corp. 1979.
3. Essential Facts of Practical Cotton Spinning, Pattabhiraman. T.K., Soumya Pub., Bombay 1979.

Web links and Video Lectures (e-Resources):
• NPTEL course on Evaluation of textile materials-Module- 4,5,6,9,10,11
• NPTEL course on Mechanics of Textile Machineries.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
• Observing machineries in spinning and weaving laboratory and calculating various parameters
• Finding out various parameters of fibre , yarn and fabrics in textile testing laboratory Seminars
• Quizzes, group discussions ,seminars and report writing on various mathematical concepts of textiles

APPAREL MARKETING AND MERCHANDISING		Semester	VII
Course Code	**BTX714A**	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 make students understand the basics of apparel Industry and Business concepts, understandthe various marketing and merchandising responsibilities and strategies.
- To study about the analysis of garment and its standards, design and understanding aboutexport marketing.
- To acquaint the students of the concepts of business, design merchandising, sourcing and export Documentation.

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 apparel marketing and merchandising in various showrooms, mallsetc.
6. Actual marketing of apparels can be demonstrated to students by taking them to show rooms, retailsetc.
7. Arrange visits to apparel manufacturing industries.
8. Encourage students to observe marketing and merchandising of various apparelsto understandmarket trends.

Module-1

Organization of the apparel business -Nature of Apparel, Organization of the Apparel Industry- Business Concepts Applied to the Apparel Industry-International Issues- Cooperation in Manufacturing and Distribution.

Marketing objectives and strategies-Functional organization of an apparel firm, responsibilities of marketing division strategic plan, marketing objectives & strategies, Retail and Wholesale Strategiesof Merchandise Distribution-Labelling and Licensing.

Module-2

Merchandising strategies & process- Concepts apparel production lines, dimensions of product change, nature & timing of merchandising responsibilities, business & marketing plans, line planning, line development line presentation,

Analysis of garment development- Role of garment analysis, process of garment analysis, professional perspectives on garment analysis.

Module-3

Product standards and specifications: Sources of Product and Quality Standards-Standards for Quality, Fit, and Performance - Use of Specifications-Writing Specifications for Apparel Manufacturing.   **Apparel design:** Product Development and the Design Function- Role of Product Change in the Design Process- Post adoption Style. Development- Apparel Design Technology.

Module-4
Export marketing: Outlook for export marketing, International agreement & agencies for promoting exports. Export import policy. Export assistance. Current pattern of India's foreign & world trade,Export barriers-tariff & non-tariff.

Module-5
Export marketing channels, physical distribution transportation, packaging & marine insurance for exports. Management of risk & export financing, Quality control& pre-shipment inspection, documents for exports. An Introduction to retail marketing. Consumer behaviour &retail operation. The retail marketing mix. Management of a retail brand. Application of IT in retail marketing.

Course outcome (Course Skill Set)

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

1. Learn about organization of the apparel industry and business concepts of apparel Industry.
2. Gain knowledge about Marketing and Merchandising Strategies.
3. Understand the procedure involved in the export of apparel and will be able to understand thebasics garment.
4. analysis and Standards for Quality, Fit, and Performance.
5. Will be able to understand the apparel design and apply the concept of marketing andmerchandizing in the apparel industry in India.
6. Understand about the apparel export marketing, apply the concept of marketing and merchandizing in the apparel industry in India.

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. Apparel Manufacturing - Ruth E. Glock, Grace I. Kunz-, PHI Publication, UK
2. Export Marketing- B.S.Rathore&J.S.Rathore, Himalaya Publishing house,Bombay, 1997
3. "Fashion Merchandising", Elian stone, Jean A samples, McGraw Hill Book Company, NewYork,1985, ISBN: 0-07- 061742-2
4. "Export Marketing" – A Practical Guide to Exporters", Shivaramu S.,Wheeler Publishing,Ohio,1996, ISBN: 81- 7544-166-6
5. "Apparel Manufacturing Sewn Product Analysis" , Ruth E. Glock, Grace I. Kunz FourthEdition,Pearson Prentice Hall, NJ, 2005, ISBN: 81-7758-076-0

 Reference books:

1. The Technology of Clothing manufacture-Herold Carr and Barbara Latham
2. Individuality-Mary Kefgan, PhyllissTouchies Specht
3. Apparel Manufacturing and Sewn Product Analysis-Ruth E Clock
4. Quality Control in Apparel Industry-By Pradip V. Mehta
5. Fabulous fit-By Judith Rashand
6. Marketing Management-Phillip Kotler

   Retail marketing management – David Gilbert

Web links and Video Lectures (e-Resources):

- Apparel marketing and merchandising
  :https://textilelearner.net/?s=Apparel+marketing+and+merchandising.
- Apparel Merchandiser & Merchandising:
  :https://www.slideshare.net/MehediHassanRifat/apparel-merchandiser-merchandising.

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

- Collection of apparel marketing and merchandising data from literature and studying theirmarket trends.
- Seminars, quizzes, group discussions, seminars and report writing on apparel marketing andmerchandising concepts.
- Practical exposure on Marketing and Merchandising Strategies on apparels.

OPERATIONS RESEARCH & RETAIL MANAGEMENT		Semester	VII
Course Code	**BTX714B**	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 make students understand the basic objectives of operation research and phases of operation research technique and its applicability in textile and garmentindustries.
- To highlight the importance of retailing and its role in the success of modern business

Teaching-Learning Process (General Instructions)

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

1. 1.State the importance of O.R & Retail management through related videos
2. Seminars & Quizzes may be arranged in respective topics to develop skills
3. Inspire the students by giving examples of Retail management in various Textile activities.
4. Support and guide the students for Self study.

Module-1
Definition of OR. Phases of OR technique. Linear programming problem by graphical and simplex method. Assignment problem by Hungarian method. Balanced and unbalanced matrix. Profit and cost matrix. Problems pertaining to these matrix.

Module-2
TRANSPORTATION PROBLEM: Vogel's approximation method – Determination of Optimal solution by MODI method, North west corner Rule and- Least cost entry method.

Module-3
Replacement: . Objects of replacement. Types of Replacement such as Individual replacement, Groupreplacement. Problems pertaining to these types of replacement problems.

Module-4
Queuing theory, queue, Waiting line FIFO and LIFO with examples. Customer's behavior in queue. M/M/I System and its details. Brief study about CPM and PERT.

Module-5
Introduction and Perspectives on Retailing World of Retailing, Retail management, introduction,meaning, characteristics, emergence of organizations of retailing - Types of Retailers (Retail Formats) – Multichannel Retailing -Customer Buying Behavior, Historical Perspective, role of retailing, trends in retailing, FDI in Retail - Problems of Indian Retailing - Current Scenario.

Course outcome (Course Skill Set)

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

1. Explain the meaning, definitions, scope, need, phases and techniques of operations research. Formulate L.P.P and derive optimal solutions to linear programming problems by graphicalmethod, Simplex method.
2. Solve the Vogel's approximation method and finding solution by different methods.
3. Demonstrate the Replacement theory and accustom to solve different types of

replacementproblems.
4.   Solve waiting line problems (Queuing theory) and gains introductory knowledge about CPM &PERT.
5.   Explain the Perspectives of Retailing World of Retailing, Retail management

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.   Operations Research – Theory and Applications – 5th Edition, J K Sharma, MACIN Publisher 2012
     Principles of Operations Research – Theory and Practice. Philips, Ravindran and SolbergJohnWiley &Sons (Asia) Pvt. Ltd,2000
2.   Principles, Methodology and Applications of Operations Research, Prof. J. Govardhan JEMConsultants India 2012
3.   Operations Research, P.K.Gupta and D.S. Hira, S. Chand and Co 2002
4.   Problems in Operations Research (Principles and Solutions) P.K.Gupta and D.S. Hira, ,S. Chandand Co 2010
5.   Retail Management Levy and Weitz McGraw Hill

6. Retail Management Chetan Bajaj Oxford University press

Web links and Video Lectures (e-Resources):

- NPTEL Courses on ORT.

FABRIC STRUCTURE AND DESIGN ANALYSIS-II		Semester	VII
Course Code	**BTX714C**	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 make students to have a knowledge about special design features of various complicated and intricate design fabrics. Students are to learn analysis of these fabrics for their various construction particulars, manufacturing data and design details. Students are to understand the characteristic features of fabrics, design features and aesthetic qualities of different fabrics. Students will understand the raw material requirements, machine and equipment for the production the fabric. Students understand the end uses of different fabrics and their suitability.

Teaching-Learning Process (General Instructions)

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

1. State the importance of Human Resource through related videos
2. Seminars & Quizzes may be arranged in respective topics to develop skills
3. Inspire the students by giving examples of present day Human resource management in variousTextile activities.
4. Support and guide the students for Self-study.

Module-1
Extra warp and extra weft figured fabrics – continuous, intermittent. Clipped spot effects, zing thing effect. Backed weaves and fabrics –warp and weft backed cloths, reversible, interchanging backed cloths, imitation backed cloths.

Module-2
Double cloths- Classification, selection criteria for threads, weaves etc., self-stitched double cloths, interchangeable double cloths. Centre stitched double cloths.

Module-3
Gauze and leno structures, principles of leno structure, basic sheds in leno structure, leno weaving with flat steel dupes with an eye, Russian cords design, simple net leno, Easing action shaker device. Principle of designing simple damask and brocades.

Module-4
Weft pile fabrics – Classification of weft pile fabrics, All over or plain velveteen, corded velveteen, weft flushes, figured velveteen fabrics. Warp pile fabrics – Classification, warp pile fabrics produced by different methods - with the aid of wires and face to face principle and special mechanisms.

Module-5
Terry pile structures - formation of pile, terry weaves, figured terry pile fabrics. Narrow fabrics. Uncommon woven structures- Lappet & Swivel fabrics.

Course outcome (Course Skill Set)

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

1. Learn various construction particulars and manufacturing data
2. Learn raw requirements and loom equipment required to produce the fabric.
3. Learn the analysis of complicated and intricate design features of various fabrics
4. Understand the suitability of these fabrics for particular end uses.

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

29. Watsons Advanced Textile Design- Z.J Grosicki- Universal Publishing Corporation, Bombay-1988.
30. Grammar of Textile Design- H. Nisbet- Taraporewala and Sons-1985.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
        Activity based on analysis and illustration of various advanced fabric structures.

WASTE MANAGEMENT AND POLLUTION CONTROL IN TEXTILE INDUSTRY		Semester	VII
Course Code	**BTX714D**	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:

- Understand environmental management aspects in textile industries.
- Understand the significance of pollution control measures, quality of water and effluent treatment methods.

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 process so that student can understand more easily.
2. Show students the different samples of the waste fibres, yarns and fabrics and ask them to identify

   different waste
3. Inspire the students to have collaborative learning in the class.
4. Support and guide the students for Self-study.

Module-1

Introduction to Environment Management. Scope and objectives, Benefits. Quality of Water. Water quality requirements for textile wet processing.

Module-2

SEWAGE- DEFINITION- characteristics of sewage, general methods of treatment of sewage, disposal of sewage.

INDUSTRIAL EFFLUENTS: The disposal of industrial effluents in to streams. Characteristics of textile mill effluents, disposal and effect on the receiving streams.

Module-3

Noise pollution, causes of noise pollution, effects of noise pollution, remedial measures. Methods of noise control in textile mills. Brief discussion about different instruments used in analysis of effluents.

Module-4

Brief discussion about different instruments used in analysis of effluents. Sources of pollution and its control. Various methods of industrial waste water treatment. Treatment of effluents received from textile wet processing industries.

Module-5

Filtration and filtration methods. Role of filter fabrics in pollution control. Indian pollution acts, their role and Effectiveness. Recent developments in pollution control in various processes in textile mills and manufacturing plants.

Course outcome (Course Skill Set)

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

- This subject helps the student to acquire the concepts of environmental management for textile industries.
- This subject prepares the student apply environmental concept tools, pollution control norms and effluent control measures in textile/garment manufacturing industries
- Students are exposed to environmental laws, EA systems, effluent treatment methods and concepts so that they apply these concepts in the actual work environment for maximum benefits.

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).**

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 shall be proportionally reduced to 50 marks

Suggested Learning Resources:
Text Books

1. Water Supply and sewage-Mc Graw Hill Publication
2. Waste Water Treatment- International Publication, M. N. Rao and A. K. Dutta
3. Waste Water Engg. Treatment Disposal Sewage- Tata Mc Graw Hill Publication
4. Pollution and its Control-Chand Publication

   Reference Books

1. Efficient use of Fuel- H. M. S. D. Publication London 1958.
2. Energy Resources- Demand and Conservation with Special Reference to India, C. Kashjan.

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.

FASHION AND TEXTILES		Semester	VII
Course Code	**BTX755A**	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	01
Examination nature (SEE)	Theory		

Course objectives: Have knowledge of concepts related to fashion and textiles

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 process so that student can understand more easily.
2. Show students the different samples of the waste fibres, yarns and fabrics and ask them to identify
3. different waste
4. Inspire the students to have collaborative learning in the class.
5. Support and guide the students for Self-study.

Module-1

Fashion: Introduction to fashion and apparel design, Origin of fashion, Definition, Terminology, Fashion concepts, Fashion analysis, Fashion trends, Fashion creations. Fashion theories:- Fashion of different eras, French revolution.

Module-2

Fashion promotion:- From design to production. Style, Fad, Trends, Fashion industry. Design, Definition, Structural, decorative, Dress designing and creating varieties, Through designs. Principals of design, Definition, Harmony, Proportion balance, Rhythm, Emphasis, Meaning, Types and application on apparel.

Module-3

Colour:- definition dimension of colour, Hue, Value,Intensity. Colour scheme: - importance, And application of colour in apparel. Psychology of clothing: – First impression, role of socio psychological and economical aspects of clothing. Comfort of the apparel

Module-4

Textiles:- Historical development of textile fibres. Classification of fibres, definition and general properties. Natural fibres- cellulose, cotton, Wool and silk, Minorfibres, Mineral fibres; Physical and chemical properties. Man- made and synthetic fibres, Rayon, Nylon, Polyster, Acrylic fibres, Physical and chemical properties; Identification of fibres.

Module-5

Yarn:- Yarn properties, yarn count, , Yarn twist, yarn types single , plied and cord yarn,Sewing thread, Complex Yarns:- Novelty Yarns, Textured Yarns and metallic Yarns. Fabric: -characteristics, Types, weaves- plain, Twill, Satin and variations. Fancy weaves: - dobby, jacquard, Leno, Lappet, Swiss, double cloth. Knitting:- circular, Tubular, Jersey. Non-woven:-films, foams, felting, braiding, bonding and laminating.

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

1. Describe concepts of fashion.
2. Emphasizing the fashion promotion, fashion designing.
3. Explain theory of colour
4. Illustrate production and properties of fibres
5. Explain the production, characteristics of yarns and 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.

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. Erwin Mabel (1994):- Clothing for Moderns, Macmillan Co. London.
2. Tate (1977) Sharon lee:- "Inside Fashion Design" Farncisco Canfield Press.
3. Bhatacharya Anand:- "Garment Technology" NCUTE, IIT, Delhi(2003).
4. Cooklin Gerry:- "Garment technology for fashion designers" OM
Book service, NewDelhi.
5. Bernard P. Corbman :- "Textile- Fiber to Fabric" McGraw –Hill international editions.
6. E P G Gohl and Vilensky :- "Textile Science" CBS Publishers and
Distributors, NewDelhi

Web links and Video Lectures (e-Resources):

• NPTEL course on textile fibres, manufactured fibres, spinning technology

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
- Visit to textile / garment industries
- Collection of various types of fibres, yarns and fabrics.

HIGH PERFORMANCE POLYMERS AND FIBRES		Semester	VII
Course Code	**BTX755B**	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	01
Examination nature (SEE)	Theory		

Course objectives:

This course aims at making the engineering students have an idea about general aspects of fibres and polymers, production and properties of high-performance polymeric 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 their creativity and analytical skills. Support and guide the students for self-study.

Module-1

Introduction to polymers and fibres. Requirement of fibre forming polymers, classification of polymers and fibres. Brief details on polymerization methods. Importance of molecular weight and thermal analysis of polymers with respect to production of high performance polymers and fibres.

Module-2

Summary of production of manufactured fibres, comparison of properties of natural and manufactured fibres. Introduction to high performance fibres. Need for production of high-performance fibres. Classification of high performance fibres on the basis of mechanical properties, General applications of high performance fibres and polymers. Comparison of high performance fibres and conventional fibres.

Module-3

Concept of liquid polymers. Types of liquid crystal polymers, characteristics of liquid crystal polymers, Polymerization, spinning and properties of aramids, aromatic polyesters, rigid rod and ladderpolymers such as PBZT, PBO, PBI, PIPD

Module-4

Manufacture of carbon fibres from polyacrylonitrile, viscose and pitch precursors, Concept of gel spinning and spinning of UHMWHDPE fibres, Elastomeric polymers and fibres, , Conducting fibres, Thermallyand chemically resistant polymers and fibres. Nano polymers and fibres, Features of Nano-polymers and fibers. Production of Nano fibres, applications OF Nano fibres and Nano polymers.

Module-5

Methods of synthesis, production and properties of: glass and ceramic fibres. Specialty fibres: profile fibres, optical fibers, bicomponent fibres and hybrid fibres, Superabsorbent polymers and fibres.

Course outcome (Course Skill Set)

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

1. Identify need for polymers and fibres, classify polymers and fibres and explain the polymer production methods and importance of molecular weight and thermal properties of polymers and fibres.

2. Summarise the production methods of manufactured fibres, identify the need for high-performance fibres and classify the high-performance fibres.

3. Demonstrate the production organic aromatic high performance fibres.

4. Summarize the production properties and applications of carbon, UHMWHDPE, Nano fibres.

5.Demonstrate the production of glass ceramic and speciality 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.

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).**

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 shall be proportionally reduced to 50 marks

Suggested Learning Resources:

1. **Books 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,
3. **Manufactured fibre technology,** Gupta V.B, Kothari V.K., Chapman Hall, London, 1997
4. **High Performance fibres**, J.W.S.Hearle, Wood Head,UK-2005.

Web links and Video Lectures (e-Resources):

- NPTEL courses on high performance fibres

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
- Students may be taken to industries which use high performance fibres for various applications.

INTRODUCTION TO TEXTILE REINFORCED COMPOSITES AND SMART TEXTILES		Semester	VII
Course Code	**BTX755C**	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	01
Examination nature (SEE)	Theory		

Course objectives:

- Course aims at making students to learn about concepts of fibre reinforced composites, methods of production applications etc. and various aspects of smart textiles.

Teaching-Learning Process (General Instructions)

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

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,. Used in the production of fibre reinforced composites.

Matrix materials for composites Classification of resins, thermoset, thermoplastic metal matrix

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, pultrasion techniques

Module-3

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.

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

Module-4

Definition of smart and intelligent textiles, Classification of smart 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. Breathable textile. Multifunctional textiles with incorporated electronics for integrated communication, music, health monitoring, defence support functions, wearable computers.

Module-5

Environmentally sensitive textiles- photochromic and thermo chromic (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. Fibres as solar cells, Shape memory textiles Recent advances

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
2. Explain the properties of fibres and resins used for composite production and summerize various methods of manufacturing of composites
3. Explain the applications of composites and derive expression for modulus of composites in axial and transverse direction.
4. Identify the need for intelligent textiles, and explain wearable electronics, textiles for extreme heat and cold and change materials
5. Summarize environmentally sensitive textiles stimuli sensitive polymers and Shape memory 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 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).**

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 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. **Composite materials**:- Krishan K. Chawla, Springer 2005
3. **High Performance Fibres:-** J.W.S. Hearle, Woodhead UK 2005
4. **Composites Engineering Hand Book** - Ed. Mallik P.K., Marcell Dekker, N.Y., 1997

Reference Books:

1. Shape memory polymers and textiles by Jinlian HU
2. Smart Clothing: Technology and Applications by Gilshoo Cho
3. Smart fibres, fabrics and clothing. X. Tao. Wood Head-2005
4. Intelligent textiles and clothing. H.R. Mattila . Wood Head-200

Web links and Video Lectures (e-Resources):
- NPTEL course on composites

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning
- Students can be demonstrated for intelligent textiles and may be taken to field visits where composites are extensively used.

INDUSTRIAL TEXTILES		Semester	VII
Course Code	BTX755D	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	01
Examination nature (SEE)	Theory		

Course objectives:

- This subject helps the student to acquire knowledge of various technical textiles used inindustries
- This subject prepares the student work in technical textile manufacturing industry.
- Students are exposed to research field in technical textiles and their applications in various industries.

Teaching-Learning Process (General Instructions)

1. 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 ofteaching methods may be adopted to develop the outcomes.
2. Use PowerPoint/Videos/Animations to explain various concepts.
3. Ask some creative and higher-order thinking questions in classes which helps critical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather thansimply recall it
5. Support and guide the students for self-study.

Module-1

Brief history of industrial/ technical textiles, Growth of industrial/technical textiles. Requirements of fibres, yarns and fabrics for technical textiles. Classification of technical textiles. Study of properties of various fibres used for technical textiles

Automotive Textiles- Use of textiles in tyres, requirements of fibres used for tyres, various fibres usedfor tyre cords, tire building, different types of tyres. Upholstery in automobiles: vehicle top covers, seat covers, headliners, carpets etc. Safety devices in automobiles: seat belts, airbags, helmets etc. Textiles used in Aerospace industry.

Module-2

Geotextiles: Usefulness of geotextiles, Understanding soil characteristics, properties affecting engineering behaviour of soil, identification, classifications, permeability, effective stress and pore water pressure, seepage of soils and design of filter criteria.

Geosynthetics types, functions and application areas of geotextiles, fibres and fabric selection criteria for geotextile applications. Mechanics of reinforcement, filtration and drainage by geotextiles and functions, material construction and manufacturing processes in case of geotextiles, evaluation of geotextiles with and without soil, evaluation of filtration and drainage functions, reinforcement, creep, moisture barrier characteristics, durability and ageing.

Geotextiles and reinforced soil structures: Retaining walls, embankment, foundation. Geotextiles in roads and railways: separation, draining and filtering. Geotextiles in environmental control: covers and liners, landslides, and erosion control.

Module-3

Filtration textiles: Definition of filtration parameters, Dust collection and solid liquid separation, filtration requirements, concept of pore size and particle size, role of fiber, fabric construction and finishing treatments.

Protective Clothing: Brief idea about different type of protective clothing, cut resistant fabric,functional requirement of textiles in defence including ballistic protection materials and parachute cloth, temperature and flame retardant clothing, chemical protective clothing, water proof breathable fabrics.

Module-4

Medical Textiles-Medical application of Textiles, requirements, classification, detailed study of application of textiles in implantable, non-implantable, extra corporal devices and health care hygienic products

Other uses of industrial textile: Cords and ropes, functional requirements and types of textiles used for paper making, agricultural, electronics, power transmission belting, hoses, canvas covers and tarpaulins.

Module-5

Smart Textiles-Introduction, concept of smart textiles, various applications of smart textiles. Introduction to nanotechnology in textiles. Application of Nano textiles in various field. Productionand properties of Nano-fibres.

Fibre Reinforced Composites – meaning, classification, brief outline on raw materials, production techniques and applications.

Course outcome (Course Skill Set)

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

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. Handbook of Technical Textiles", Ed. A R Horrocks and S C Anand, Woodhead Publication Ltd., Cambridge, 2000.
2. "Wellington Sears Handbook of Industrial Textiles", Ed. Sabit Adanaur, Technimic Publishing Company, Inc., Pennslavania, USA, 1995.
3. ShuklaS K, YinJian-hua, Fundamentals of Geosynthetic Engineering, Taylor and Francis, 2006, UK.
4. "Modern Textile Characterization Methods", Ed. M Raheel, Marcel Dekker, Inc., 1996.
5. Nonwoven Fabrics; Ed. W. Albrecht, H. Fuchs, and W. Kittelmann, WLLEY VCH Publication, 2003, UK.
6. Smart Fibres - Fabrics & Clothing Xiaoming Tao Wood Head Pub., England 2001

Web links and Video Lectures (e-Resources):

- https://www.jasonmills.com/technical-textiles/
- https://nptel.ac.in/courses/116102057
- https://www.sciencedirect.com/book/9781782424581/handbook-of-technical-textiles

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

- Quiz/Group discussion.
- Practical demonstration of Technical Textile product application
- NPTEL and YouTube videos