

**Institute of Chemical Technology
Nathalal Parekh Marg,
Matunga, Mumbai - 400019**

*Category I deemed to be University (MHRD/UGC)
Elite Status and Centre of Excellence, Govt. of Maharashtra
“National Rank 1 in Atal Innovation Ranking (ARIIA)”
World Renowned for Quality of Education, Research and Connectivity with Industry*



**Department of Fibres and
Textile Processing Technology**



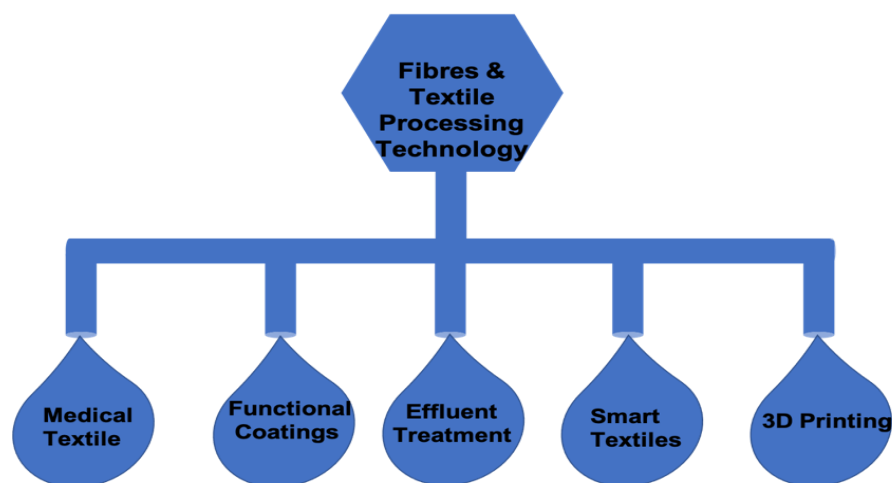
**Curriculum
(Instruction, Evaluation and Course content)
(Revision 2021)
For the Two-year course leading to the
Master of Technology (M.Tech.) degree
Implemented from the batch admitted in Academic Year**

2017-18

Department of Fibres and Textile Processing Technology

The Institute of Chemical Technology (ICT) was established in 1933 and earlier known as a University Department of Chemical Technology (UDCT). Inaugurated by then Chairman of the Textile Mill Owner's Association, with an objective to provide Education and develop Capabilities in Textile Processing and to fulfil the needs of blooming Textile Industry in India.

Initially, it offered two courses, one in Textile Chemistry and the other in Chemical Engineering. The Textiles department is now completing glorious journey of 88 years. This is the first and only premium institute specifically dedicated to study various aspects of Textile wet processing and conduct in-depth research to provide feasible techno-commercial solutions to the ever-evolving industrial needs.



The educational curriculum of the department encompasses various segments of Textile value chain and covers components from the 'Farm to Fashion'. The strong technical foundation is laid based on the topics covered, theoretical fundamentals clarified, and the hands-on practical know-how provided to the budding technologists. It has helped the alumnus of the department demonstrate industrial excellence and entrepreneurial ability. The alumni of the department can provide value added differentiation, achieve leadership positions in different facets of Textile manufacturing and allied industries as well as shine in academic and research institutes across the world.

The department is closely working with various industries involved in fibre and yarn manufacturing, fabric processing and garment making, colourant and auxiliary chemical producing, instrument and equipment making, fashion designing and branding. It also has

strong linkage and signed Memorandum of Understanding (MOU) with many national and international renowned universities. It is well known for the translational research and technology transfer and is often cited as a role model for academic institutes.

The department has the unique distinction of being the first discipline with which this academic institute started and has the highest student intake capacity among the technology courses within the institute. The course involves study of chemistry and manufacture of fibres, their chemical processing such as bleaching, dyeing, printing, and finishing. It further encompasses the study of chemistry as well as application of various kinds of chemicals, dyes, thickeners, and finishing auxiliaries which are used in chemical processing of apparel, home furnishing and technical textiles. It also involves knowledge of green chemistry, biotechnology, and nanotechnology with special reference to chemical processing of textiles.

VISION

To be the world class center of excellence in teaching and research in chemical processing of fibres, textiles, apparels and the key areas of technical textiles with ecological, social and ethical responsibility, meeting the crucial needs of trained man power and technological solutions of Indian textile industry.

MISSION

- To be the leader in offering top class human resources by training them from bachelors to doctorate level degrees in core competence i.e. in chemical processing of fibres, textiles and apparels.
- To train the industrial technicians as per the demands of the industry, upgrading their skill to meet international quality standards.
- To conduct industrially relevant research and provide technical guidance aimed at offering technology solutions and enhancing competitive edge to the industry.
- To offer technological interventions to preserve our rich heritage of the artisans in rural areas in hand looms, khadi and village industry and to strengthen the rural economy by enhancing the use of rural fibres and natural dyes.
- To create awareness of the environment protection and social and ethical commitment in pollution abatement

Program Educational Objectives (PEOs)

PEO1 Work efficiently and productively as a Textile Technologist and Scientist in academia as well as industry in supportive or leading role.

PEO2 Be a good learner at all stages of profession by acquiring higher education, professional degrees, or courses.

PEO3 Promote research, technology and products related to fibres and textile science for the good of society and scientific world.

PEO4 Aware of the environmental and societal impact of textile technology and work within the periphery.

PROGRAM OUTCOMES

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

PO2: An ability to write and present a substantial technical report/document.

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

PO4: Students should be able to profess as a researcher or entrepreneur the social and environmental awareness of textile technology and cope up with futuristic technologies which will lead the textile processing towards sustainability.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1.Instil in the student enthusiasm and motivation to develop themselves into Academician and Research scientists making positive contribution to generation and dissemination of new knowledge.

PSO2.With increased interaction with the diverse industry and upcoming varied segments of Technical & Smart Textiles, create a thirst among the students to plan for innovative start- up or career options taking advantage of the fast-developing Indian economy.

PSO3.Develop a confident masters in field to handle technical problems related to textile industry shop floor or supply chain.

M.Tech. (Fibres and Textile Processing Technology)

Semester I

| No. | Contents | Course Code | Subject | Hours/Week (L+T) | Marks | Credits |
|--------------|--------------|-------------|--|------------------|-------|---------|
| 1. | Core I | TXT 2502 | Advanced Textile Materials | (2+1) | 50 | 3 |
| 2. | Core II | TXT 2803 | Sustainable Textile Processing | (2+1) | 50 | 3 |
| 3. | Core III | PYT 2106 | Physical Methods of Analysis | (2+1) | 50 | 3 |
| 4. | *Elective I | | | (2+1) | 50 | 3 |
| 5. | *Elective II | | | (2+1) | 50 | 3 |
| 6. | Project I | TXP 2001 | Seminar & Critical Review | 6 | 50 | 3 |
| 7. | Practical I | TXP 2301 | Advanced Textile Characterisation Techniques | 6 | 50 | 3 |
| 8. | Research I | TXP 2002 | Literature survey, project plan and proof of concept | 12 | 100 | 6 |
| Total | | | | 39 | 450 | 27 |

Semester II

| No. | Contents | Course Code | Subject | Hours/Week (L+T) | Marks | Credits |
|--------------|---------------|-----------------|---|------------------|-------|---------|
| 1. | Core IV | TXT 2804 | Management of Textile Waste | (2+1) | 50 | 3 |
| 2. | Core V | TXT 2503 | Smart Textile | (2+1) | 50 | 3 |
| 3. | Core VI | TXT 2203 | Developments in Textile Processing Machinery | (2+1) | 50 | 3 |
| 4. | *Elective III | | | (2+1) | 50 | 3 |
| 5. | *Elective IV | | | (2+1) | 50 | 3 |
| 6. | Practical II | TXP 2302 | Process Optimisation & Performance Evaluation | 6 | 50 | 3 |
| 7. | Research II | TXP 2003 | Mid project Evaluation | 18 | 150 | 9 |
| Total | | | | 39 | 450 | 27 |

Semester III

| No. | Contents | Course Code | Subject | Week (L+T) | Marks | Credits |
|--------------|------------|-------------|-------------------|--------------------------|-------|---------|
| 1. | Project II | TXP 2004 | In-plant Training | 15 weeks (40 hours/week) | 450 | 30 |
| Total | | | | 15 | 450 | 30 |

Semester IV

| No. | Contents | Course Code | Subject | Week (L+T) | Marks | Credits |
|--------------|--------------|-------------|--------------------------------|--------------------------|-------|---------|
| 1. | Research III | TXP 2005 | Research Thesis & Open Defense | 15 weeks (40 hours/week) | 450 | 30 |
| Total | | | | 15 | 450 | 30 |

***List of electives recommended by the department for Sem I**

1. PHT 2101: Research Methodology (**Elective I**)
2. BST 2106: Intellectual Property Rights (**Elective II**)

***List of electives offered by the department for Sem II**

1. TXT 2902: Entrepreneurship Development (**Elective III**)
2. TXT 2903: Laboratory Management Systems (**Elective IV**)
3. TXT 2904: Supply Chain Management
4. TXT 2205: Continuous Processing of Textile
5. TXT 2601: Biotechnology in Textiles
6. TXT 2204: Developments in Textile Auxiliary Chemicals

Note: Department will offer the course provided more than 8 students are opting the course

Syllabus for the M. Tech. (Textile Processing) Two Year (4 Semesters) Course

Semester I

| | |
|---------------------------------------|---|
| Code & Title of the Course | TXT 2502: Advanced Textile Materials |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | I |

| Sr.No. | Topic | Hrs. |
|---------------|---|-------------|
| 1. | Definition & Classification of Technical Textiles, Economics, Growth Potential, Selection Criteria for the fibres to be used in individual fields | 4 |
| 2. | Application & Growth of individual segments like geo textiles, medical textiles, automotive textiles, etc, Detailed description of some products of each category | 8 |
| 3. | Fibre composites, preparation, testing, applications | 6 |
| 4. | Introduction to basic principles of coating and laminating, Processes, Preparation for coating and lamination, Coating and Lamination methods, Applications | 8 |
| 5. | Methods of characterization of advanced materials | 4 |

Course Outcome:

Students will be able to,

TXT2502-1. Examine and choose among different types of textiles including geo textile, medical textile, automotive textile, etc. (K3)

TXT2502-2. Design the quality among various types of composites based on their constituents. (K3)

TXT2502-3. Express the selection criteria for fibres based on economics and growth potential. (K3)

TXT2502-4. Carry out characterisation of advanced materials. (K5)

Reference books:

1. Handbook of technical textiles, A.R. Horrock and S.C. Anand
2. Coated textiles Principles and applications by Dr. A.K. Sen
3. Medical textiles '96 by Subhash Anand
4. Automotive textiles by Dr. S.K. Mukhopadhyay and J.F. partridge, The Textile Institute.
5. Smart textile coatings and Laminates, Edited by William C. Smith

| | |
|---------------------------------------|---|
| Code & Title of the Course | TXT 2803: Sustainable Textile Processing |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | I |

| Sr.No. | Topic | Hrs. |
|---------------|--|-------------|
| 1. | Eco-friendly preparation, dyeing, printing, and finishing - Pollutants in processing industry and their effect on ecology, Standards for fresh water as well as wastewater, Special techniques for reducing pollution caused by textile processing, Eco- friendly substitutes of chemicals and processes | 14 |
| 2. | Hazardous substances in clothing and other textiles, Concept of RSL, APL, Zero Discharge of Hazardous Chemicals, Higg's Index, Mark and Spencer Plan A, Greenpeace and its campaigns | 6 |
| 3. | Life Cycle Assessment (LCA) of textiles, eco-audit, eco-norms, and eco-labeling | 6 |
| 4. | Carbon footprint in textile industry, Importance of Compliances for brands and retailers, importance of SIN (Substitute It Now!) | 4 |

Course outcome:

Students will be able to,

- TXT2803-1.** Develop textile processing protocols with eco-friendly/fewer polluting alternatives. (K4)
- TXT2803-2.** Examine the contents of pollutants or hazardous substances in textile goods. (K3)
- TXT2803-3.** Design the life cycle of textile goods and examine the environmental load. (K4)
- TXT2803-4.** Judge among textile brands according to their carbon footprint. (K5)

Reference books:

1. Sustainable Apparel, Richard Blackburn
2. Sustainable Textiles, Richard Blackburn
3. Handbook of Sustainable Textile Production, Marion I Tobler-Roh
4. Environmental Issues - Technology Options for Textile, Chavan R.B., Radhakrishnan J
5. Environmental Chemistry of dyes and pigments, Wiley, Reife A and Freeman H.S

| | |
|---------------------------------------|---|
| Code & Title of the Course | PYT 2106: Physical Methods of Analysis |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | I |

| Sr. No. | Topic | Hrs. |
|----------------|---|-------------|
| 1. | Fourier Transform Infrared Spectroscopy: Molecular vibrations, frequency shifts associated with structural changes, basic theory of FTIR spectroscopy, interferogram, digitization of interferogram, data points collection, instrumentation and advantages of FTIR spectrophotometry, qualitative and quantitative analysis using infrared spectrophotometry | 5 |
| 2. | Ultraviolet and visible spectrophotometry: Electronic transitions, spectrum, shift of bands with solvents, isolated double bonds, conjugated dienes, carbonyl compounds, aromatic and hetero-aromatic compounds, application in pollution control and chemical industry | 5 |
| 3. | Nuclear Magnetic Resonance: Basic principles of NMR phenomenon, relaxation processes, spin-spin interaction, chemical shifts, interpretation of NMR spectra, correlation - hydrogen bonds to carbon and other nuclei, instrumentation, continuous and pulsed NMR, carbon-13 NMR. | 5 |
| 4. | X-ray Diffraction: Crystal geometry and structural determination, Bragg's law of X-ray diffraction, powder method, X-ray spectrometers - wide and small angle diffractometers, chemical analysis by X-ray diffraction | 2 |
| 5. | Particle size analysis: Particle size, sampling, conventional techniques of particle size measurement, light scattering, particle size measurement by light scattering techniques, dynamic light scattering (DLS), fibre-optic dynamic light scattering | 5 |
| 6. | Chromatography: Basic theory of separation, efficiency, resolution, liquid chromatography, high performance liquid chromatography (HPLC), gas chromatography - columns and detectors, qualitative and quantitative analysis | 5 |
| 7. | Mass Spectroscopy: Basic principles, ionization of a molecule on electron impact, fragmentation processes in organic compounds, interpretation of mass spectra, molecular weight, molecular formula, instrumentation - different types of ionization sources and magnetic analysers | 3 |

Reference books:

1. Fundamentals of Molecular Spectroscopy - C. Banwell and E. McCash
2. Instrumental Methods of Analysis - H. H. Willard, I. M. Merritt and J. A. Dean
3. Infrared Spectra of Complex Molecules - L. J. Bellamy
4. Fundamentals of Surface and Thin Film Analysis - L. C. Feldman and J. Mayer
5. X-ray Structure Determination - G. H. Stout and I. H. Jensen
6. High Resolution NMR Spectroscopy - E. D. Becker
7. Nuclear Magnetic Resonance Spectroscopy—R. X. Harris
8. Physical Methods - R. S. Drago
9. Advances in Electrochemical Science and Engineering - I. M. Gerischer and C. W. Tobias (eds.)

| | |
|---------------------------------------|--|
| Code & Title of the Course | TXP 2001: Project I (Seminar & Critical Review) |
| Marks | 50 |
| Number of Hours per Week | 6 |
| Credits | 3 |
| Class | M Tech |
| Semester | I |

| Sr.No. | Topic | Hrs. |
|---------------|--|-------------|
| 1. | Student will be required to prepare critical reviews of selected topic in Chemical Technology and Allied subjects and submit in the form of standard typed report. The student will also be required to make an oral presentation of the review. | 15 |
| 2. | Student will be required to review single research publication as decided by the faculty advisor. In general, a written Critical Reviews report needs to be submitted in the form of standard typed report. The student will also be required to make an oral presentation of the review | 15 |

Course Outcome:

Students will be able to,

TXT2001-1. Contrast different methodologies reported in a research article. (K4)

TXT2001-2. Design protocol for textile processing by referring research articles. (K4)

TXT2001-3. Judge best method among various methodologies reported in literature. (K5)

| | |
|---------------------------------------|---|
| Code & Title of the Course | PYT 2106: Physical Methods of Analysis |
| Marks | 50 |
| Number of Hours per Week | 6 |
| Credits | 3 |
| Class | M Tech |
| Semester | I |

| Sr.No. | Topic |
|---------------|--|
| 1. | DSC Analysis of neat and modified polyester, Nylon and polypropelene fibres on Differential Scanning Calorimeter |
| 2. | Analysis of neat and modified polyester, Nylon and polypropelene fibres on TGA and LOI tester |
| 3. | FTIR analysis of natural and synthetic untreated and finished fabrics on FTIR |
| 4. | Structure analysis with respect to crystallinity, orientation and crystal size of neat and modified polyester, Nylon and polypropelene fibres on XRD machine |
| 5. | Determination of zeta potential of untreated and surface modified cotton material on Electrokinetic Analyzer |
| 6. | To measure particle size of nano TiO ₂ on nano particle size analyzer |
| 7. | To study the morphology of different treated and untreated fibres using Image Analyzer |
| 8. | To measure static charge decay time, bulk, and surface resistivity of untreated and conducting polyester fabric. |
| 9. | Measurement of contact Angle on untreated, finished, and coated fabric on Contact Angle Analyzer |
| 10. | Measurement of surface energy of untreated and finished fabric on Tensiometer |

Course Outcome:

Students will be able to,

TXP2301-1. Calibrate instruments required for textile characterisations. (K4)

TXP2301-2. Measure contact angle, particle size, and zeta potential as surface characterisation technique. (K5)

TXP2301-3. Demonstrate different experiments for characterisation of textile materials. (K5)

| | |
|---------------------------------|-------------------|
| TXP 2002 | Research I |
| Marks | 100 |
| Number of Hours per Week | 12 |
| Credits | 6 |
| Class | M Tech |
| Semester | I |

| Sr. No. | Topic | Hrs./Week |
|----------------|--|------------------|
| 1. | Student will be required to make a detailed literature search of the proposed area to be undertaken under the guidance of the research supervisor. In general, a written review report along with his proposed plan of research work emanating from it needs to be submitted in the form of standard typed report. The student will also be required to perform preliminary experiments to achieve proof of concept. | 12 |

Course Outcome:

Students will be able to,

TXP2002-1. Carry out through literature review and choose a research area to work on with novel inputs. (K5, A4)

TXP2002-2. Judge the best area according to resources dependant implementation ease and potential applications. (K5, A3)

TXP2002-3. Design experiment and perform proof of concept research on the topic selected. (K5, A5).

Semester II

| | |
|---------------------------------------|--|
| Code & Title of the Course | TXT 2804: Management of Textile Waste |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | II |

| Sr.No. | Topic | Hrs. |
|---------------|--|-------------|
| 1 . | Understanding the textile and apparel recycling process, designing textile products that are easy to recycle | 3 |
| 2 . | Reclaimed Fibres, the Source and Usage, Fibre Industry and Waste Management | 5 |
| 3 . | Cotton Waste Reclamation | 5 |
| 4 . | Recycling of High-Tech Fibres | 2 |
| 5 . | Recycling and re-use of textile chemicals | 6 |
| 6 . | Nonwovens from Recycled Waste | 3 |
| 7 . | Apparel disposal, recycling, and reuse | 2 |
| 8 . | Recycled textile products and market | 2 |
| 9 . | Applications of recycled textiles, Carpet recycling technologies and making composite products from post-consumer carpet | 2 |

Course Outcome:

Students will be able to,

TXT2804-1. Design textile recycling process according to the substrate and texture of the material. (K4)

TXT2804-2. Justify the recycling process based on the cost and by-products utilisation of the obtained material. (K3)

TXT2804-3. Develop recycling protocols and utilisation of the product in the composite formation. (K3)

TXT2804-4. Express the cost effectiveness of the recycling in terms of market value of the respective products. (K3)

Reference books:

1. Recycling Textile and Plastic Waste, Richard Horrocks
2. Recycling in Textiles, Youjiang Wang

| | |
|---------------------------------------|---------------------------------|
| Code & Title of the Course | TXT 2503: Smart Textiles |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | II |

| Sr.No. | Topic | Hrs. |
|---------------|---|-------------|
| 1. | Smart technology for textiles and clothing | 3 |
| 2 | Heat-storage, thermo-regulated and thermally sensitive textiles, and Clothing | 3 |
| 3. | Multifunctional and multi-use intelligent materials | 3 |
| 4. | Stimuli-responsive interpenetrating polymer network, Adaptive and responsive textile structures | 3 |
| 5. | Optical fibres and fibre optic sensors | 3 |
| 6. | Embroidery for technical applications | 3 |
| 7. | Hollow fibre membranes for gas separation | 4 |
| 8. | Smart medical textiles, Tailor-made intelligent polymers for biomedical applications, Textile scaffolds in tissue engineering | 8 |

Course Outcome:

TXT2503-1. Demonstrate the difference between technical textile and smart textile and the compositions. (K2).

TXT2503-2. Contrast between active and passive smart materials. (K3)

TXT2503-3. Express the importance of smart textile in various fields such as medical, defence, fashion, etc. (K3)

TXT2503-4. Choose best application protocol and material to develop smart textile for application. (K5)

Reference books:

1. Smart fibres, fabrics, and clothing, Xiaoming Tao
2. Smart textiles for medicine and healthcare, L. Van Langenhove
3. Textile advances in the automotive industry, R. Shishoo

| | |
|---------------------------------------|---|
| Code & Title of the Course | TXT 2203: Developments in Textile Processing Machinery |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | II |

| Sr.No. | Topic | Hrs. |
|---------------|--|-------------|
| 1 | Developments in machinery for pretreatment, dyeing, printing and finishing | 14 |
| 2 | Automation and computer as well as microprocessor applications in processing | 6 |
| 3 | Modifications for energy and water conservation | 6 |
| 4 | Effluent treatment plant organization | 4 |

Course Outcome:

Students will be able to,

TXT2203-1. Justify the improvisation in the textile processing machinery according to the efficiency and ease of operation. (K5)

TXT2203-2. Examine the various parts and segments of textile processing machinery and differentiate them according to their functions. (K3)

TXT2203-3. Demonstrate the new developments in the textile processing machineries with respect to their utility. (K4)

TXT2203-4. Design processing machinery setup and effluent treatment plant according to the prerequisites. (K3)

Reference books:

1. Technology of Bleaching and Dyeing, Chakraverty, R.R., Trivedi S.S., Vol. 1, Mahajan Publishers Private Ltd., Ahmedabad, 1979.
2. Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar
3. Introduction to Textile Printing, W. Clarke, Newness Butterworths, London, 4th edition, 1977.
4. Guide to Printing Techniques, Naoharu Oyabu, Mahajan Brothers Publish Ltd., Ahmedabad,1978.

| | |
|---------------------------------------|--|
| Code & Title of the Course | TXP 2302: Process Optimization & Performance Evaluation |
| Marks | 50 |
| Number of Hours per Week | 6 |
| Credits | 3 |
| Class | M Tech |
| Semester | II |

| Sr.No. | Topic | |
|---------------|--|------------|
| 1. | To perform digital printing on the cotton and polyester using pigment colours and measure its fastness characteristics | 6 hrs/week |
| 2. | To coat the cotton fabric with TiO ₂ nano particles and measure its UPF rating | |
| 3. | To measure BOD and COD of untreated and treated textile effluent | |
| 4. | To measure the heavy metal content in the treated fabric and effluent water using Atomic Absorption Spectrophotometer | |
| 5. | Characterization of the textile effluent on HPLC | |
| 6. | Measurement of colour in the effluent using UV-Vis spectrophotometer | |
| 7. | To study the process of decolourization by Ozonolysis | |
| 8. | To make PVA nano fibres using electrospinning | |
| 9. | Shade Matching using CCM | |
| 10. | Design of Experiment for Textile Process optimization | |

Course Outcome

Students will be able to,

- TXP2302-1.** Demonstrate digital printing on cotton and polyester substrate. (K3)
- TXP2302-2.** Characterise and treat the textile effluent using different techniques. (K3)
- TXP2302-3.** Develop protocol for electrospinning with variable size of nano fibres. (K4)
- TXP2302-4.** Demonstrate shade matching using CCM (K5)
- TXP2302-5.** Coat and characterise textile substrate with TiO₂ for UV protection (K3)

| | |
|---------------------------------------|---|
| Code & Title of the Course | TXP 2003: Research II (Mid Project Evaluation) |
| Marks | 150 |
| Number of Hours per Week | 18 |
| Credits | 9 |
| Class | M Tech |
| Semester | II |

| Sr. No. | Topic | Hrs./Week |
|----------------|--|------------------|
| 1. | Student will be required to make a detailed presentation to the guide in presence of an external referee on the research work done so far to ensure satisfactory progress. | 18 |

Course Outcome:

Students will be able to,

- TXP2003-1.** Organise the initial results obtained during the research project. (K4)
- TXP2003-2.** Justify the methodology to obtain desired output. (K5)
- TXP2003-3.** Modify the methodology as per requirement to obtain the desired output. (K5)

Semester III

| | |
|---------------------------------------|---|
| Code & Title of the Course | TXP 2004: Project II (In-plant Training) |
| Marks | 450 |
| Number of Hours per Week | 40 |
| Credits | 30 |
| Class | M Tech |
| Semester | III |

| Sr. No. | To pic | Hrs./Week |
|----------------|--|------------------|
| 1. | Student will undergo in plant training in textile wet processing / allied areas. Students will be required to submit certificate of successful completion of the training along with the report and make a presentation. | 40 |

Course Outcome:

Students will be able to,

- TXP2004-1.** Examine the textile processing protocols and understand the utility. (K3)
- TXP2004-2.** Organise and demonstrate the results obtained during the training. (K4)
- TXP2004-3.** Modify the studied processing protocol as per requirement and justify it. (K5)

Semester IV

| | |
|---------------------------------------|--|
| Code & Title of the Course | TXP 2005: Research III (Research Thesis & Open Defence) |
| Marks | 450 |
| Number of Hours per Week | 40 |
| Credits | 30 |
| Class | M Tech |
| Semester | IV |

| Sr. No. | Topic | Hrs./Week |
|----------------|---|------------------|
| 1. | Student should complete the research work, submit synopsis, face open defense, and submit final copy of thesis. | 40 |

Course Outcome:

Students will be able to,

- TXP2005-1.** Perform experiments systematically to accomplish the set objectives (K3)
- TXP2005-2.** Evaluate critically the experimental data and draw meaningful inferences (K5)
- TXP2005-3.** Develop skills to defend own research effectively (K6)
- TXP2005-4.** Develop skills for writing scientific documents (K6)

Syllabus of electives recommended by the department for Sem I

| | |
|---------------------------------------|---------------------------------------|
| Code & Title of the Course | PHT 2101: Research Methodology |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | I |

| Sr.No. | Topic | Hrs. |
|---------------|--|-------------|
| 1. | <p>Research</p> <p>Meaning of Research, Purpose of Research, Types of Research (Educational, Clinical, Experimental, Historical, Descriptive, Basic applied and Patent Oriented Research) – Objective of research- Literature survey – Use of Library, Books, & Journals – Medline – Internet, getting patents and reprints of articles as sources for literature survey.</p> <p>Selecting a problem and preparing research proposal for different types of research mentioned above.</p> <p>Methods and tools used in Research</p> <ul style="list-style-type: none"> • Qualitative studies, Quantitative Studies • Simple data organization, Descriptive data analysis • Limitations and sources of Error • Inquiries in form of Questionnaire, Opinionnaire or by interview • Statistical analysis of data including variance, standard deviation, student's 't' test and annova, correlation data and its interpretation, computer data analysis | 4 |
| 2. | <p>Documentation</p> <ul style="list-style-type: none"> • “How” of Documentation • Techniques of Documentation • Importance of Documentation • Uses of computer packages in Documentation | 4 |
| 3. | <p>The Research Report / Paper writing / thesis writing</p> <ul style="list-style-type: none"> • Different parts of the Research paper <ol style="list-style-type: none"> 1. Title – Title of project with author's name 2. Abstract – Statement of the problem Background list in brief and purpose and scope 3. Key-words- <p>Methodology-Subject, Apparatus / Instrumentation, (if necessary) and procedure</p> | 4 |
| 4. | <p>Results – tables, Graphs, Figures, and statistical presentation</p> <p>Discussion – Support or non- support of hypothesis – practical & theoretical implications, conclusions</p> <p>Acknowledgements</p> <p>References</p> <p>Errata</p> <p>Importance of spell check for Entire project Use of footnotes</p> | 5 |

| | | |
|----|--|---|
| 5. | Presentation (Specially for oral) <ul style="list-style-type: none"> • Importance, types, different skills • Content of presentation, format of model, Introduction and ending • Posture, Gestures, Eye contact, facial expressions stage fright • Volume- pitch, speed, pauses & language Visual aids and seating Questionnaire | 5 |
| 6. | Protection of patents and trademarks, Designs, and copyrights <ul style="list-style-type: none"> • The patent system in India – Present status Intellectual property Rights (IPR), Future changes expected in Indian Patents • Advantages • The Science in Law, Turimetrics (Introduction) • What may be patented • Who may apply for patent? Preparation of patent proposal | 5 |
| 7. | Sources for procurement of Research Grants Industrial- Institution Interaction - Industrial projects – Their feasibility reports | 3 |

Reference books:

1. Research in Education – Johan V. Best James V. Kahn
2. Presentation skills- Michael Halton- Indian Society for Institute Education
3. A Practical Introduction to copy right – Gavin Mcfarlane
4. Thesis projects in Science and Engineering – Richard M. Davis
5. Scientists in legal system – Ann labor science
6. Thesis and Assignment writing – Jonathan Anderson
7. Writing a technical paper- Donald Menzel
8. Effective Business Report writing – Leland Brown
9. Protection of Industrial property rights- Purushottam Das and Gokul Das
10. Spelling for the million – Edna furness
11. Preparing for publication – King Edwards Hospital fund for London
12. Information technology – The Hindu speaks
13. Documentation – Genesis & Development 3792
14. Manual for evaluation of Industrial projects – United Nation

| | |
|---------------------------------------|---|
| Code & Title of the Course | BST 2106: Intellectual Property Rights |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | I |

| Sr.No. | Topic | Hrs. |
|---------------|---|-------------|
| 1 | General Introduction to IPR and Essentials of IP management <ul style="list-style-type: none"> • History of Indian and International Patent System and International Treaties • Introduction to Trademark filing in India • Introduction to Design filing in India • Introduction to Geographical Indication filing in India • Introduction to Indian Patent Law • Assessment of Invention by documentation and Search • Analysis of R&D Activity for Patentability | 10 |
| 2 | Techno-legal requirements for filing of Patent Drafting of Patent Specification | 4 |
| 3 | Patent Prosecution in India Patent Prosecution at International level (Convention and PCT Routs) Agreements & Contracts for Patent Management and drafting of same Infringements for Patent Commercialisation Search and Patentability Opinion | 12 |
| 4 | Case Studies: Cases of Herbal medicines, biomolecules, agrochemicals, and bulk drugs, oil and textile in India and abroad before Patent Office/ Courts | 4 |

List of electives offered by the department for Sem II

| | |
|---------------------------------------|---|
| Code & Title of the Course | TXT 2902: Entrepreneurship Development |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | II |

| Sr.No. | Topic | Hrs. |
|---------------|---|-------------|
| 1 | Introduction and meaning of Entrepreneurship; Qualities and Characteristics of Entrepreneur: Functions of an Entrepreneur, Types of Entrepreneurs | 3 |
| 2 | Innovation, decision, making ability, management and organization, leadership, Innovative, Adoptive, Fabian, Drone, qualities of entrepreneur | 3 |
| 3 | Concept and Characteristics of Entrepreneurship; Evolution and Development of Entrepreneurship. | 3 |
| 4 | Roles of Entrepreneur in economic development, Barriers of Entrepreneurship; Concept, functions, and problems of Entrepreneurs | 4 |
| 5 | Concept of EDP, short term objective, long term objectives, phases of entrepreneur development | 4 |
| 6 | Meaning and objective of project, quantifiable and non-quantifiable project, sectoral project, techno | 4 |
| 7 | Concept, need, elements of project formulation, feasibility analysis, Identification of Business | 3 |
| 8 | Appraisal format, planning commission guidelines, check list for feasibility report | 2 |
| 9 | Technical, Financial and Social Feasibility Study | 2 |
| 10. | Various schemes and supports from Central Government Schemes like Technological Upgradation Fund (TUF), Objectives of Textile Committee, DC Handlooms and Handy Crafts. | 2 |

Course Outcome:

Students will be able to,

TXT2902-1. Explain the types and qualities of an entrepreneur. (K2)

TXT2902-2. Discuss phases of entrepreneurship development and the concept of EDP. (K2)

TXT2902-3. Design proposal for entrepreneurship development in line with various central and state government schemes. (K4)

Reference books:

1. Management and Entrepreneurship N.V.R.Naidu, T.Krishna Rao, I.K. International 2008, New Delhi.

2. Dynamics of Entrepreneurial Development & Management by Vasant Desai , Himalaya Publishing House

3. Entrepreneurship Development – Small Business Enterprises Poornima M Charantimath, Pearson Education 2006, 2nd Edition.

4. Entrepreneurship Development – Small Business Enterprises Entrepreneurship Development, SS. Khanka – S.Chand

| | |
|---------------------------------------|--|
| Code & Title of the Course | TXT 2903: Laboratory Management systems |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | II |

| Sr. No. | Topic | Hrs. |
|----------------|---|-------------|
| 1. | Laboratory Selection Guidelines- Introduction to types of Laboratories, Designing basic layout of Laboratory, Laboratory Regulation, Machinery selection | 6 |
| 2. | Good Laboratory Practice - Fundamentals of GLP | 4 |
| 3. | Laboratory Management Systems- Introduction to Laboratory quality, Organization, Infrastructure, Purchasing and inventory, Process control, Internal Quality control, Assessments, Personnel, Occurrence management, Documentations and records | 10 |
| 4. | Laboratory Safety: OSHA standards for Laboratory safety, Safety Requirements | 4 |
| 5. | Certifications or accreditations: International standards and standardization bodies, National standards and technical guidelines, Certification and accreditation, Process of Accreditation, Benefits of Accreditation | 6 |

Course Outcome:

Students will be able to,

- TXT2903-1.** Understand and explain the principles of supply chain management and logistic. (K2)
- TXT2903-2.** Plan and manage supply and demand in a typical textile production house. (K3)
- TXT2903-3.** Explain the documentation regarding import-export, insurance, packaging, etc. (K2)

Reference books:

1. Good Laboratory Practice Regulations, Sandy Weinberg, CRC Press, 2002
2. Good Laboratory Practice the Why and the How, Seiler, Jürg P, Springer, 2005
3. Laboratory Management: Principles and Processes, [Denise M. Harmening](#), D. H. Publishing & Consulting Inc., 2012
4. Good Laboratory Practice, OECD Principles and Guidance for Compliance Monitoring, [OECD: Organisation for Economic Co-Operation and Development](#), 2006
5. Good Laboratory Practice, [Dr. P. V. Mohanan](#), Educational Book Centre, 2006

| | |
|---------------------------------------|---|
| Code & Title of the Course | TXT 2904: Supply chain management for textile industry |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | II |

| Sr.No. | Topics | Hrs. |
|---------------|---|-------------|
| 1. | Basic principles of supply chain management and logistics, supply chain models, supply chain for volatile market; supply chain drivers and metrics in apparel industries; roll of supply chain in the textile and apparel industries' financial stability | 4 |
| 2. | Planning supply and demand in apparel production house, managing economies of scale, supply cycle and inventory levels; managing uncertainty in supply chain, safety pricing and inventory; make Vs buy decision, make Vs hire decision; geographical identification of suppliers, supplier evaluation, supplier selection, contract negotiations and finalization | 8 |
| 3. | Distribution network and design for global textile and apparel products, models of distribution – facility location and allocation of capacity, uncertainty on design and network optimization; the role of transportation in supply chain, modes of transportation, characteristics of transportation, transport design options for global textile and apparel network, trade-off in transport design, risk management in transportation, transport decision in practice for textile and apparel industries. | 6 |
| 4. | Coordination in supply chain- the bullwhip effect, forecasting, obstacles to coordination in supply chain; supply chain management for apparel retail stores, high fashion fad; supply chain in e-business and b2b practices | 6 |
| 5. | Import - Export management, documentation, insurance, packing and foreign exchange; methods of payments – domestic, international, commercial terms; dispute handling modes and channels; supply chain and Information system. Customer relationship management | 6 |

Course Outcome:

Students will be able to,

TXT2903-1. Understand and explain the principles of supply chain management and logistic. (K2)

TXT2903-2 Plan and manage supply and demand in a typical textile production house. (K3)

TXT2903-3. Explain the documentation regarding import-export, insurance, packaging, etc. (K2)

REFERENCES

1. Janat Shah, "Supply Chain Management – Text and Cases", Pearson Education, 2009
2. Sunil Chopra and Peter Meindl, "Supply Chain Management-Strategy Planning and Operation", PHI Learning / Pearson Education, 2007
3. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, "Designing and Managing the Supply Chain: Concepts, Strategies, and Cases", Tata McGraw-Hill, 2005
4. Altekar Rahul V, "Supply Chain Management-Concept and Cases", PHI, 2005

| | |
|---------------------------------------|---|
| Code & Title of the Course | TXT 2205: Continuous Processing of Textile |
| Marks | 50 |

| | |
|---------------------------------|--------|
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | I |

| Sr.No. | Topic | Hrs. |
|---------------|---|-------------|
| 1. | Continuous pretreatment of textiles-Processes & Machinery | 4 |
| 2. | Combined pretreatment of different textiles | 4 |
| 3. | Continuous dyeing of natural & synthetic and blended fabrics-various dyeing processes, different classes of dyes used, dyeing machinery | 18 |
| 4. | Recent advances in continuous processing | 4 |

Course Outcome:

Students will be able to,

TXT2205-1. Justify the improvisation in the continuous textile processing and machinery. (K5)

TXT2205-2. Examine the various textile wet processing conditions and their effects. (K3)

TXT2205-3. Explain the recent advancement in terms of conditions and machineries for continuous textile processing. (K2)

Reference books:

1. Technology of Scouring and Bleaching, Trotman E.R., Griffin, London, 1968.
2. Technology of Bleaching and Dyeing, Chakraverty, R.R., Trivedi S.S., Vol. 1, Mahajan Publishers Private Ltd., Ahmedabad, 1979.
3. Mercerizing by J.T.Marsh
4. Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar
5. Encyclopedia of Textile Finishing, Rouette, H.K., Springer Verlag, New York, 2001.
6. Textile Finishing, Hall A.J., Heywood book, London, 1966.
7. An Introduction to Textile Finishing, Marsh J.T., B.I. Publication, Bombay, 1979.
8. Digital printing of textiles , Ujjiie.H.,Woodhead publishing,2006

| | |
|---------------------------------------|--|
| Code & Title of the Course | TXT 2601: Biotechnology in Textiles |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | II |

| Sr.No. | Topic | Hrs. |
|---------------|---|-------------|
| 1. | Biotechnology Definition, History and Branches | 1 |
| 2. | Biodegradable Fibres: Concept, Different Fibres used and their Biodegradability study, Areas of applications | 3 |
| 3. | Enzymes: Definition and Advantages, Sources of Enzymes, Classification Industrial Manufacturing of Enzymes using Fermentation: Application of different enzymes in various areas of Textiles: Bioscouring, Bidesizing, Biopolishing, silk degumming, effluent treatment. | 15 |
| 4. | Genetic Engineering: Concept and Origin Application in Textiles: Bt Cotton, Genetic engineering of Silkworm | 7 |
| 5. | Microbial Dyes: A rising concept in Textiles Introduction, Synthesis, Application, Advantages and Limitations | 4 |

Course Outcome:

Students will be able to,

- TXT2601-1.** Identify and examine the enzymes for potential textile wet processing operation. (K3)
- TXT2601-2.** Explain the concepts of genetic engineering and their application in fibre science. (K2)
- TXT2601-3.** Explain the synthesis, application, and properties of biological pigments. (K2)
- TXT2601-4.** Design textile processing protocol based on enzymes and biological pigments. (K4)

Reference books:

1. Textile processing with enzymes, A. Cavaco-Paulo and G. M. Gübitz, Woodhead Publishing Limited
2. Biodegradable and sustainable fibres, R. S. Blackburn, Woodhead Publishing Limited
3. Biodegradable polymers for industrial applications, Ray Smith, Woodhead Publishing Limited

| | |
|---------------------------------------|--|
| Code & Title of the Course | TXT 2204: Developments in Textile Auxiliary Chemicals |
| Marks | 50 |
| Number of Hours per Week | 2+1 |
| Credits | 3 |
| Class | M Tech |
| Semester | II |

| Sr.No. | Topic | Hrs. |
|---------------|--|-------------|
| 1. | Chemistry of new types of auxiliaries for processing | 10 |
| 2. | Relation between structure and properties | 5 |
| 3. | Methods of manufacture | 5 |
| 4. | Methods for evaluation of auxiliaries as well as for their effectiveness or activity | 10 |

Course Outcome:

Students will be able to,

TXT2204-1. Design recipe formulations for various textile wet processes. (K3)

TXT2204-2. Differentiate properties of the novel textile auxiliaries based on their structures. (K4)

TXT2204-3. Explain the methods of manufacturing of textile auxiliaries. (K2)

TXT2204-4. Evaluate the auxiliaries for their effectiveness. (K5)

Reference books:

1. Colourants and Auxiliaries: Organic Chemistry and Application Properties, Shore, J., SDC, Bradford, 1990.
2. Laundry Detergents, Smulders, E., Wiley VCH, Weinheim, 2002.
3. Chemistry and Textile Auxiliaries, Shenai V.A., Vol. 65, Sevak Publication, Bombay, 2nd edition, 2002.
4. Textile Auxiliaries, Batty, J.W., Dergamon Press, Oxford, 1967.
5. Textile Chemicals and Auxiliaries, Speel H.C., Reinhold Processing Corporation, New York, 1952.