

Syllabus for Four Years Program

In

B. Tech (Fibres and Textile Processing Technology)

(2023-2024)

(Under the New Education Policy (NEP 2020))



Offered by

**DEPARTMENT OF FIBRES AND TEXTILE
PROCESSING TECHNOLOGY**

INSTITUTE OF CHEMICAL TECHNOLOGY

(University Under Section-3 of UGC Act, 1956)

Elite Status and Center for Excellence

Government of Maharashtra

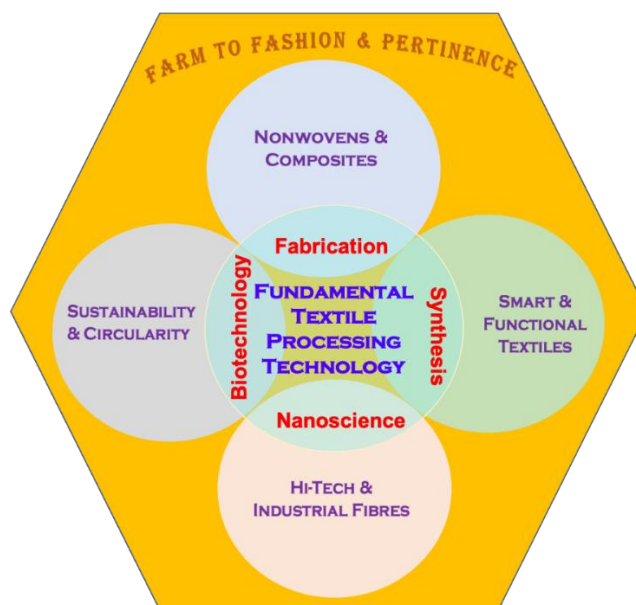
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A. Preamble:

The Institute of Chemical Technology (ICT) was established in 1933 and was earlier known as the 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 the area of Textile Processing and to fulfil the needs of the 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 the 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 ever-evolving industrial needs.



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.

B. Programme Outcomes:

Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and knowledge in specialized field of Fibres and Textile Processing Technology to the solution of complex Textile and apparel industrial problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex Textile and Apparel chemical technological problems reaching substantiated conclusions using first principles of mathematics, natural sciences, engineering sciences including Fibres and Textile Processing technology.
3. **Design/development of solutions:** Design solutions for complex Fibres and Textile Processing technology related problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions which can be used for constructing solutions to the problems.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex Fibres and Textile Processing technology related activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the Fibres and Textile Processing technology practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions with respect to Fibres and Textile Processing technology, in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex technological activities with reference to Fibres and Textile Processing Technology, with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Develop a **confident graduate** who can offer **solutions to the shop floor complex problems** in **fibre to garment** textile processing field.
2. Instil fundamental knowledge and motivation to **go for advance studies and research** so that they could develop themselves into **Academician and Research scientists** making positive contribution to **generation and dissemination** of new **knowledge**.
3. Introduce **the diverse industry** and emerging **Textile Technologies** to create a **thirst** among the **students** for **innovative start- up** or career options taking advantage of the fast developing Indian economy.

C. Intake: 34

D. Eligibility criteria: HSC/12th Science

E. Structure of the main course:

Syllabus structure B. Tech as per NEP-2020

| First Year Semester-I | | | | | | | | | | |
|-------------------------------|-------------|-------------------------------------------------|-----------|-----------|----------|-----------|-------------------------|----|----|-------------|
| Course | Course Code | Subject | Credits | Hrs./Week | | | Marks for various Exams | | | |
| | | | | L | T | P | CA | MS | ES | Total |
| BSC | CHTXXXX | Physical Chemistry | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| BSC | CHTXXXX | Analytic Chemistry | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| ESC | MAT 1301 | Engineering Mathematics | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| VSEC | GEP1129 | Engineering Drawing and Computer Aided Drafting | 3 | 1 | 0 | 4 | 0 | 50 | 50 | 100 |
| BSC | | Applied Physics | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| ESC | TXT1107 | SPL1: Introduction to Textile Substrates | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| BSC | | Physics Lab | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| AEC-01 | | Communication Skills (English) | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| CCA | | Yoga | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| | | TOTAL | 22 | 9 | 5 | 16 | | | | 900 |
| First Year Semester-II | | | | | | | | | | |
| Course | Course Code | Subject | Credits | Hrs./Week | | | Marks for various Exams | | | |
| | | | | L | T | P | CA | MS | ES | Total |
| BSC | CHTXXXX | Organic Chemistry | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| BSC | CHTXXXX | Industrial Chemistry | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT1218 | SPL-2 Introduction to Textile Wet Processing | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| ESC | GET 1130 | Basic Mechanical Engineering | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| ESC | | Process Calculations | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| ESC | GET 1131 | Electrical Engineering and Electronics | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| BSC | CHPXXXX | Physical and Analytical Chemistry Lab | 2 | 0 | 0 | 4 | 00 | 50 | 50 | 100 |
| VSEC | CHPXXXX | Organic Chemistry Lab for Technologists | 2 | 0 | 0 | 4 | 00 | 50 | 50 | 100 |
| CCA | | CCA | 2 | 0 | 0 | 4 | 00 | 50 | 50 | 100 |
| IKS | | IKS | 2 | 0 | 0 | 4 | 00 | 50 | 50 | 100 |
| | | TOTAL | 22 | 7 | 5 | 20 | | | | 1000 |

| Second Year Semester-III | | | | | | | | | | |
|--------------------------|-------------|---------------------------------------------------------------------|-----------|-----------|----------|-----------|-------------------------|----|----|------------|
| Course | Course Code | Subject | Credits | Hrs./Week | | | Marks for various Exams | | | |
| | | | | L | T | P | CA | MS | ES | Total |
| PCC | TXT1219 | SPL-3: Textile Wet Processing Machinery | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT1216 | SPL-4 Chemistry and Application of Speciality Chemicals | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| OE | | OE | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| MDM | TXT1107 | Introduction to textile substrates | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| AEC-02 | | Regional Lang. Marathi | 2 | 0 | 0 | 4 | 00 | 50 | 50 | 100 |
| EEM | | Basic Economics and Finance for non-finance students | 2 | 0 | 0 | 4 | 00 | 50 | 50 | 100 |
| VEC | | Value Education-I | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXP1015 | PR 1: Analysis of Textile Chemicals and Fibers | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| PCC | TXP1022 | PR 2: Textile Wet Processing Lab 1 (Pretreatment, Dyeing, Printing) | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| | | TOTAL | 22 | 9 | 5 | 16 | | | | 900 |

| Second Year Semester-IV | | | | | | | | | | |
|-------------------------|-------------|--------------------------------------------------------|-----------|-----------|----------|----------|-------------------------|----|----|------------|
| Course | Course Code | Subject | Credits | Hrs./Week | | | Marks for various Exams | | | |
| | | | | L | T | P | CA | MS | ES | Total |
| PCC | | Transport Phenomena | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT 1301 | SPL-5: Testing of Textile Materials | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT1405 | SPL-6: Garment Manufacturing and Merchandising | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| MDM | TXT1218 | Introduction to textile wet processing | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| OE | | OE | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| EEM | | Chemical Process Economics | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| VEC | | Value Education-II | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| CEP/FP | | Field Project | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| VSEC | TXP1023 | PR3: Textile Wet Processing Lab 2 (Finishing, Testing) | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| | | TOTAL | 22 | 11 | 7 | 8 | | | | 900 |

| Third Year Semester-V | | | | | | | | | | |
|-----------------------|-------------|---------------------------------------------------------------|-----------|-----------|----------|-----------|-------------------------|----|----|------------|
| Course | Course Code | Subject | Credits | Hrs./Week | | | Marks for various Exams | | | |
| | | | | L | T | P | CA | MS | ES | Total |
| PCC | | Chemical Reaction Engineering | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | | Chemical Engineering Operations | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT 1201 | SPL-7: Technology of Textile Pretreatment | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| MDM | TXP1022 | Textile wet processing Lab 1 (pretreatment, dyeing, printing) | 4 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| PEC | TXT1210 | SPL-8: Technology of Textile Dyeing | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT1701 | Honors Course -I: Chemistry of Colorants | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXP 1002 | PR4: Pretreatment Lab | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| OE | | MOOCs | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXP 1004 | PR5: Experimental Dyeing Lab | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| | | TOTAL | 26 | 12 | 6 | 12 | | | | 900 |

| Third Year Semester-VI | | | | | | | | | | |
|------------------------|-------------|---------------------------------------------------|-----------|-----------|----------|-----------|-------------------------|----|----|------------|
| Course | Course Code | Subject | Credits | Hrs./Week | | | Marks for various Exams | | | |
| | | | | L | T | P | CA | MS | ES | Total |
| PCC | TXT1106 | SPL-9: Technology of Fibers and Polymers | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT 1101 | SPL-10: Manufacturing of Yarn and Fabrics | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| PEC | TXT1212 | SPL-11: Technology of Textile Printing | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT1213 | Honors Course-II: Theory of Dyeing | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT1211 | SPL-12: Technology of Finishing | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| MDM | TXT1216 | Chemistry and application of speciality chemicals | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| VSEC | | Chemical Engineering Laboratory | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| PCC | TXP 1006 | PR6: Printing Lab | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| PEC | TXP 1011 | PR7: Finishing & Evaluation of Textiles | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| | | TOTAL | 26 | 14 | 6 | 12 | | | | 900 |

| Final Year Semester-VII | | | | | | | | | | |
|-------------------------|-------------|----------------------------------------------------|-----------|-----------|---|----|-------------------------|----|----|------------|
| Course | Course Code | Subject | Credits | Hrs./Week | | | Marks for various Exams | | | |
| | | | | L | T | P | CA | MS | ES | Total |
| CC | TXT1504 | SPL-13: Non-Woven and High-Tech Fibres | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT1803 | SPL-14- Effluent Characterisation and Treatment | 2 | 2 | 0 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXP1019 | PR8: Shade Matching and Bulk Coloration | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| PEC | TXT1804 | Dept Elective -1: Eco Compliance and Certification | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| PEC | TXT 1901 | Dept Elective -2: Textile Process House Management | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT 1207 | Honors-III: Emerging Textile Technology | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| MDM | TXT 1301 | Testing of textile materials | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| RM-I | | Research Methodology | 4 | 3 | 1 | 0 | 20 | 30 | 50 | 100 |
| Project | TXP1013 | Project -I | 4 | 0 | 0 | 8 | 0 | 50 | 50 | 100 |
| TOTAL | | | 26 | 14 | 6 | 12 | | | | 900 |

| Final Year Semester-VIII (10 weeks) | | | | | | | | | | |
|----------------------------------------|-------------|----------------------------------------------------|-----------|-----------|---|----|-------------------------|----|----|------------|
| Course | Course Code | Subject | Credits | Hrs./Week | | | Marks for various Exams | | | |
| | | | | L | T | P | CA | MS | ES | Total |
| PCC | TXP1017 | Project-II | 3 | 0 | 0 | 6 | 0 | 50 | 50 | 100 |
| PCC | TXT 1502 | SPL-15: Technical Textiles | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| PEC | TXP1024 | PR9: Advanced Characterisation Techniques | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| MDM | TXP1023 | Textile wet processing Lab 2 (finishing, testing) | 2 | 0 | 0 | 4 | 0 | 50 | 50 | 100 |
| PCC | TXT1702 | Honors Course-IV: Textile Physics | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| PCC | TXT1217 | Honors Course-V: Continuous Processing of Textiles | 3 | 2 | 1 | 0 | 20 | 30 | 50 | 100 |
| Final Year Semester-VIII (12-16 weeks) | | | | | | | | | | |
| OJT | TXP1014 | Internship with Industry | 12 | 0 | 0 | 0 | | | | 100 |
| TOTAL | | | 28 | 6 | 3 | 14 | | | | 700 |

Exit After First Year: Certificate Course in Technology of Textile Processing

Exit After Second Year: Diploma in Technology of Textile Processing

Exit After Third Year: B. Vocational in Technology of Textile Processing

Exit after completion of course: B.Chem.Tech in Technology of Textile Processing

Exit after completion of course: B.Chem.Tech in Technology of Textile Processing+ Honors or Research Degree

F. Structure of the Multidisciplinary Minor Courses:

| Multidisciplinary Minors: Fibres and Textile Processing Technology | | | | | | | | | | |
|--------------------------------------------------------------------|-------------|---------------------------------------------------------------|-----------|-----------|---|----|-------------------------|----|----|-------|
| Course | Course Code | Subject | Credits | Hrs./Week | | | Marks for various Exams | | | |
| | | | | L | T | P | CA | MS | ES | Total |
| MDM-I | TXT1107 | Introduction to Textile Substrates | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| MDM-II | TXT1218 | Introduction to Textile Wet Processing | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| MDM-III | TXP1022 | Textile Wet Processing Lab 1 (pretreatment, dyeing, printing) | 4 | 0 | 0 | 8 | 0 | 50 | 50 | 100 |
| MDM-IV | TXT1216 | Chemistry and application of speciality chemicals | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| MDM-V | TXT1301 | Testing of textile materials | 2 | 1 | 1 | 0 | 20 | 30 | 50 | 100 |
| MDM-VI | TXP1023 | Textile Wet Processing Lab 2 (finishing, testing) | 2 | 0 | 0 | 4 | 00 | 50 | 50 | 100 |
| | | TOTAL | 14 | 4 | 4 | 12 | | | | 600 |

F. Detailed syllabus:

**B. Tech. in Fibres & Textile Processing Technology
Syllabus Structure B. Tech. First Year**

Semester I

| | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|--------------------------------|----------|-----------------|
| | Course Code: CHTXXXX | Course Title: Physical Chemistry | Credits = 3 | | |
| | Semester: I | | Total Contact Hours: 45 | L | T |
| List of Prerequisite Courses | | | | | |
| Std. XII Chemistry | | | | | |
| List of Courses where this course will be Prerequisite | | | | | |
| Physical and Analytical Chemistry laboratory (CHP1341), other multidisciplinary courses on Chemistry / Chemical Engineering | | | | | |
| Description of relevance of this course in the B. Tech. Programme | | | | | |
| The course will enable the students to understand and apply the principles of thermodynamics to real world systems. The students would be able to apply the insights to understand the stability of solutions, spontaneity of physical / chemical processes, effect of thermodynamics parameters on phase and chemical equilibria, etc | | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | | Reqd Hrs |
| 1 | Laws of thermodynamics – a) Enthalpy and heat capacities, application of first law to gases, thermochemistry- Hess law b) Statements and applications of second law of thermodynamics, Clausius inequality, entropy as a state function, entropy changes for reversible and irreversible processes, entropy and probability c) Third law of thermodynamics, absolute entropies, verification of third law | | | | 6 |
| 2 | Spontaneous process and equilibrium – Helmholtz and Gibbs free energy, spontaneity and free energy, Maxwell's relations, effect of T and P on free energy, | | | | 3 |
| 3 | Multicomponent system – free energy and entropy of mixing, partial molar quantities and chemical potential, Gibbs Duhem equation | | | | 6 |
| 4 | Equilibrium in solutions – ideal and non-ideal solutions, Henry's law and Raoult's law, colligative properties, activity and activity coefficients, thermodynamic properties of electrolytes in solution | | | | 7 |

| | | |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| 5 | Solubility equilibria – solubility constant, common ion effect, effect of added salts on solubility pH, weak and strong acids and bases, buffer solutions, ionic solutions Chemical Equilibria – Le Chatelier's principle, Effect of temperature, pressure and composition on equilibrium | 5 |
| 6 | Introduction – concept of reaction rates and order, experimental methods in kinetic studies, differential and integral methods to formulate rate equations of zero, first and second order reactions Experimental methods of kinetic studies | 3 |
| 7 | Kinetics and reaction mechanism – rate determining step, steady state approximation Complex reactions - parallel, consecutive and reversible reactions Mechanism of thermal, photochemical chain reactions, polymerization reactions Fast reactions – experimental techniques | 6 |
| 8 | Homogenous catalysis – homogeneous acid / base catalysis (specific and general acid catalysis), enzyme catalysis (Michaelis-Menten kinetics) | 6 |
| 9 | Reactions at interface – Adsorption isotherms, kinetics of surface reactions-Hishelewod and Rideal models of surface reactions | 3 |
| List of Text Books/ Reference Books | | |
| 1 | <i>Atkin's Physical Chemistry</i> (11 th edition) by P. W. Atkins, J. de Paula and J. Keeler, Oxford University Press, 2017. | |
| 2 | <i>Elements of Physical Chemistry</i> (7 th edition) by P. W. Atkins and J. de Paula, Oxford University Press, 2016. | |
| 3 | <i>Chemical Kinetics</i> (3 rd edition) by Keith J. Laidler, New York : Harper & Row, 1987. | |
| Course Outcomes (Students will be able to.....) | | |
| CO1 | <i>Elements of Physical Chemistry</i> (7 th edition) by P. W. Atkins and J. de Paula, Oxford University Press, 2016. | |
| CO2 | <i>Physical Chemistry</i> (6 th edition) by Ira Levine, McGraw-Hill Education, 2009 | |
| CO3 | Elucidate the effect of thermodynamic quantities on chemical equilibria and relate it to properties of chemical systems | |
| CO4 | Comprehend fundamental knowledge in chemical kinetics with basics of order, molecularity and temperature effect | |
| CO5 | Examine kinetics for complex, fast as well as surface reactions and comprehend different theories in kinetics | |

| | | | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|--------------------------------|----------|-----------------|
| | Course Code: CHTXXXX | Course Title: Analytical Chemistry | Credits = 3 | | |
| | Semester: I | | Total Contact Hours: 45 | L | T |
| | | | 2 | 1 | 0 |
| List of Prerequisite Courses | | | | | |
| | Standard XII Chemistry | | | | |
| List of Courses where this course will be Prerequisite | | | | | |
| | Physical and Analytical Chemistry Laboratory (CHP XXXX), other Chemistry Courses | | | | |
| Description of relevance of this course in the B. Tech. Programme | | | | | |
| The course introduces the students to key concepts of chemical analysis – sampling, selection of analytical method and data analysis. It presents basic techniques like spectroscopy and chromatography. The students should be able to select an appropriate analytical technique and apply it in accordance with its strengths and limitations. | | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | | Reqd Hrs |
| 1 | Introduction to chemical analysis, terminology (technique / method / procedure / protocol), broad classification of analytical techniques, good laboratory practices | | | | 5 |
| 2 | Criteria for selecting analytical methods – accuracy, precision, sensitivity, selectivity, and detection limit Calibration and validation | | | | 8 |
| 3 | Data analysis: errors – systematic and random errors, statistical treatment of experimental results (F, Q and t tests, rejection of data, and confidence intervals), least square method, correlation coefficients | | | | 6 |
| 4 | Spectroscopic methods: General principle, instrumentation and applications of - UV-visible spectroscopy - Infrared spectroscopy - fluorescence spectroscopy | | | | 8 |
| 5 | Electrochemical methods: General principle, instrumentation and applications of - conductometry - potentiometry | | | | 8 |
| 6 | Chromatographic methods: General principle, instrumentation and applications of - gas chromatography (GC) - HPLC | | | | 10 |
| List of Text Books/ Reference Books | | | | | |
| 1 | Modern Analytical Chemistry by David Harvey, McGraw-Hill, 1999. | | | | |

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|--------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | Quantitative Analysis by R. A. Day and A. L. Underwood, Prentice Hall of India, 2001. |
| 3 | Instrumental Methods of Analysis by H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Settle, Wadsworth Publishing, USA |
| 4 | Fundamentals of Analytical Chemistry by D. A. Skoog, D. M. West, F. James Holler and S. R. Crouch, Cengage Learning, 2014 |
| 5 | Principles of Instrumental Analysis by D. A. Skoog, F. James Holler and S. R. Crouch, Cengage Learning, 2007 |
| Course Outcomes (Students will be able to.....) | |
| CO1 | Draw and understand the 2D and 3D structures of small-molecule drugs and write their IUPAC names |
| CO2 | Understand and explain the molecular mechanism of action of drugs and biologics, with particular emphasis on the emerging trends and newer targets for varied therapeutic indications |
| CO3 | Decipher the structure-activity relationship (SAR), metabolism, therapeutic indications, drug-drug interactions, adverse effects of drugs and/or biologics |
| CO4 | Understand the logic behind the design of synthetic routes for small-molecule drugs and related compounds such as metabolites, impurities and prodrugs |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|--------------------------------|----------|-----------------|
| | Course Code: MAT 1301 | Course Title: Engineering Mathematics | Credits = 3 | | |
| | Semester: I | | Total contact hours: 45 | L | T |
| | | | 2 | 1 | 0 |
| List of Prerequisite Courses | | | | | |
| HSC Standard Mathematics | | | | | |
| List of Courses where this course will be prerequisite | | | | | |
| This is a basic Mathematics course. This knowledge will be required in almost all subjects later. | | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | | |
| This is a basic Mathematics course which will give the students the required foundations of mathematics to understand engineering concepts in the later part of the technology programs in ICT Mumbai. This course will also introduce probability distributions and basic statistics will be helpful to understand various data science studies in different engineering disciplines. | | | | | |
| Course Contents (Topics and subtopics) | | | | | Reqd Hrs |
| 1 | <p>Linear Algebra: Vectors in \mathbb{R}^n, notion of linear independence and dependence. \mathbb{R}^n as a vector space, vector subspaces of \mathbb{R}^n, basis of a vector subspace, row space, null space, and column space, rank of a matrix. Determinants and rank of matrices.</p> <p>Linear transformations in \mathbb{R}^n, Matrix of a linear transformation, change of basis and similarity, rank-nullity theorem, and its applications.</p> <p>Inner product spaces, orthonormal bases, Gram-Schmidt orthogonalization process, Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special Orthogonal projection and its application to least square methods, Diagonalization of matrices and its applications to stochastic matrices</p> | | | | 15 |
| 2 | <p>Differential Calculus: Higher order differentiation and Leibnitz Rule for the derivative, Taylor's and Maclaurin's theorems, Maxima/Minima, convexity of functions and applications.</p> <p>Functions of two or more variables, Limit and continuity, Partial differentiation, Total derivatives, Taylor's theorem for multivariable functions and its application to error calculations, Maxima/Minima, Method of Lagrange Multipliers, Introduction to double and triple integrals.</p> | | | | 15 |
| 3 | <p>Probability & Statistics: Random variables and cumulative distribution function; probability mass function and probability density function; Some common univariate distributions: Binomial, Poisson, Uniform, exponential, Normal; Expectation and Moments; Moment generating function, Multiple random variables, and Joint distribution; marginal distributions, Covariance and Correlation.</p> <p>Concept of parameter estimation: maximum likelihood estimation; method of least squares and simple linear regression; nonlinear regression</p> | | | | 15 |
| List of Textbooks/ Reference Books | | | | | |
| 1 | G. Strang, Linear Algebra and its Applications (4th Edition), Thomson (2006). | | | | |

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|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| 2 | Howard Anton, Elementary Linear Algebra, John Wiley & Sons (2016) | |
| 3 | Stewart, James, Single Variable Calculus, 6th Edition, Cengage learning (2016) | |
| 4 | Hughes-Hallett et al., Calculus - Single and Multivariable (3rd Edition), John-Wiley and Sons (2003). | |
| 5 | E. Kreyszig, Advanced Engineering Mathematics (8th Edition), John Wiley (1999). (Officially prescribed) | |
| 6 | S. R. K. Iyengar, R. K. Jain, Advanced Engineering Mathematics Narosa, (2020) | |
| 7 | A First Course in Probability, Sheldon Ross, Pearson Prentice Hall, 9 th Edition (2018) | |
| 8 | W.W. Hines, D. C. Montgomery, D.M. Goldsman, John-Wiely, Probability and Statistics in Engineering, John Wiley & Sons (2008) | |
| 9 | Alexander M. Mood, Duane C. Boes, and Franklin A. Graybill, Introduction to the Theory of Statistics, Mc GrawHill, (1973) | |
| Course Outcomes (students will be able to....) | | |
| CO1 | understand the notion of differentiability and be able to find maxima and minima of functions of one and several variables. | K2, K3 |
| CO2 | Understand the computational and geometrical concepts related to linear transformations, eigenvalues and eigenvectors and apply them to solve computational problems | K1, K2, K3 |
| CO3 | Demonstrate understanding of different concepts in linear algebra in solving computational problems related to vectors and matrices and apply them to solve problems arising the Engineering especially in AI and ML. | K2, K3, K5 |
| CO4 | Understand the concepts of various probability distributions and apply them to analyze various engineering problems and make inference about the system | K2, K3, K4 |
| CO5 | Understand the method of linear and nonlinear least squares method and apply it to choose appropriate mathematical functions for modelling real data sets, arising from engineering disciplines | K3, K4, K5 |

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| Course Code: GEP1129 | Course Title: VSEC Engineering Drawing and Computer Aided Drafting | Credits = 3 | | |
| | | L | T | P |
| Semester: I | Total contact hours: 75 | 1 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Draw Orthographic and Sectional Orthographic Views from Pictorial View. (K5) | | | |
| 2 | Draw isometric view when Front View and either top view or side view is given. (K5) | | | |
| 3 | Understand basics of Assembly Drawing. (K2) | | | |
| 4 | Understand basics of CAD and Prepare 2D,3D drawings using CAD. (K2) | | | |
| List of Prerequisite Courses | | | | |
| Mathematics, Geometry, basic drawing and visualization | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Industrial drawing, Equipment Design, Manufacturing and designing of any component, industrial 3D product modelling etc. | | | | |
| Description of relevance of this course in the B. Chem. Engg. Program | | | | |
| Drawing is a language used by engineers and technologists. A student is required to know the various processes and the equipment used to carry out the processes. Some of the elementary areas like product sizing, manufacturing etc., are very common to all the branches of technology. These and many other processes require machines and equipment's. One should be familiar with the design, manufacturing, working, maintenance of such machines and equipments. The subject of "drawing" is a medium through which, one can learn all such matter, because the "drawings" are used to represent objects and various processes on the paper. Through the drawings, a lot of accurate information is conveyed which will not be practicable through a spoken word or a written text. This course is required in many subjects as well as later in the professional career. | | | | |
| Course Contents (Topics and subtopics) | | | | |
| Sr. no. | | | | Reqd. hrs |
| 1. | Orthographic projections: Introduction, Principles of Projection, Methods of Projection, Planes of projection, Quadrants, First-angle method of projection, Third-angle method of projection, and concept of orthographic projections. | | | 20 |
| 2. | Sectional Projections and Missing Views: Need for the drawing sectional views, concept of sectioning and section lines, Sectional drawings of different solids and machine components, Auxiliary planes, and views. Missing Views: Concept of recognizing missing views and their interpretation, drawing of missing views from given orthographic drawings. | | | 15 |
| 3. | Isometric projections: Concept of isometric views, isometric projections and isometric scale, Iso metric projections of different solids and machine components. | | | 15 |
| 4. | Computer Aided Drafting and Assembly drawing: Basic introduction to CAD softwares, Design and Development of new products, Application of CAD, 2D, 3D part modelling on softwares, drawing modification and dimensioning, modelling of different machine components. Basics of Assembly | | | 25 |

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| | drawing, preparation of 2D, 3D components and assembling on CAD software, conversions, labelling and table creation for bill of materials. | |
| List of Textbooks/ Reference Books | | |
| 1. | Engineering Drawing by N.D.Bhat | |
| 2. | Engineering Drawing by N.H.Dubey | |
| 3. | CAD/CAM: Theory and Practice by Ibrahim Zeid and R Sivasubramanian | |

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| Course Code: | Course Title: BSC Applied Physics | Credits = 2 | | |
| | | L | T | P |
| Semester: I | Total contact hours: 30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Assign Miller indices to various crystallographic planes and directions in a crystal lattice, thereby understand periodicity in the crystal lattice. (K2) | | | |
| 2 | Analyse a given x-ray diffraction pattern to deduce the crystal structure of the material and calculate the values of the basic structural parameters. (K4) | | | |
| 3 | Classify solids, and in turn semiconductors, and calculate basic quantities related to charge transport in them. (K4) | | | |
| 4 | Analyse simple ideal fluid flows by applying the continuity equation and Bernoulli's equation. (K4) | | | |
| 5 | Describe the basic behaviour of viscous flows and the relationships between various flow parameters. (K1) | | | |
| 6 | Understand simple models that are used to describe viscoelastic flows. (K2) | | | |
| List of Prerequisite Courses | | | | |
| Standard XII Physics, Applied Physics – I, Physics Laboratory | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Applied Physics – II, Physics Laboratory, Chemical Engineering Thermodynamics, Momentum and Mass Transfer, Heat Transfer, Material Science and Engineering, Structural Mechanics, etc. | | | | |
| Description of relevance of this course in the B. Chem. Engg. Program | | | | |
| This is a basic physics course. This knowledge will be required in almost all subjects later on. This knowledge is also required for understanding various chemical engineering concepts that will be introduced in courses such as momentum transfer, reaction engineering, separation processes, thermodynamics, heat transfer, etc. | | | | |
| Course Contents (Topics and subtopics) | | | | |
| Sr. no. | | | | Reqd. hours |
| | Solid State Physics | | | |
| 1. | Crystal Structure of Solids: A revision of concepts of a lattice, a basis, unit cell, different crystal systems (SC, BCC, FCC, HCP), co-ordination number and packing fractions. Single crystalline, Polycrystalline, and Amorphous materials. | | | |
| 2. | Crystallographic planes and directions: concept of Miller indices and its determination, examples; calculation of inter-planar spacing in terms of Miller indices. | | | |
| 3. | Determination of crystal structure using X-rays: Bragg's law of X-ray diffraction, types of diffractometers, Indexing diffraction peaks and calculation of various lattice parameters and crystallite size. | | | |
| 4. | Energy band in solids and classification of solids, the concept of Fermi level and Fermi distribution function, Intrinsic and extrinsic semiconductors, Transport properties of semiconductors: Conductivity in semiconductors and its dependence of carrier concentration and mobility. | | | |
| | Physics of Fluids | | | |

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| 5. | A revision of the basic concepts of hydrostatics and ideal fluid flow: Equation of continuity and Bernoulli's equation. | |
| 6. | The concept of viscosity, Newton's law of viscosity, Reynold's number, Poiseuille's equation for streamline flows | |
| 7. | An introduction to Rheology: Parameters of viscous flows, Newtonian and non-Newtonian behaviour, Variation of viscosity with shear rate, shear time, temperature, and pressure (qualitative ideas with illustrative examples), measuring properties of viscous flows. | |
| 8. | The concept of viscoelasticity, Maxwell and Kelvin models of relaxation, relaxation spectrum, creep testing. | |
| List of Textbooks/ Reference Books | | |
| 1. | Fundamentals of Physics – Halliday, Resnick, Walker – 6 th Edition - John Wiley | |
| 2. | Sears and Zeemansky's University Physics – Young and Freedman – 12 th Edition - Pearson Education | |
| 3. | A Textbook of Engineering Physics - M N Avadhanulu, P G Kshirsagar, TVS Arun Murthy - 11 th Edition -S. Chand Publishers | |
| 4. | Solid State Physics – S. O. Pillai – 10 th Edition - New Age Publishers | |
| 5. | Solid State Physics – A. J. Dekker - MacMillan India. | |
| 6. | Engineering Physics – V Rajendran – 6 th Edition - McGraw Hill Publishers | |
| 7. | Introduction to Rheology – H. A. Barnes, J. F. Hutton and K. Walters - 4 th Edition - Elsevier Science. | |
| 8. | Viscoelastic Properties of Polymers – J. D. Ferry - 3 rd Edition - Wiley | |

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| Course Code: TXT1107 | Course Title: SPL1 Introduction to Textile Substrates | Credits = 2 | | |
| | | L | T | P |
| Semester: I | Total contact hours: 30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Understand fibre-forming properties with different textile terms and their classification (K2). | | | |
| 2 | Acquire deeper understanding and insights into basic chemistry, production processes and physical and chemical properties of Natural and Synthetic fibers. (K2). | | | |
| 3 | Calculate yarn and fabric production related numerical. (K3) | | | |
| 4 | Analyze designs of various type of fabrics and different types of defects in fabric. (K4) | | | |
| List of Prerequisite Courses | | | | |
| H. S. C. Science | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technology of Textile Dyeing, Testing of Textile Materials, Technology of Fibres and Polymers, Manufacturing of Yarn and Fabric | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Students will have better understanding of different natural and synthetic fibres, their properties as well as important concept of polymer chemistry which will help in manufacturing as well as designing processing parameters. | | | | |
| Sr. no. | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1. | Introduction to textile fibre as polymer, Fibre forming characteristics of polymers, Definition of various basic textile terms, Introduction to Fibre, Yarn, Fabric, Classification of fibres based on sources of origin and on chemical constitution. | | | 4 |
| 2. | Natural fibres of plant, animal and mineral origin, chemistry, morphology, physical and chemical properties, structure property relationship with application, commercially important fibres like cotton, jute, linen, bamboo, wool, silk etc., Fibre to fabric conversion steps. | | | 7 |
| 3. | Semi-synthetic fibres such as viscose rayon, cuprammonium rayon, acetate rayon, bamboo rayon and lyocell with respect to chemistry, manufacturing process, morphology, physical and chemical properties and structure property relationship with applications. | | | 5 |
| 4. | Synthetic fibres such as polyester and its variants, polyamides, acrylic, polypropylene, etc with respect to their raw materials, synthesis, manufacturing processes including LOY, FOY, POY, FDY, draw ratio, physical and chemical properties and applications. | | | 5 |

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| 5. | Manufacturing of yarn: Introduction of spinning, Primary properties of textile fibres, Physical properties of Cotton, Silk, Wool. Fineness measurement of Filament and Yarn. Process comparison of staple spinning and filament spinning. | 3 |
| 6. | Manufacturing of Fabric: Introduction to fabric manufacturing, types of manufacturing, weaving, knitting and non-woven. | 3 |
| 7. | Numerical – Fineness, Moisture percentage, Motion transfer in gears and rollers, Drafting and doubling, Twist, Fabric production, Cover factor, statistical analysis. | 3 |
| List of Text Books/ Reference Books | | |
| 1. | Textile Fibres, Shenai V.A., Vol-1, Sevak Publications, Bombay, 3rd edition, 1991. | |
| 2. | Mishra, S. P. A Text Book of Fibre Science and Technology. India: New Age International, | |
| 3. | Ghosh, P. . Fibre Science and Technology. United States: McGraw Hill Education (India) Private Limited, 2004 | |
| 4. | Kothari, V. Manufactured Fibre Technology. Netherlands: Springer Netherland, 2012 | |
| 5. | Visco-Elastic Properties of Polymers, Ferry, J.D., John Wiley and Sons, New York, 3 rd | |
| 6. | Polymer Science, V R Gowariker, New Age international (P) Ltd Publications, New | |
| 7. | Weaving: Machines, mechanisms, management, Talukdar, M.K., Sriramulu P.K., Ajgaonkar D.B., Mahajan Publishers Private Ltd., Ahmedabad, 1998 | |
| 8. | Knitting technology, D. B. Ajgaonkar, Universal Pub, 1998 | |
| 9. | Nonwovens - Process, Structure, Properties and Applications; T Karthik, 2017 | |

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| Course Code: | Course Title: BSC Physics Laboratory | Credits = 2 | | |
| | | L | T | P |
| Semester: I | Total Contact Hours: 60 | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Apply various laws which they have studied through experiments (K3) | | | |
| 2 | Measure transport properties like viscosity, conductivity, etc.(K4) | | | |
| 3 | Explain the application of acoustic cavitation (K2) | | | |
| List of Prerequisite Courses | | | | |
| Applied Physics - I | | | | |
| List of Courses where this course will be prerequisite | | | | |
| This is a basic physics Laboratory course. This knowledge will be required in almost all subjects later on. | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| Students will be able to learn various concepts by doing experiments on different topics. This knowledge will be required in almost all subjects later. This knowledge is also required for understanding various chemical engineering concepts that will be introduced in courses such as momentum transfer, reaction engineering, separation processes, thermodynamics, heat transfer, etc. | | | | |
| Sr. No. | Course Contents (Topics and Subtopics) | | | Reqd Hrs |
| 1 | Viscosity | | | 5 |
| 2 | Thermistor | | | 6 |
| 3 | Thermal conductivity | | | 5 |
| 4 | Ultrasonic interferometer | | | 6 |
| 5 | Photoelectric effect | | | 5 |
| 6 | Hall effect | | | 6 |
| 7 | Newton's rings | | | 5 |
| 8 | Dispersive power of prism | | | 8 |
| 9 | Laser diffraction | | | 8 |
| 10 | Resolving power of grating | | | 6 |
| List of Text Books/ Reference Books | | | | |
| 1 | Physics : Vols. I and II – D. Halliday and R. Resnick, Wiley Eastern | | | |
| 2 | Lectures on Physics: Vols. I, II and III – R. P. Feynman, R. B. Leighton and M. Sands, Narosa. | | | |
| 3 | Concepts of Modern Physics – A. Beiser, McGraw-Hill. | | | |
| 4 | Introduction to Modern Optics – G. R. Fowles ,Dover Publications. | | | |
| 5 | Optical Fibre Communication – G. Keiser, McGraw-Hill. | | | |
| 6 | A Course of Experiments with LASERs – R. S. Sirohi, Wiley Eastern | | | |
| 7 | Optoelectronics – J. Wilson and J. F. B. Hawkes, 2nd ed, Prentice-Hall India. | | | |
| 8 | Ultrasonics: Methods and Applications – J. Blitz, Butterworth | | | |
| 9 | Applied Sonochemistry – T. J. Mason and J. P. Lorimer, Wiley VCH. | | | |

Semester II

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| | Course Code: CHTXXXX | Course Title: Organic Chemistry | Credits = 3 | | |
| | Semester: II | | Total Contact Hours: 45 | L | T |
| List of Prerequisite Courses | | | | | |
| Std. XII Chemistry | | | | | |
| List of Courses where this course will be Prerequisite | | | | | |
| Description of relevance of this course in the B. Tech. Programme | | | | | |
| To acquaint the students with concepts related to fundamentals of Organic Chemistry including reaction mechanisms, organic transformations, types of reactions, selectivity of chemical transformations, stereochemical implications of organic reactions, functional group identification and reactions so that they are perfectly aligned to apply the same for future courses and in their professional career | | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | | Reqd Hrs |
| 1 | Chemistry of Carbonyl Compounds Concept of acidity and tautomerism of carbonyl compounds, General methods of preparation and Nucleophilic Addition reactions Enolate chemistry, Aldol and related condensation reactions, Michael reaction, Robinson annulation, Claisen condensation, Dieckmann condensation, Mannich reaction. | | | | 9 |
| 2 | Aromatic Substitution Reactions A) Electrophilic Substitution Reactions Nitration, Halogenation, Alkylation, Acylation and Sulfonation Activating, deactivating and orienting effects of functional groups in mono- and poly-substituted benzenes Friedel-Crafts alkylation, Acylation, Gattermann, Gattermann-Koch, Riemer-Tiemann reactions. B) Nucleophilic Substitution Reactions Addition and elimination mechanism, Benzyne mechanism, Sandmeyer reaction. | | | | 10 |
| 3 | Heteroaromatic Compounds IUPAC nomenclature, structures and common names, comparison with benzenoid compounds, reactivity and synthesis – pyrroles, furans, thiophenes and pyridines | | | | 8 |
| 4 | Named Organic Reactions Perkin reaction (Mauvine synthesis-dyes), Fischer indole synthesis, (dyes), Jacobson Corey epoxide synthesis (Pharmaceutical), Ziegler Natta polymerisation (polymer), Multicomponent reactions, Mailard reaction | | | | 10 |

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| | (foods), Strecker amino acid synthesis (Pharmaceuticals & Food), Wittig reactions, Prilezhaev reaction | |
| 5 | Stereochemistry of Organic Compounds Containing one and two asymmetric carbon atoms, Stereo descriptors – R/S, E/Z, erythro and thero, Conformation – Ethane and butane. Enantiomers and Diastereomers, meso compounds, different representations of stereoisomers – Saw-horse, Newmann, Wedge and dash and Fischer and their interconversions | 8 |
| List of Text Books/ Reference Books | | |
| 1 | Clayden, J., Greeves, N., Warren, S.; Organic Chemsitry; 2nd ed.; Oxford University Press (2012) | |
| 2 | Graham Solomons, T. W.; Fryhle, Craig B.; Snyder, Scott A. Organic Chemistry; 12th Ed.; John Wiley & Sons. Inc. (2016) | |
| 3 | Smith, M. B.; March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure; 7th ed.; Wiley, India (2015) | |
| 4 | Carey F. A., Sundberg, R. J. Advanced Organic Chemistry: Part A: Structure and Mechanisms; 5th ed.; Springer (2005) | |
| 5 | Carey F. A., Sundberg, R. J.; Advanced Organic Chemistry: Part B: Reaction and Synthesis; 5th ed.; Springer (2007) | |
| 6 | Wade, L. G.; Simek, J. W.; Singh, M. S. Organic Chemistry; 9th Ed.; Pearson Education (2019) | |
| 7 | Eliel, E. L. Stereochemistry of Carbon Compounds; Mcgraw-Hill (2001) | |
| 8 | Bruice, Paula, Y. Organic Chemistry; 8th Ed.; Pearson Education (2020) | |
| Course Outcomes (Students will be able to.....) | | |
| CO1 | draw structures of organic compounds and write their IUPAC names correctly (K2). | |
| CO2 | be well versed with aromatic chemistry and interpret the outcome of general transformations (K3). | |
| CO3 | understand the importance of heterocycles, learn the properties and synthetic routes, interpret the IUPAC of compounds and decipher outcomes of various transformations involving heterocycles (K3). | |
| CO4 | apply the knowledge obtained through the course to predict the outcome of reactions and devise solutions to unknown problems (K3). | |
| CO5 | appreciate the stereochemical implications of organic compounds and visualize and appreciate the chirality concept (K2). | |

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| CO 6 | understand organic chemistry reactions related to aliphatic as well as aromatic compounds as well as decipher the outcome of a given organic transformation (K3). |
| CO7 | interpret and analyze reactions having different functionalities, deduce and solve problems related to the reactions as well as apply them, if need be (K4). |

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| Course Code: CHT XXXX | Course Title: Industrial Chemistry | Credits = 3 | | |
| Semester: II | Total contact hours: 45 L + 15 T | L | T | P |
| | | 3 | 1 | 0 |
| List of Prerequisite Courses | | | | |
| Standard XII Chemistry | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| This course aims to introduce the students to the various industrial applications of Chemistry and its allied fields. The course content is designed to familiarize the students with bulk and fine chemical industry and the various processes used in the same. The emphasis will be on relating the previously taught concepts of Chemistry to real world examples. The course will combine theoretical training for promoting better understanding of concepts. | | | | |
| | | | | |
| Sr. no | Course Contents (Theory) | Reqd. hours | | |
| 1 | Introduction to Chemical Industry: Bulk chemicals, fine chemicals, intermediates, active pharmaceutical ingredients (API), etc. | 3 | | |
| 2 | Petrochemical Industry: operations and processes in manufacture of ethers, hydrocarbons, aromatic compounds, etc. | 6 | | |
| 3 | PRIMARY INORGANIC MATERIALS: Water, Hydrogen, Hydrogen Peroxide and Inorganic Peroxo Compounds, Nitrogen and Nitrogen Compounds, Phosphorus and its Compounds, Sulfur and Sulfur Compounds, Halogens and Halogen Compounds, | 8 | | |
| 4 | MINERAL FERTILIZERS: Phosphorus-Containing Fertilizers, Nitrogen-Containing Fertilizers, Potassium-Containing Fertilizers | 4 | | |
| 5 | METALS AND THEIR COMPOUNDS: Alkali and Alkaline Earth Metals and their Compounds Aluminum and its Compounds, Chromium Compounds and Chromium, Silicon and its Inorganic Compounds, Manganese Compounds and Manganese | 8 | | |
| 6 | ORGANIC BULK CHEMICALS: Manufacture of methanol, acetic acid, ethanol, ethylene, propylene, butadiene, acetaldehyde, acetylene, BTX, alkyl benzenes, acetone, phenol, styrene, esters, ethylene oxide, phthalic acid, Vinyl-Halogen and Vinyl-Oxygen Compounds, azo dyes, Polyamides, Propene Conversion Products, Aromatics - Production and Oxidation Products of Xylene and Naphthalene | 8 | | |
| 7 | Important pharmaceutically active ingredients, agrochemicals, insecticides, pesticides, perfumery chemicals. | 8 | | |
| List of Text Books/ Reference Books | | | | |
| | 1) Industrial Organic Chemistry, 3rd, Completely Revised Edition, Klaus Weissermel, Hans-Jürgen Arpe ISBN: 978-3-527-61459-2 July 2008 | | | |
| | 2) Industrial Inorganic Chemistry, 2nd Completely Revised Edition, Karl Heinz Buchel, Hans-Heinrich Moretto, Dietmar Werner, ISBN: 978-3-527-61333-5, 667 pages, November 2008, Wiley-VCH. | | | |

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| | 3) Inorganic Chemistry – an industrial and environmental perspective, T.W. Swaddle, ISBN 0-12- 678550-3 , 482 pages, Academic Press |
| Course Outcomes (Students will be able to.....) | |
| | 1) Understand the important of chemical principles applied to various industrial processes 2) Describe the fundamental processes underlying manufacture of important organic and inorganic chemicals 3) Review and assess the impact of the chemical factors on the efficiency of industries and feedstock manufacturing Modify existing applications for improving the efficiencies in terms of yields, energy requirement and environmental impact |

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| Course Code: | Course Title: SPL2 Introduction to Textile Wet Processing | Credits = 2 | | |
| | | L | T | P |
| Semester: II | Total contact hours: 30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Explain the need for sizing yarns and desizing of fabric; effect of scouring and bleaching agent on fabric pretreatment, mercerization of yarn and fabric. (K2) | | | |
| 2 | Applying various dyes on textile coloration and understanding the importance of various textile processing parameters for quality dyeing. (K3) | | | |
| 3 | Comprehend fundamental knowledge thickener selection for printing and stages of printing. (K3) | | | |
| 4 | Select between different types of softeners, fastness-improving agents, antimicrobial, antistatic, flame retardant, their chemistry, application on fabric and evaluation tests. (K4) | | | |
| List of Prerequisite Courses | | | | |
| H. S. C. Science | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technology of Textile Dyeing, Technology of Textile Printing, Technology of Textile Pretreatment, Technology of Finishing | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Students will have better understanding of various stages of textile wet processing and the gain a basic idea about the wet processing operations. | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1. | Pretreatment: Basic operations in textile wet processing – overall sequence, an overview of textile types and chemicals used, Singeing, Desizing, Scouring and Bleaching, Mercerization, Pretreatment of Blends. | | | 5 |
| 2. | Dyeing: Parameters of quality dyeing, Classification of dyes based on application, Performance characteristics of dyed textiles. Machinery for dyeing of textiles in various forms such as fibres, yarns, woven and knitted fabric. | | | 10 |
| 3. | Printing: Introduction to various colouration technics, Stages in the printing of textiles, and History of textile printing. Preparation of print paste, functions of various ingredients of print paste, classification of thickeners, Preparation of stock thickening, Selection of thickening agents based on dye class, style and method, Styles of Printing and various special styles of printing | | | 10 |
| 4. | Finishing of Textile: Objective of textile Finishing and type of finishing techniques, Mechanical finishes like Calendaring, sanforising. Chemical finishing – conventional softeners, stiffeners, binders, weighting agents, silicone finishes, speciality finishes. | | | 5 |

List of Text Books/ Reference Books

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| 1. | Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar, 1999 |
| 2. | Technology of Bleaching and Mercerizing, Shenai V.A., Sevak Publication, Bombay, Vol.3, 3rd edition, 2003. |
| 3. | Technology of Dyeing, Shenai V.A., Vol. 6, Sevak Publication, Bombay, 1994. |
| 4. | Technology of Printing, V. A. Shenai, Sevak Publications, Bombay, Vol. 4, 1990. |
| 5. | Textile Printing by L. W. C. Miles, revised second edition published by SDC, 2003. |
| 6. | Technology of Finishing, Shenai V.A., Vol. 10, Sevak Publication, Bombay, 1990. |

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| Course Code: GET 1130 | Course Title: ESC Basic Mechanical Engineering | Credits = 2 | | |
| | | L | T | P |
| Semester: II | Total contact hours: 30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to....) | | | | |
| 1 | Understand different types of stresses and their effects on bodies. (K2) | | | |
| 2 | Describe the working of steam boilers, mountings, and accessories. (K2) | | | |
| 3 | Explain the working principles of power developing systems such as steam turbines, gas turbines and internal combustion engines. (K2) | | | |
| 4 | Describe the working principle of vapour compression and vapour absorption refrigeration systems. (K2) | | | |
| 5 | Discuss different types of power transmission systems and their typical applications. (K2) | | | |
| 6 | Explain the working principles of power absorbing devices such as pumps and compressors. (K2) | | | |
| List of Prerequisite Courses | | | | |
| Physics, Basic Mathematics | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Energy Engineering, Unit Operations, Mechanical design of chemical equipments | | | | |
| Description of relevance of this course in the B. Tech. Engg. Program | | | | |
| Students will be able to understand various equipments like steam turbine, gas turbine, pumps, compressors, and power transmission system. | | | | |
| Sr. no | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1. | Introduction-Concept of Stress Condition of Equilibrium for concurrent coplaner and non-concurrent coplaner forces. Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses, Stress Strain Diagram, elastic constants and their relations volumetric, linear and shear strains. | | | 6 |
| 2. | Introduction to Thermodynamics First Law of Thermodynamics, Steady-flow energy equation, Second Law of Thermodynamics | | | 3 |
| 3. | Steam Generators Fire tube and Water tube boiler, Low pressure, and high-pressure boilers, once through boiler, examples, and important features of HP boilers, Mountings and accessories, Equivalent evaporation of boilers, Boiler performance, Boiler efficiency | | | 4 |
| 4. | Steam Turbines Working principle of steam, gas and water turbines, Concept of impulse and reaction steam turbines. | | | 3 |
| 5. | Compressors/Pumps Different Types of Compressors and their applications, Different Types of Pumps, and their applications. | | | 3 |
| 6. | Refrigeration COP of refrigerator and heat pumps, Classification of refrigerants, Nomenclature, Properties desired by refrigerants, Vapour compression refrigeration cycle, Methods of increasing COP of VCRS, Vapour absorption refrigeration systems | | | 4 |
| 7. | I. C. Engines/Gas Turbines | | | 3 |

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| | Classification, working of 2-stroke, 4-stroke C.I. and S.I. Engines with P-V diagrams, Working of Gas Turbines. | |
| 8. | Transmission of Power Introduction to various drives such as belt, rope, chain and gear drives, Introduction to mechanical elements such as keys, couplings, and bearings in power transmission (No numerical) | 4 |
| List of Textbooks/ Reference Books | | |
| 1. | Theory of Machines by Rattan. S.S | |
| 2. | Thermodynamics by P.K. Nag | |
| 3. | Power plant by Morse | |
| 4. | Hydraulic Machines by Jagdish Lal | |
| 5. | Renewable Energy resources by Tiwari and ghosal, Narosa publication. | |
| 6. | Non-conventional energy sources, Khanna publications | |
| 7. | Gas turbine theory by HiH Saravanamutoo. | |
| 8. | Heat Engines by P.L. Balani | |

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| Course Code: | Course Title: ESC Process Calculations | Credits = 2 | | |
| | | L | T | P |
| Semester: II | Total contact hours: 60 | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Convert units of simple quantities from one set of units to another set of units. (K3) | | | |
| 2 | Calculate quantities and /or compositions, energy usages, etc. in various processes and process equipment such as reactors, filters, dryers, etc. (K3) | | | |
| List of Prerequisite Courses | | | | |
| XII th Standard Mathematics, Chemistry, Physics | | | | |
| List of Courses where this course will be prerequisite | | | | |
| This is a basic Course. This knowledge will be required in ALL subjects later. | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| This is a basic course. This knowledge will be required in almost all subjects later. This subject introduces the various concepts used in Chemical Engineering to the students. The knowledge of this subject is required for in ALL B. Tech. courses, etc. It can be applied in various situations such as process selection, economics, sustainability, environmental impacts | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | Reqd. Hrs |
| 1 | Introduction to Chemical process calculations, overview of single stage and multistage operations, concept of process flow sheets | | | 2 |
| 2 | Revision of Units and Dimensions, Dimensional analysis of equations, Mathematical techniques | | | 4 |
| 3 | Mole concept, composition relationship, types of flow rates | | | 2 |
| 4 | Material balance in non-reacting systems: application to single and multistage processes | | | 8 |
| 5 | Stoichiometry | | | 2 |
| 6 | Material balance in reacting systems: application to single and multistage processes | | | 6 |
| 7 | Behavior of gases and vapors | | | 4 |
| 8 | Introduction to psychrometry, humidity and air-conditioning calculations. | | | 6 |
| 9 | Calculation of X-Y diagrams based on Raoult's law. | | | 2 |
| 10 | Applications of material balances to Multiphase systems | | | 6 |
| 11 | Basic concepts of types of Energy and calculations | | | 2 |
| 12 | Application of Energy balance to non-reacting systems | | | 6 |
| 13 | Application of Energy balance to reacting systems | | | 6 |
| 14 | Fuels and combustion. | | | 4 |
| List of Text Books/ Reference Books | | | | |
| 1. | Elementary Principles of Chemical Processes, Felder, R.M. and Rousseau, | | | |
| 2. | Chemical Process Principles, Hougen O.A., Watson K. M. | | | |
| 3. | Basic Principles and Calculations in Chemical Engineering, Himmelblau, | | | |
| 4. | Stoichiometry, Bhatt B.I. and Vora S.M. | | | |

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| Course Code: GET 1131 | Course Title: ESC Electrical Engineering and Electronics | Credits = 2 | | |
| | | L | T | P |
| Semester: II | Total contact hours: 30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Understand the basic concepts of D.C., single phase and three phase AC supply and circuits Solve basic electrical circuit problems. (K3) | | | |
| 2 | Understand the basic concepts of transformers and motors used as various industrial drives. (K3) | | | |
| 3 | Understand the basic concepts of electronic devices and their applications in power supplies, amplification and instrumentation. (K3) | | | |
| 4 | Understand the basic concepts of Data acquisition, signal conditioning. (K3) | | | |
| List of Prerequisite Courses | | | | |
| XII th Standard Physics and Mathematics courses, Applied Physics - II | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Chemical Process Control, Energy Engineering, | | | | |
| Description of relevance of this course in the B. Tech Engineering Program | | | | |
| Students will get an insight to the importance of Electrical Energy in Chemical Plants. The students will understand the basics of electricity, selection of different types of drives for a given application process. They will get basic knowledge as regards to Power supplies, instrumentation amplifiers and thyristor application in industries. | | | | |
| Sr.no | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1 | Fundamentals of DC Circuits Voltage and Current Sources, Basic Laws, Network Theorems, Superposition Theorem and Thevenin's Theorem, | | | 4 |
| 2 | AC Fundamentals: A.C. through resistance, inductance and capacitance, simple RL, RC and RLC circuits. Power, power factor | | | 4 |
| 3 | Three Phase Systems: Three phase system of emfs and currents, Star and Delta connections, three phase power | | | 3 |
| 4 | Single phase transformers: Principle of working, Efficiency, regulation. | | | 3 |
| 5 | Electrical drives: Basic concepts of different types of Electrical motors as drives, Their suitability for various applications. | | | 2 |
| 6 | Regulated power supplies, Diodes as rectifiers, Half wave and Full wave rectifier, Filters and Regulators | | | 3 |
| 7 | Bipolar junction transistors: Different configurations, Characteristics, Concept of basic amplifier circuits, Amplifier gain, Transistor as switch | | | 3 |
| 8 | Introduction to Integrated circuits: Basic concepts of ICs | | | 2 |
| 9 | Introduction to data acquisition and signal conditioning, Basic concept and Block diagram, Concept of conversion of physical quantity to electrical signal, signal conditioning, Introduction to A/D and D/A converters | | | 3 |
| 10 | Introduction to instrumentation amplifiers and their applications Operational Amplifier – Notation, Pin diagram, Differential and common mode gain, CMRR, Introduction to various applications such as Non-inverting, inverting amplifiers, adder, subtractor, integrator, differentiator | | | 3 |

| List of Textbooks/ Reference Books | |
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|---|---------------------------------------------------------------|
| 1 | Electrical Engineering Fundamentals by Vincent Deltoro |
| 2 | Electronic devices and circuits by Boylestad, Nashelsky |
| 3 | Electrical Machines by Nagrath, Kothari |
| 4 | Electrical Technology by B.L.Theraja, A.K.Theraja vol I,II,IV |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------|---------------|-----------------------|
| BSC | Course Code: CHPXXXX | Course Title: Physical and Analytical Chemistry Laboratory | Credits = 2 | | |
| | Semester: II | | Total Contact Hours: 45 | L 0 | T 0 |
| List of Prerequisite Courses | | | | | |
| Standard XII th Organic Chemistry Laboratory | | | | | |
| List of Courses where this course will be Prerequisite | | | | | |
| This is a basic physical and analytical chemistry laboratory course. The knowledge gained here will be required in many subsequent course | | | | | |
| Description of relevance of this course in the B. Tech. Programme | | | | | |
| Students will become familiar with laboratory experimental skills, plan and interpretation of experimental tasks, understand the relevance of principles of physical and analytical chemistry in chemical processes | | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | | Required Hours |
| 1 | (8 to 10 experiments will be conducted from following list) 1. To determine the total hardness of given water sample 2. To determine the dissociation constants of a polybasic acid using pH meter 3. To determine pKa of the given weak acid by potentiometric titration 4. To determine the critical micelle concentration (CMC) of the given surfactant by surface tension measurement using a stalagmometer 5. To determine the normality and volume of weak acid and strong acid in the given mixture using conductometric titration 6. To determine the rate constant of hydrolysis of an ester catalyzed by an acid 7. To study the kinetics of the reaction between K ₂ S ₂ O ₈ and KI and hence, determine rate of the reaction 8. To verify Beer – Lambert’s Law 9. To determine the equivalent conductance of strong electrolyte at infinite dilution and verify Ostwald’s law of dilution, for dissociation of weak electrolyte 10. To determine the molecular weight of the given polymer by viscosity measurements 11. To determine the vitamin C concentration from the given tablet sample by titration 12. Demo of Gas chromatography and FT-IR | | | | 4th per practical |
| List of Text Books/ Reference Books | | | | | |
| 1 | Practical physical Chemistry – B.Viswanthan and P.S. Raghavan | | | | |

| | |
|--------------------------------------------------------|---------------------------------------------------------------------------|
| 2 | Practical physical Chemistry- Alexander Findlay |
| Course Outcomes (Students will be able to.....) | |
| CO1 | Identify reaction rate parameters |
| CO2 | List simple methods of chemical analysis |
| CO3 | Determination of physic chemical parameters using simple laboratory tools |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------|---------------|-----------------------|
| | Course Code: CHPXXXX | Course Title: Organic Chemistry Laboratory | Credits = 2 | | |
| | Semester: II | | Total Contact Hours: 45 | L 0 | T 0 |
| List of Prerequisite Courses | | | | | |
| Standard XII th Organic Chemistry Laboratory | | | | | |
| List of Courses where this course will be Prerequisite | | | | | |
| All the Applied Chemistry Practicals | | | | | |
| Description of relevance of this course in the B. Tech. Programme | | | | | |
| The course is relevant for training the students for working with binary mixtures. The students are exposed to basics of organic separations and identification of organic compounds based on their physicochemical properties. The laboratory training is crucial for the students to carry out work-up of organic reactions leading to separation of crude products followed by purification using recrystallization and/or distillation or related methods. | | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | | Required Hours |
| 1 | a) Principles of qualitative separation of organic mixtures using physical properties, chemical properties and their combination | | | | 4 |
| | b) Principles of quantitative separation of organic mixtures using physical properties, chemical properties and their combination | | | | 4 |
| 2 | a) Separation of solid-solid water insoluble binary organic mixtures | | | | 5X4 |
| | b) Separation of solid-solid partly water soluble binary organic mixtures | | | | 2X4 |
| | c) Separation of solid-solid mixtures by fractional crystallization | | | | 2X4 |
| | d) Separation of liquid-liquid mixtures by distillation | | | | 2X4 |
| | e) Separation of liquid-liquid mixtures by solvent extraction | | | | 2X4 |
| List of Text Books/ Reference Books | | | | | |
| 1 | Arthur, Vogel. Textbook of Practical Organic Chemistry, 5th edition, publishers Longman group Ltd, 1989 | | | | |
| 2 | F.G. Mann and B.C. Saunders, Practical Organic Chemistry, 4th edition published by Orient Longman | | | | |
| 3 | Keese, R, Martin P. B, and Trevor P. Toubé. Practical Organic Synthesis: A Student's Guide. John Wiley & Sons, 2006. | | | | |

| Course Outcomes (Students will be able to.....) | |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
| CO1 | work safely in the organic chemistry laboratory (K3). |
| CO2 | separate binary organic mixtures by multiple techniques (K4). |
| CO3 | understand basic principles for separation of binary organic mixtures qualitatively and quantitatively (K3). |

**B. Tech. in Fibres & Textile Processing Technology
Syllabus Structure B. Tech. Second Year**

Semester III

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|------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|----------|
| Course Code: TXT1219 | Course Title: SPL3 Textile wet processing machinery | Credits = 4 | | |
| | | L | T | P |
| Semester: III | Total contact hours: 60 | 3 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Justify the improvisation in the textile processing machinery according to the efficiency and ease of operation. (K5) | | | |
| 2 | Examine the various parts and segments of textile processing machinery and differentiate them according to their functions. (K3) | | | |
| 3 | Demonstrate the new developments in the textile processing types of machinery with respect to their utility. (K4) | | | |
| 4 | Design processing machinery setup and effluent treatment plant according to the prerequisites. (K3) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Substrates, Introduction to Textile Wet Processing | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technology of Textile Dyeing, Technology of Textile Printing, Technology of Textile Pretreatment, Technology of Finishing | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Students will better understand various stages of textile wet processing, and types of machinery used and gain a basic idea about the wet processing operations. | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | Reqd. hrs | | |
| 1 | Shearing, Cropping, and Singeing types of machinery, machine specifications for gas singeing, latest developments in gas-based singeing machines | 6 | | |
| 2 | Machinery used for these preparatory processes in batch-wise, semi-continuous, and continuous operations for different forms of textiles such as loose fibres, yarn, and fabric | 18 | | |
| 4 | Developments in machinery for pretreatment, dyeing, printing, and finishing | 16 | | |
| 5 | Automation in computer applications in textile wet processing and microprocessor applications in processing. | 8 | | |
| 6 | Modifications for energy and water conservation in textile wet processing | 6 | | |
| 7 | Effluent treatment plant organization in textile | 6 | | |
| List of Text Books/ Reference Books | | | | |

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|---|------------------------------------------------------------------------------------------------------------|
| 1 | Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar, 1999 |
| 2 | Technology of Bleaching and Mercerizing, Shenai V.A., Sevak Publication, Bombay, Vol.3, 3rd edition, 2003. |
| 3 | Technology of Dyeing, Shenai V.A., Vol. 6, Sevak Publication, Bombay, 1994. |
| 4 | Technology of Printing, V. A. Shenai, Sevak Publications, Bombay, Vol. 4, 1990. |
| 5 | Technology of Bleaching and Dyeing, Chakraverty, R.R., Trivedi S.S., Vol. 1, Mahajan |
| 6 | Textile Printing by L. W. C. Miles, revised second edition published by SDC, 2003. |
| 7 | Technology of Finishing, Shenai V.A., Vol. 10, Sevak Publication, Bombay, 1990. |
| 8 | Principles of Textile Finishing, Choudhury A. R, Woodhead Publishing, 2017 |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|-----------------|
| Course Code: TXT1216 | Course Title: SPL4 Chemistry & Applications of Specialty Chemicals | Credits = 2 | | |
| | | L | T | P |
| Semester: III | Total contact hours: 30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1. | Evaluate surfactants and identify their ionic nature. (K3) | | | |
| 2. | Explain the biodegradability of surfactants and eco-friendly textile auxiliaries. (K2) | | | |
| 3. | Understand the fundamentals of textile auxiliaries. (K1) | | | |
| 4. | Classify different types of surfactants and their role in textile (K4) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile substrates, Introduction to Textile Wet Processing | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Testing of Textile Materials | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The course will provide student deep understanding about the role of different functional groups on the properties of various specialty chemicals used in different industries. | | | | |
| | | | | |
| Sr.No. | Course contents (topics/subtopics) | | | Reqd Hrs |
| 1 | Nomenclature, functions, and classification of textile auxiliaries | | | 2 |
| 2 | Surface activity phenomenon, Surfactants and their chemistry and applications. | | | 2 |
| 3 | Anionic Surfactants: Properties and uses of anionics from carboxylic acids, alkylaryl sulphonates, alkyl sulphates, alkane sulphonates and phosphate esters, etc. | | | 3 |
| 4 | Cationic Surfactants: Chemistry, Properties, and applications | | | 2 |
| 5 | Nonionic Surfactants: Chemistry, Properties, and applications | | | 2 |
| 6 | Processing Aids: The structure-property relationships of Antimigrant, Defoamers, Dyeing Assistants, Enzymes in Preparation, Lubricants, Peroxide Stabilizers, Printing Binders, Surfactants (Scouring and Wetting Agents), Thickeners Warp Sizes | | | 5 |
| 7 | Performance Enhancers: The structure-property relationships of Antimicrobial Finishes, Antipilling Agents, Antistatic Agents, Durable Press Agents, Dye Fixatives, Elastomeric Finishes, Enzymes in Finishing, Flame Retardants, Hand Modifiers (Softeners and Hand Builders), Repellent Finishes, Soil Release Agents, Stain blockers and Ultraviolet Absorbers | | | 5 |
| 8 | Qualitative and quantitative evaluation of auxiliaries; Testing of surfactants, detergency, identification of ionic nature. | | | 3 |
| 9 | Biodegradability of surfactants | | | 2 |
| 10 | Banned chemicals in pre-treatments, Natural textile auxiliaries | | | 2 |
| 11 | Recent developments in textile auxiliaries | | | 2 |

List of Text Books/ Reference Books

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|---|---------------------------------------------------------------------------------------------------------------|
| 1 | Textile Chemicals and Auxiliaries, Speel H.C., Reinhold Processing Corporation, New York, 1952. |
| 2 | Textile Auxiliaries, Batty, J.W., Dergamon Press, Oxford, 1967. |
| 3 | Colourants and Auxiliaries: Organic Chemistry and Application Properties, Shore, J., SDC, Bradford, 1990. |
| 4 | Laundry Detergents, Smulders, E., Wiley VCH, Weinheim, 2002. |
| 5 | Chemistry and Textile Auxiliaries, Shenai V.A., Vol. 65, Sevak Publication, Bombay, 2nd edition, 2002. |
| 6 | Textile finishing, D. Heywood, ed., Society of Dyers and Colourists, Bradford, England, 2003 |
| 7 | Chemical finishing of textiles, W.D. Schindler and P.J. Hauser, Woodhead Publishing, Cambridge, England, 2004 |

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|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|-----------------|
| Course Code: TXP1015 | Course Title: PR1 Analysis of Textile Chemicals and Fibres | Credits = 2 | | |
| | | L | T | P |
| Semester: III | Total contact hours: 60 | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1. | Estimate the purity of the different acids, alkali, reducing agents, oxidizing agents used in the textile processing. (K4) | | | |
| 2. | Analyze the efficiency e.g. of Sizing chemicals, blend analysis, fibre identification by microscopic and by chemical methods. (K5) | | | |
| 3. | Describe , carry out and use yarn twist/count, Appearance, Hairiness/yarn imperfections, fabric GSM. (K2) | | | |
| 4. | Describe , interpret, examine, and determine twist in double and single yarn, strength and elongation at break. (K3) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Substrates, Introduction to Textile Wet Processing | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Testing of Textile Materials | | | | |
| Description of the relevance of this course in the B.Tech. Program | | | | |
| It will provide scientific background to students which will help them to understand relation between processing chemicals and fibre substrate. | | | | |
| Sr. No. | Course contents (topics/subtopics) | | | Reqd hrs |
| 1 | Estimation of bleaching powder and sodium chlorite | | | 2 |
| 2 | Estimation of sodium silicate and sodium carbonate | | | 2 |
| 3 | Estimation of composition of alkali mixture and barium hydroxide | | | 2 |
| 4 | Estimation of Glauber's salt and sodium chloride | | | 2 |
| 5 | Estimation of chrome alum and hardness of water | | | 2 |
| 6 | Estimation of sodium hydrosulphite and Rangolite C | | | 2 |
| 7 | Estimation of formaldehyde and oxalic acid | | | 2 |
| 8 | Estimation of sodium alginate | | | 2 |
| 9 | Estimation of acid value and Iodine value of fatty acids | | | 2 |
| 10 | Estimation of efficiency of Sizing chemicals | | | 2 |
| 11 | Estimation of Chelating agents | | | 2 |
| 12 | Estimation of bleaching powder and sodium chlorite | | | 2 |
| 13 | Identification of fibres by microscopic method | | | 2 |
| 14 | Identification of fibres by chemical methods | | | 2 |
| 15 | Identification of fibres from binary blends by chemical methods | | | 2 |
| 16 | Identification of fibres from tertiary blends by chemical methods | | | 2 |
| 17 | Quantitative analysis of blends | | | 2 |

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|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|---|
| 18 | Determination of count of yarn | 2 |
| 19 | Fibre maturity measurements | 2 |
| 20 | Fibre fineness by Cut-Weight Method | 2 |
| 21 | Measurement of maturity and fineness by airflow instrument | 2 |
| 22 | Determination of twist in double and single yarn | 2 |
| 23 | To measure Yarn Appearance, Hairiness/yarn imperfections (Zwellager) | 2 |
| 24 | To measure Yarn twist/Count | 2 |
| 25 | To determine Types of weave (Weave Diagram) | 2 |
| 26 | To measure Fabric weight (GSM) | 2 |
| 27 | To measure Fabric Count (Ends/pick, Wales/course) | 2 |
| 28 | Determination of the single yarn strength and elongation at break of the yarns | 2 |
| List of Text Books/ Reference Books | | |
| 1 | Technology of Bleaching and Mercerizing, Shenai V.A., Sevak Publication, Bombay, Vol. - 3, 3rd edition, 2003. | |
| 2 | Textile Bleaching, Steven A.B., Pitman and Sons, London. | |
| 3 | Technology of Scouring and Bleaching, Trotman E.R., Griffin, London, 1968. | |
| 4 | Technology of Bleaching and Dyeing, Chakraverty, R.R., Trivedi S.S., Vol. 1, Mahajan Publishers Private Ltd., Ahmedabad, 1979. | |
| 5 | Textile Chemistry, Peters R.H, Vol-2, Elsevier Publishing Company, London, 1967. | |
| 6 | Sizing by D.B.Ajgaonkar, M.K.Talukdar and V.R.Wadekar | |
| 7 | Mercerizing by J.T.Marsh | |
| 8 | Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar | |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|------------------|
| Course Code: TXP1022 | Course Title: PR 2 Textile wet processing lab 1 (Pretreatment, Dyeing, Printing) | Credits = 2 | | |
| | | L | T | P |
| Semester: III | Total contact hours: 60 | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Perform desizing, scouring and bleaching of cotton along with its evaluation. (K3) | | | |
| 2 | Demonstrate colouration of natural and synthetic fibres using different class of dyes. (K3) | | | |
| 3 | Achieve different printing effects by varying fibres, application methods and machinery (K4). | | | |
| 4 | Evaluate performance effect of different class of dyes on fibres (K4). | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet processing, Introduction to Textile Substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technology of Textile Pretreatment, Technology of Textile Dyeing and Technology of Textile Printing | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The practical will enable students to perform dyeing and printing on different textile substrates using various classes of dyes by different methods of application. | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The practical will enable students to perform dyeing and printing on different textile substrates using various classes of dyes by different methods of application. | | | | |
| Sr.No | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1. | Desizing cotton-acid desizing, enzyme desizing, oxidative desizing of cotton and Evaluation of desizing efficiency-staining with iodine, loss in weight and estimation of residual starch | | | 4 |
| 2. | Scouring of cotton-open boil, pressure boil, pad-steam process and Evaluation of scouring efficiency-wetting time, sinking time, loss in weight | | | 4 |
| 3. | Bleaching of Cotton by bleaching powder, hydrogen peroxide and Evaluation of bleaching efficiency -whiteness index and % reflectance | | | 4 |
| 4. | To study dyeing of cotton and Viscose with Direct and Reactive dyes | | | 4 |
| 5. | To study dyeing of cotton with Vat and Sulpher dyes | | | 4 |
| 6. | To study dyeing of cotton with azoic colors | | | 4 |
| 7. | To study dyeing of Wool and silk with Acid dyes | | | 4 |
| 8. | To study dyeing of Polyester with Disperse dyes | | | 4 |
| 9. | Direct style of printing of Direct and Reactive Dyes on cotton | | | 4 |
| 10. | Direct style of printing of Vat Dyes and cotton | | | 4 |
| 11. | Direct style printing on Wool and Silk with Acid dyes | | | 4 |
| 12. | Direct style printing on Polyester and Nylon with Disperse dyes | | | 4 |
| 13. | Discharge style of printing – white discharge under Reactive dyed ground | | | 4 |
| 14. | Resist style of printing – White resist under reactive dyed ground | | | 4 |
| 15. | Special print effect – Batik and Tie & Dye style of printing | | | 4 |
| List of Text Books/ Reference Books | | | | |
| 1. | Gile's Laboratory Course in Dyeing, D G Duff and R S Sinclair, SDC Publ. | | | |

Semester IV

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| Course Code: | Course Title: PCC Transport Phenomena | Credits = 4 | | |
| | | L | T | P |
| Semester: IV | Total contact hours: 60 | 3 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Calculate friction factor, pressure drop, power requirements of single phase flow in a circular pipe. (K3) | | | |
| 2 | Calculating flow and power required for pumps. (K3) | | | |
| 3 | Calculate heat transfer coefficients and do basicizing of double pipe and shell and tube heat exchangers. (K3) | | | |
| 4 | Calculate mass transfer coefficients and estimate mass transfer rates in simple situations. (K3) | | | |
| List of Prerequisite Courses | | | | |
| XII th Standard Physics and Mathematics | | | | |
| List of Courses where this course will be prerequisite | | | | |
| This is a basic course required in special subjects that deal with flow of fluids, heat and mass transfer, etc. | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| This basic course introduces concepts of momentum, heat and mass transfer to students. Various concepts such as pressure, momentum, energy are introduced. Laws related to conservation of momentum, energy, mass are taught. Applications of these laws to various engineering and technological situations and process equipment is explained with the help of several problems. | | | | |
| | | | | |
| Sr. No. | Course contents (topics/subtopics) | Reqd. hrs | | |
| 1. | Fluid Statics and applications to engineering importance. | 4 | | |
| 2. | Applications of Bernoulli's Equation, Pressure drop in pipes and Fittings, meters, and fluid moving machinery such as pumps. | 10 | | |
| 3. | Particle Dynamics, Flow through Fixed and Fluidised Beds | 4 | | |
| 4. | Equations of Continuity and Motion in laminar flows and its applications for simple Couette flow and Poiseuille flow applications | 6 | | |
| 5. | Heat conduction. Convective heat transfer and concept of heat transfer | 4 | | |
| 6. | Design and constructional aspects of exchangers: Types of flows: Concurrent, counter-current and cross flows, log mean temperature difference, double pipe and Shell and tube heat exchangers. Introduction to other heat exchangers like, PHE, finned tube heat exchangers, graphite block, etc. | 10 | | |
| 7. | Heat transfer aspects in agitated tanks, condensers, reboilers and evaporators. | 6 | | |

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| 8. | Fundamentals of mass transfer: Molecular diffusion in fluids, concept of mass transfer coefficients, and interface mass transfer. | 4 |
| 9. | Theories of Mass transfer, Analogies for heat and mass transfer, Empirical correlations | 4 |
| 10. | Mass transfer applications in simple 1-D situations. | 8 |
| List of Text Books/ Reference Books | | |
| 1. | Transport Phenomena, Bird R.B., Stewart W.E., Lightfoot E.N. | |
| 2. | Fluid Mechanics, Kundu Pijush K. | |
| 3. | Fluid Mechanics, F. W. White | |
| 4. | Unit Operations of Chemical Engineering, McCabe, Smith | |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|------------------|
| Course Code: TXT1301 | Course Title: SPL5 Testing of Textile Materials | Credits = 3 | | |
| | | L | T | P |
| Semester: IV | Total contact hours: 45 | 2 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Comprehend the objects of testing and its reasons and stages at which testing is to be done (K2) | | | |
| 2 | Analyze different physical testing performed on the fibres, yarn, and fabric for their mechanical, aesthetic and performance behaviour. (K3) | | | |
| 3 | Interpret and examine different fastness tests of the coloured goods (K4) | | | |
| 4 | Identify different testing standards and their importance (K3) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile Substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technology of Garment Manufacturing and Merchandising | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| This course will help students to understand and apply different analytical methods for testing textile, measurement of colour fastness and assessment of performance properties of textile. | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Sr. No. | Course contents (topics/subtopics) | | | Reqd. hrs |
| 1. | Objects of testing; Introduction to textile testing, Selection of samples for testing, Random and biased samples, Testing equipment and their use; Analysis of results, Quality, statistical analysis of results, t-test | | | 4 |
| 2. | Analytical (Advanced) equipment's and their role in Textile analysis, Identification, and testing of fibres by different methods like density, burning behavior, stain test, melting point, dissolution test etc. | | | 4 |
| 3. | Various testing standards such as BIS, AATCC, ISO along with their format for measurement and reporting of colour fastness to various agencies, standard depth of shade | | | 14 |
| 4. | Tensile testing of fibres, yarns and fabrics. Tearing, Bursting, Pilling and Abrasion resistance tests for fabrics. Bending, shear and compressional properties of fabrics. Fabric drape and handle. Crease and wrinkle behavior. Air, water and water-vapour transmission through fabrics. Thermal resistance of fabrics. Testing of interlaced and textured yarns. | | | 14 |
| 5. | Flame retardancy, antimicrobial, hydrophilic and hydrophobic testing of fabrics along with special tests for carpets. | | | 7 |
| 6. | Care labelling, Testing of lycra blended fabric material | | | 2 |

List of Text Books/ Reference Books

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|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Textile Analysis, Trotman E.R., Trotman S.R., Charles Griffin and Co., London, 1932. |
| 2. | Principles of Textile Testing : An introduction to Physical methods and Testing textile fibres, yarn and fabric, Booth J.E., Heywood Books, London, 3rd edition, 1968. |
| 3. | Microscopic and Chemical Testing of Textiles, Koch, P.H., Chapman and Hall, London, 1963 |
| 4. | Physical Properties of Textile Fibres, Morton, W.E. and Hearle, J.W.S., Textile Institute, Manchester, 2nd edition, 1975. |
| 5. | Society of Dyers and Colourists : standard methods for the determination of the colour fastness of Textiles and Leather.1980 |
| 6. | Handbook of Textile Testing and Quality Control, Grover, B. and Hemby, P.S., Wiley Eastern Ltd., New Delhi, 2nd edition, 1988. |
| 7. | Textile Testing and Analysis, Collier, B.J. and Hellen H., Upper Saddle River: Pentice Hall Inc., 1999. |
| 8. | Principles of Textile Testing, 3e (PB) India: CBS Publishers and Distributors, 1996 |
| 9. | Saville, B. P. Physical Testing of Textiles. United Kingdom: Elsevier Science, 1999 |
| 10. | Raul, J. Textile Testing. India: APH Publishing Corporation, 2005 |
| 11. | Izquierdo, V., Vermeersch, O., Dolez, P. I. Advanced Characterization and Testing of Textiles. United Kingdom: Elsevier Science, 2017 |

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| Course Code: TXT1405 | Course Title: SPL6 Garment manufacturing and merchandising | Credits = 3 | | |
| | | L | T | P |
| Semester: IV | Total contact hours: 45 | 2 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1. | Understand the concept of various stages of garment processing, (pretreatment dyeing printing finishing) its problems and remedies. (K2) | | | |
| 2. | Comprehend fundamental knowledge of the garment industry and the stages at which garments are manufactured. (K2) | | | |
| 3. | Classify different manufacturing processes and various equipment which are related to the fabric cutting, sewing, fusing, pressing technology of garment manufacturing. (K4) | | | |
| 4. | Interpret different trims and components used in the garment industry, analyze the federal classification of seams and stitches which are widely used in the garment industry. (K3) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B.Tech. | | | | |
| The course will help students to understand the applications of the textile products and the requirements of markets. | | | | |
| Sr No | Course contents (topics/subtopics) | | | Reqd Hrs |
| | Garment Manufacturing: | | | |
| 1. | The Garment Industry: Structure of the garment industry, sectors of Industry, product types and organization. Apparel industry in India, Domestic industry: size of the industry, nature, and developments in recent years. Export industry: Size and nature of the industry. | | | 3 |
| 2. | Manufacturing Technology: Types of Fabric Packages, Types of Fabrics - One Way - Two Way Fabrics - Their effect on spreading -Methods of Fabric spreading - Spreading equipments - Computerized spreaders - Marker making –Marker efficiency - Factors affecting marker efficiency - Marker duplicating methods-Computer aided marker making. | | | 3 |
| 3. | Introduction to cutting machines -Types and functions of cutting machines - straight knife, round knife, band knife, cutting machines - Notches, drills, die cutting machines - Computerized cutting machines -maintenance of cutting machines - common defects in cutting & their remedies. | | | 3 |

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| 4. | Types of needles - Parts of needles and their function - Needle size -sewing thread - properties of sewing threads - ticket number - fabric sewability. Seam quality - effect of stitch type on seam quality; Selection of seam and stitch | 3 |
| 5. | Federal classification of seam and stitches - Basic parts of sewing machine | 2 |
| 6. | Needle - Bobbin case /Bobbin hook, Loopers - Loop spreader - Threading fingers - Throat plate - Tongue chaining plates - Take-up devices. | 2 |
| 7. | Sewing Technology: feed systems, , machinery and equipment, basic sewing machines, like general sewing, over locking, safety stitching, blind stitching, button holes, bartacking, & button sewing, special sewing machines like three thread over lock with a microprocessor, Sewing. | 2 |
| 8. | Problems, slipped stitches, staggered stitches, etc. | 2 |
| 9. | Fusing Technology: Construction of Fusible, Fusing process, Fusing machinery, quality control | 2 |
| 10. | Pressing Technology: Classification, components of Pressing, machinery and equipments viz. Hand irons, dry iron, electric steam iron, under pressing, top pressing, scissors press, Carousel machines, Steam dolly, tunnel finishing, controls, handling systems, boiler room. | 2 |
| 11. | Garment Finishing and Inspections: Attaching buttons, marking, sewing labels, cleaning, final touch, fitting quality, live models, measurements, viewing the garments, quality standards. | 2 |
| 12. | Production Technology: Manual systems, making through, section system, progressive bundle system, straight line system, mechanical transport systems, selective conveyor belt system, unit production system, quick response sewing system. Ware Housing: Handling equipment, storage equipment, packing equipment. Basic Pattern Making: Measurement Taking - Size chart and Measuring of Sizes. Definition of various garments parts & positions. Methods: Bespoke method & Industrial method (Using Blocks) - Basic block construction - Block preparation & correction. Figure analysis: Body ideals, body proportion, height, weight distribution, body parts, individual figure analysis, study of body measurement of all age groups. Preparation of basic blocks, muslin pattern, commercial pattern, sizes and its understanding, fabric preparation for garment construction. CAD/CAM in Garment Manufacturing | 3 |
| Merchandising: | | |
| 13. | Sourcing of textiles materials; Inventory planning and marketing of final products; Techniques and principles of merchandising; Merchandising according to domestic and international demand, requirements and supply; Application of information technology in merchandising; Costing with respect to export and domestic market | 15 |
| List of Text Books/ Reference Books | | |
| 1 | Introduction to textile finishing by J.T. Marsh. | |
| 2 | Technology of finishing - Vol. X by Dr. V.A. Shenai. | |

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| 3 | Chemical processing of polyester/cellulosic blends by R.M. Mittal and S.S. Trivedi. |
| 4 | Silk dyeing, printing and finishing by Prof. M.L. Gulrajani. |
| 5 | Garment Finishing and Care Labelling by S.S.Satsangi, Usha Publishers,53-B/AC-IV, Shalimar Bagh, New Delhi. |
| 6 | Stain Removing Techniques by by S. S. Satsangi, Usha Publishers, 53-B/AC-IV, Shalimar Bagh, New Delhi. |
| 7 | Fabric Care by Noemia D'SOUZA, New Age International Publishers, Daryaganj, New Delhi |
| 8 | Garment Processing, Mittal, R.M. |

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| Course Code: | Course Title: EEM Chemical Process Economics | Credits=2 | | |
| | | L | T | P |
| Semester: IV | Total contact hours: 30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Calculate working capital requirement for a given project. (K3) | | | |
| 2 | Calculate cost of equipment used in a plant total project cost. (K3) | | | |
| 3 | Calculate cashflow from a given project. (K3) | | | |
| 4 | Select a site for the project from given alternatives. (K4) | | | |
| 5 | List out various milestones related to project concept to commissioning. (K2) | | | |
| List of Prerequisite Courses | | | | |
| Material and Energy Balance Calculations, Equip Design and Drawing I, Energy Engineering, Ind Eng Chem. | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Home Paper I and II | | | | |
| Description of relevance of this course in the B Tech.Program | | | | |
| This course is required for the future professional career | | | | |
| Course Contents (Topics and subtopics) | | | | |
| Sr no. | | | | Reqd. hrs |
| 1. | Introduction to the green field projects and global nature of the projects; Impact of currency fluctuations on Project justification and cash flows and Concepts of "Quality by Design" including typical design deliverables and understanding constructability, operability and maintainability during all stages of project execution. Meaning of Project Engineering, various stages of project implementation. | | | 4 |
| 2. | Relationship between price of a product and project cost and cost of production, EV Analysis. Elements of cost of production, monitoring of the same in a plant, Meaning of Administrative expenses, sales expenses etc. Introduction to various components of project cost and their estimation. Introduction to concept of Inflation, location index and their use in estimating plant and machinery cost. Various cost indices, Project financing, debt: equity ratio, promoters, contributors, shareholders | | | 5 |
| 3. | Project financing, debt: equity ratio, promoters, contributors, shareholders contribution, source of finance, time value of money. Concept of interest, time value of money, selection of various alternative equipment or system based on this concept. Indian norms, EMI calculations. Depreciation concept, Indian norms and their utility in estimate of working results of project. Working capital concept and its relevance to project. | | | 5 |
| 4. | Estimate of working results of proposed project. Capacity utilization, Gross profit, operating profit, profit before tax, Corporate tax, dividend, Net cash accruals. Project evaluation: Cumulative cash flow analysis Break-Even analysis, incremental analysis, various ratios analysis, Discounted cash flow analysis | | | 5 |
| 5. | Process Selection, Site Selection, Feasibility Report | | | 2 |

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| 6. | Project: Conception to Commissioning: milestones, Project execution as conglomeration of technical and nontechnical activities, contractual details. Contract: Meaning, contents, Types of contract. Lump- sum Turnkey (LSTK), Eng, Procurement and Construction(EPC), Eng, Procurement and Construction Management (EPCM). Mergers and Acquisitions | 5 |
| 7. | PERT, CPM, bar charts and network diagrams | 4 |
| List of Text Books/ Reference Books | | |
| 1 | Chemical Project Economics, Mahajani V.V. and Mokashi S.M. | |
| 2 | Plant Design and Economics for Chemical Engineers, Peters M.S., Timmerhaus K.D. | |
| 3 | Process Plant and Equipment Cost Estimation, Kharbanda O.P. | |

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| Course Code: TXP1023 | Course Title: PR 3 Textile wet processing lab 2 (Finishing and Testing) | | Credits = 2 | | |
| Semester: IV | | | L | T | P |
| Total contact hours:60 | | | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | | |
| 1 | Apply crosslinking, flame retarding agent and softener on cotton fabric along with its evaluation. (K4) | | | | |
| 2 | Apply water & oil repellent agents on cotton fabric along with its evaluation. (K4) | | | | |
| 3 | Apply optical brightener on cotton & polyester fabric along with its evaluation. (K4) | | | | |
| 4 | Measure tensile, tearing and bursting strength, & % elongation of cotton & polyester fabric and/ yarn. (K3) | | | | |
| List of Prerequisite Courses | | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile substrates | | | | | |
| List of Courses where this course will be prerequisite | | | | | |
| Technology of Finishing | | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | | |
| This will help students to understand the properties and applications of textile substrate used in different end-uses. | | | | | |
| Course Contents (Topics and subtopics) | | | | | |
| Sr. no. | | | | | Reqd. hours |
| 1. | Application of cross-linking agent on cotton fabric and testing of finished fabric for crease recovery angle, tensile and tear strength. | | | | 4 |
| 2. | Application of flame retarding agent on cotton fabric and testing of finished fabric by measurement of char length, rate of burning and Limiting Oxygen Index | | | | 4 |
| 3. | Application of softeners on cotton fabric and testing of finished fabric for its feel, drapability, effect on absorbency, yellowing, shade change, sewability testing, Handlometer /surface friction assessment. | | | | 4 |
| 4. | Application of water repellent/waterproof agent on cotton fabric and evaluation of fabric for water repellency by spray/shower test and water penetration test. | | | | 4 |
| 5. | Application of Optical brightening agent on cotton & Polyester fabric and evaluation of fabric for its whiteness. | | | | 4 |
| 6. | Application of stiffening agent and evaluation of fabric for its feel and bending length | | | | 4 |
| 7. | To measure the Tensile strength and % elongation of cotton & polyester yarn and fabric | | | | 4 |
| 8. | To measure the Tearing and bursting strength of cotton & polyester fabric | | | | 4 |
| 9. | To measure the % crimp of texturized yarn and fabric, , | | | | 4 |
| 10. | To measure the GSM, drapability and bending length of finished fabrics | | | | 4 |
| 11. | To measure the count and denier of the yarn | | | | 4 |

**B. Tech. in Fibres & Textile Processing Technology
Syllabus Structure B. Tech. Third Year**

Semester V

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| Course Code: | Course Title: PCC Chemical Reaction Engineering | Credits = 2 | | |
| | | L | T | P |
| Semester: V | Total contact hours: 30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Describe and discuss principles of various types of reactors. (K3) | | | |
| 2 | Calculate rates of reactions based on given reaction scheme. (K3) | | | |
| 3 | Design various components of reactors used in industrial practice. (K3) | | | |
| 4 | Compare various reactors and select an appropriate reactor for a given situation. (K4) | | | |
| 5 | Describe and discuss principles of various types of reactors. (K2) | | | |
| List of Prerequisite Courses | | | | |
| Physical Chemistry I and II, Transport Phenomena | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Environmental Engineering and Process Safety, Chemical Project Economics | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Chemical Reaction Engineering is concerned with the utilization of chemical reactions on a commercial scale. This course is very relevant but not limited to the following industries: Inorganic chemicals, organic chemicals, petroleum & petrochemicals, Pulp & paper, Pigments & paints, rubber, plastics, synthetic fibres, Foods, Dyes and intermediates, Oils, oleo chemicals, and surfactants, Minerals, clean sing agents, Polymers and textiles, Biochemicals and biotechnology, pharmaceuticals and drugs, Microelectronics, energy from conventional and non-conventional resources, Metals | | | | |
| Sr. no | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1 | Kinetics of homogeneous reactions, Interpretation of batch reactor data, Single ideal reactors including design aspects | | | 8 |
| 2 | Multiple reactions, Temperature, and pressure effects | | | 3 |
| 3 | Introduction to Non ideal flow, RTD measurements, Models to predict conversions | | | 2 |
| 4 | Homogeneous and Heterogeneous Catalysis, Kinetics of Solid Catalyzed Reactions. Design of gas – solid catalytic reactors | | | 8 |
| 5 | Introduction to Multiphase reactors | | | 4 |
| 6 | Mass transfer with chemical Reactions: Regimes of operation and Model contactors | | | 5 |
| List of Textbooks | | | | |
| 1 | Elements of Chemical Reaction Engineering – H.Scott Fogler | | | |
| List of Additional Reading Material / Reference Books | | | | |
| 1 | Heterogeneous Reactions, Vol.I and II –L.K. Doraiswamy, M.M.Sharma | | | |

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| Course Code: | Course Title: PCC Chemical Engineering Operations | Credits = 2 | | |
| | | L | T | P |
| Semester: V | Total contact hours:30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Do basic sizing of continuous and batch distillation columns (K3) | | | |
| 2 | Analyze filtration data and select systems based on requirements, estimate filtration area for given requirements, understand filter aids and their usage.(K4) | | | |
| 3 | Describe few industrial crystallization, filtration and drying equipment. (K2) | | | |
| 4 | Describe the need and importance of other separation processes like adsorption, ion exchange and membrane. (K2) | | | |
| 5 | Gain a practical perspective of unit operation in chemical industries. (K3) | | | |
| List of Prerequisite Courses | | | | |
| Process Calculations, Transport Phenomena | | | | |
| List of Courses where this course will be prerequisite | | | | |
| This is a basic course. It is required in many other courses that involve physical processes | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| This is a basic Chem Engg. course. The principles learnt in this course are required in almost all the courses and throughout the professional career of student | | | | |
| Sr no. | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1 | Distillation: Fundamentals of flash, batch and continuous distillation, distillation columns internals, steam and azeotropic distillation | | | 10 |
| 2 | Liquid-Liquid Extraction: Solvent selection, construction of ternary diagrams, staged calculations, types of extraction equipment. | | | 5 |
| 3 | Crystallisation: Phase diagram (temp/solubility relationship), evaporative and cooling crystallization, introduction to different types of crystallizers | | | 5 |
| 4 | Filtration: Mechanism of filtration, basic equation, constant volume, constant pressure filtration, rate expressions with cake and filter cloth resistances, compressible and incompressible cakes, introduction to various types of filters | | | 5 |
| 5 | Drying: Drying mechanism, drying rate curves, estimation of drying time and types of dryers | | | 5 |
| List of Text Books/ Reference Books | | | | |
| 1 | Richardson, J.F., Coulson, J.M., Harker, J.H., Backhurst, J.R., 2002. Chemical engineering: Particle technology and separation processes. Butterworth-Heinemann, Woburn, MA. | | | |
| 2 | Seader, J.D., Henley, E.J., 2005. Separation Process Principles, 2 ed. Wiley, Hoboken, N.J. | | | |
| 3 | Svarovsky, L., 2000. Solid-Liquid Separation. Butterworth-Heinemann, Woburn, MA. | | | |
| 4 | McCabe, W., Smith, J., Harriott, P., 2004. Unit Operations of Chemical Engineering, 7 ed. McGraw-Hill Science/Engineering/Math, Boston. | | | |
| 5 | Green, D., Perry, R., 2007. Perry's Chemical Engineers' Handbook, Eighth Edition, 8 ed. McGraw-Hill Professional, Edinburgh. | | | |
| 6 | Dutta, B.K., 2007. Principles of Mass Transfer and Separation Process. Prentice-Hall of India Pvt. Ltd, New Delhi. | | | |

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| Course Code: TXT1201 | Course Title: SPL7 Technology of Textile Pretreatment | Credits = 4 | | |
| Semester: V | Total contact hours: 60 | L | T | P |
| | | 3 | 1 | 0 |
| Course Outcomes (students will be able to..) | | | | |
| 1 | Comprehend the need for singeing of loom state fabric and use of latest technologies for open width woven and knit fabrics. (K2) | | | |
| 2 | Explain the need for sizing of yarns and desizing of fabric; sizing chemicals and different desizing methods. (K2) | | | |
| 3 | Elaborate the different scouring and bleaching recipes for natural and synthetics textiles and their blends (K3) | | | |
| 4 | Illustrate methods for the pretreatments of wool and silk (K3) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile Substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technology of Textile Dyeing, Technology of Textile Printing and Technology of Finishing | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Being the initial stage of wet processing, the knowledge of pretreatment is significant to understand further processing stages such as dyeing, printing and finishing. | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Being the initial stage of wet processing, the knowledge of pretreatment is significant to understand further processing stages such as dyeing, printing and finishing. | | | | |
| Sr No. | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1. | Basic operations in textile wet processing – overall sequence, an overview of textile types and chemicals used | | | 4 |
| 2. | Purpose of yarn Sizing and chemicals used for sizing of different types of textile substrates | | | 8 |
| 3. | Shearing and Cropping; Singeing – plate, roller, gas singeing, latest technologies in singeing | | | 5 |
| 4. | Desizing of cotton; different methods – hydrolytic and oxidative, types of enzymes used and determination of desizing efficiency, machinery used. | | | 8 |
| 5. | Techniques of demineralization, machinery used for discontinuous and continuous operations. | | | 5 |
| 6. | Scouring and bleaching of different forms of textiles, material and energy balance, reduction in liquor ratios and savings in water and energy. Batch, semi and continuous processing, Enzymatic (Bio)scouring, determination of scouring and bleaching efficiency. | | | 8 |
| 7. | Mercerization, material and energy balance; caustic recovery, its importance and efficiency, Ammonia mercerization, its significance and benefits, machinery for mercerization, Mercerization of Knits, mercerisation efficiency determination | | | 6 |
| 8. | Silk degumming and bleaching, Scouring and bleaching of wool; Bioscouring, Carbonization of wool, Scouring and bleaching of synthetics and their blends with natural fibres | | | 8 |

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| 9. | Application of optical brightening agents in bleaching of natural and synthetic fabrics and determination of whiteness index | 4 |
| 10. | Washing principles and methods used different types of continuous washers for textiles. Environmental load of conventional pre-treatment | 4 |
| List of Text Books/ Reference Books | | |
| 1 | Textile Bleaching, Steven A.B., Pitman and Sons, London, 1947 | |
| 2 | Mercerizing by J.T.Marsh; 1951 | |
| 3 | Textile Chemistry, Peters R.H, Vol-2, Elsevier Publishing Company, London, 1967. | |
| 4 | Technology of Scouring and Bleaching, Trotman E.R., Griffin, London, 1968. | |
| 5 | Sizing by D.B.Ajgaonkar, M.K.Talukdar and V.R.Wadekar; December 1969 | |
| 6 | Technology of Bleaching and Dyeing, Chakraverty, R.R., Trivedi S.S., Vol. 1, Mahajan Publishers Private Ltd., Ahmedabad, 1979. | |
| 7 | Chemical Technology in the Pre-treatment Processes of Textiles by S.R.Karmakar, 1999 | |
| 8 | Technology of Bleaching and Mercerizing, Shenai V.A., Sevak Publication, Bombay, Vol.3, 3rd edition, 2003. | |

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| Course Code: TXT1210 | Course Title: SPL8 Technology of Textile Dyeing | Credits = 4 | | |
| | | L | T | P |
| Semester: V | Total contact hours: 60 | 3 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1. | Understand the importance of various textile processing parameters for quality dyeing. (K1) | | | |
| 2. | Explain the developments in dyes, machinery, and processes in tune with the constantly changing industry requirements. (K2) | | | |
| 3. | Analyze the dyeing quality, type, and form of the substrate, and suggest corrective measures. (K4) | | | |
| 4. | Design the process for dyeing of novel fibres and blends based on their physicochemical characteristics. (K4) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile Substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technology of Textile printing, Experimental dyeing lab | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Students will understand the importance and relevance of textile coloration, the problems and remedies to solve them, the developments in machinery with respect to the growth of industry, the quality of dyed textiles and the environmental relevance of dyeing processes | | | | |
| Sr.No. | | | | |
| Course contents (topics/subtopics) | | | | Reqd. hrs |
| 1 | Physical and chemical characteristics of textile fibres in relation to dyeing, Pretreatments of textiles and quality of water in relation to dyeing | | | 4 |
| 2 | Parameters of quality dyeing, machines used and terms used; Classification of dyes based on application, Performance characteristics of dyed textiles | | | 2 |
| 3 | Earlier developments in processes and machinery for dyeing of textiles in various forms such as fibres, yarns, woven and knitted fabric | | | 4 |
| 4 | Dyeing of cellulosic fibres with Direct, Azoic, Vat, Solubilized Vat, Sulphur, Oxidation colours and OBA's | | | 8 |
| 5 | Dyeing of polyamide fibres with Acid, Mordant and Metal Complex dyes | | | 4 |
| 6 | Dyeing of Acrylic with Basic and modified cationic dyes | | | 2 |
| 7 | Dyeing of Indigo and Natural dyes | | | 2 |
| 8 | Dyeing of Polyester with Disperse dyes | | | 6 |
| 9 | Dyeing of Cellulosics with Reactive dyes | | | 4 |
| 10 | Dyeing of blends, Dyeing of union fabrics; Dyeing of micro fibre fabrics | | | 2 |

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| 11 | Batch, semi-continuous and continuous type dyeing machinery for all forms of | 6 |
| 12 | Dosing systems for dyeing, automatic colour and chemical dispensing systems, automated inventory management systems for dyes and chemicals | 3 |
| 13 | Right First-Time approach, Faults in dyed materials and their correction. | 4 |
| 14 | Machinery used for washing and soaping of dyed materials, Recent developments in machinery and dyeing techniques | 4 |
| 15 | Concept of conservation of chemicals and water in dyeing | 3 |

List of Text Books/ Reference Books

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|----|---------------------------------------------------------------------------------------------------------------------|
| 1 | The Theory and Practice of Wool Dyeing, Bird, C.L., SDC Publ., Bradford, 1972 |
| 2 | Chemical Processing of Synthetic Fibres and Blends by K V Datye and A A Vaidya, John Wiley and Sons, New York, 1984 |
| 3 | Wool Dyeing by D M Lewis, SDC Publication, 1992 |
| 4 | Batchwise Dyeing of Woven Cellulose Fabric by John Shore, SDC Publ., 1993 |
| 5 | Colour for Textiles-User's Handbook, W. Ingamells, SDC Publ., 1993 |
| 6 | Technology of Dyeing, Shenai V.A., Vol. 6, Sevak Publication, Bombay, 1994. |
| 7 | Cellulosic Dyeing by John Shore, SDC Publ., 1995 |
| 8 | Blends Dyeing by John Shore, 1998 |
| 9 | Handbook of Synthetic Dyes and Pigments, K.M.Shah, Multitech Publishing, 1998. |
| 10 | Reactive Dyes for Textile Fibres, A. Hunter and M. Renfrew, SDC Publ., 1999. |
| 11 | Basic Principles of Textile Coloration by A D Broadbent, SDC Publ., 2001 |
| 12 | Synthetic Fibre Dyeing by C Hawkyard, SDC Publ., 2004 |

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| Course Code: TXT1701 | Course Title: PCC Honors Course-I Chemistry of Colorants | Credits = 4 | | |
| | | L | T | P |
| Semester: V | Total contact hours: 60 | 3 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1. | Understand fundamental knowledge of the basics of chemistry involved in the colorants. (K2) | | | |
| 2. | Compare the physical properties of pigments and dyes to differentiate them (K4) | | | |
| 3. | Illustrate synthetic methods used for azo dyes and their properties. (K3) | | | |
| 4. | Classify types of dyes based on application, properties, and functional groups. (K4) | | | |
| List of Prerequisite Courses | | | | |
| HSC (Science), Organic Chemistry | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technology of Textile Dyeing | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| Students will understand the chemistry behind the colorants. They will be able to explain its applications in various fields according to the chemistry involved. | | | | |
| Course Contents (Topics and subtopics) | | | | |
| Sr. No. | | | | Reqd. hrs |
| 1 | Introduction of Pigments, Colour Index Generic Names of Pigments, Colour Constitution Number, Polymorphism, Properties required in a pigment and extender, Pigment dispersion basics Classification of inorganic and organic pigments with examples, additive and subtractive colour mixing. Definitions of pigment, | | | 5 |
| 2 | Theory of color formation in organic compounds, effect of auxiliary groups on the shade and hue of the pigment (Bathochromic and hyper chromic shift) Practices and requirement of Pigments | | | 5 |
| 3 | Inorganic pigments such as titanium dioxide, zinc oxide, carbon black, chromate pigments, molybdate orange, chrome green. General methods of processing and synthesis of inorganic pigments: Crushing and grinding, vaporization, co precipitation, filtration, drying, flushing, calcinations/roasting, vapour phase oxidation etc. Raw materials for organic pigments: A brief study of coal tar distillation and the role of distillation products in the manufacture of synthetic dyes: bases and precipitants used in the colour striking, toners and lake formation. | | | 5 |
| 4 | Ultramarine blue, iron blue, cadmium red, pearlescent and other effect pigments Ceramic pigments, metal flake pigments, extenders | | | 5 |
| 5 | Organic pigments such as Antraquinone, Benzimidazolonedioxazines, Diazo lakes | | | 3 |

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| 6 | Litholrubones, Monoazo lakes, Napthol AS lakes, Napthol AS, Perylenes, Phthalocyanines, Quinacridones effect pigments | 5 |
| 7 | Pigments for Plastics, Textiles, Paints, Resins, Printing Ink, Cosmetics, Rubbers, Special Application fields. | 3 |
| 8 | Spectral properties of colorants, Jablonski diagram, classification of dyes according to application/constitution, empirical treatment of colour and constitution | 5 |
| 9 | Azo dyes: Diazotisation and coupling reactions, azoic colours, acid dyes, mono azo dye; diasazo, nitro, diphenylamine and anthraquinone dyes; acid mordant dyes, azo metal complex dyes, direct dyes | 5 |
| 10 | Basic dyes: Diphenylmethane and triphenylmethane dyes and heterocyclic analogues thereof, triphenodioxazine dyes. | 3 |
| 11 | Vat dyes: Indigoid, anthraquinonoid and polycyclic quinonoid dyes; solubilised vat dyes. Sulphur dyes and sulphurised vat dyes | 5 |
| 12 | Reactive dyes: Chlorotriazine and other halo heterocyclic compounds, vinyl sulphone based dyes, high fixation, highly substantive, neutral fixing bifunctional reactive dyes. | 5 |
| 13 | Disperse dyes: azo, anthraquinone, dinitrophenylamine, methine dyes; properties in relation to constitution | 6 |

List of Text Books/ Reference Books

| | |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Color Chemistry, 3rd Edition, Heinrich Zollinger, Wiley – VCH 2003 |
| 2 | Colorants and Auxiliaries: Colorants v. 1: Organic Chemistry and Application Properties, John Shore, Society of Dyers & Colourists; 2nd edition edition (Jan. 2002) |
| 3 | The Chemistry of Synthetic dyes, K. Venkataraman, Academic Press (1 January 1971) |
| 4 | Industrial Inorganic Pigments, Gunter Buxbaum, Wiley-VCH; 1 edition (March 11, 2005) |
| 5 | Industrial Organic Pigments: Production, Properties, Applications, 3 rd , Completely Revised Edition by Herbst, Klaus HungerWilly March 2006 |
| 6 | Application Properties of Pigments By A.Karnik, First Edition Thane1999 |

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| Course Code: TXP1002 | Course Title: PR4 Pretreatment Lab | Credits = 2 | | |
| | | L | T | P |
| Semester: V | Total contact hours: 60 | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Carry out desizing, scouring and bleaching of cotton by different methods and its evaluation by suitable methods (K3) | | | |
| 2 | Prepare textile material by scouring and bleaching of cellulose, degumming and bleaching of Silk (K3) | | | |
| 3 | Perform mercerisation of cotton and measurement of its efficiency by shrinkage, Barium Activity Number (BAN), dye uptake, strength (K4) | | | |
| 4 | Apply semi-continuous and continuous process process in pretreatment of textiles. (K5) | | | |
| List of Prerequisite Courses | | | | |
| Technology of Textile Pretreatment | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Testing of Textile Materials | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Being initial stage of wet processing the knowledge on pre-treatment is important to understand further processing and testing | | | | |
| Sr No | Course Contents (Topics and subtopics) | | | Reqd. Hrs |
| 1 | Stain removal by spotting, chemicals used and methods of stain removing. | | | 4 |
| 2 | Methods of Desizing of cotton woven fabric – acidic, enzymatic, and oxidative, qualitative and quantitative evaluation of desizing efficiency- TEGEWA scale staining, loss in weight, water absorbency. | | | 4 |
| 3 | Scouring of cotton-open boil, pressure boil; Scouring of knitted cotton fabric – conventional and bio-scouring; Evaluation of scouring efficiency-Drave’s test, sinking time, wicking property, loss in weight, core alkali determination – boil fabric and check pH, phenolphthalein. | | | 8 |
| 4 | Bleaching of cotton with oxidative and reductive bleaching agent, Scouring and bleaching of polyester/cotton blends. | | | 4 |
| 5 | Scouring and bleaching of wool, Degumming and Bleaching of Silk | | | 4 |
| 6 | Drumming and weight reduction of polyester fabric, Bleaching of polyester with hydrogen peroxide and nylon with sodium chlorite. | | | 4 |
| 7 | Evaluation of bleaching efficiency – whiteness index and bleach clean-up (peroxide killer – enzymatic and reducing agent). | | | 8 |

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| 8 | Mercerisation of cotton with and without tension, Evaluation of mercerization – Shrinkage, Barium Activity no., dye uptake, strength and elongation; microscopic observation. | 4 |
| 9 | Assessment of cotton for degradation by Methylene Blue Absorption. | 4 |
| 10 | Application of OBA/FBA on natural and synthetic fabrics and evaluation of fabric for whiteness index – exhaust and pad application | 4 |
| 11 | Pre-treatment by semi-continuous process – combined desizing, scouring, bleaching; Pre-treatment by continuous process – separate and combined scouring, bleaching | 8 |
| 12 | To study effect of heat setting on dye uptake, dimensional stability and strength | 4 |

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| Course Code: TXP1004 | Course Title: PR5 Experimental Dyeing Lab | Credits = 2 | | |
| | | L | T | P |
| Semester: V | Total contact hours: 60 | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1. | Analyze the effect of various parameters on the dyeing and printing textiles with different dyes classes (K4). | | | |
| 2. | Demonstrate colouration of natural and synthetic fibres using different classes of dyes (K3). | | | |
| 3. | Carry out different printing effects by varying fibres and application methods (K4). | | | |
| 4. | Evaluate the performance effect of the different classes of dyes on fibres (K4). | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Theory of Dyeing, Technology of Textile Dyeing, Technology of Textile Printing | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The practical will enable students to perform dyeing and printing on different textile substrates using various classes of dyes by different application methods. | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The practical will enable students to perform dyeing and printing on different textile substrates using various classes of dyes by different application methods. | | | | |
| Sr.No | Course contents (topics/subtopics) | | | Reqd Hrs |
| 1 | To study the effect of liquor ratio, percentage shade, and salt concentration on exhaust dyeing of direct dyes on cotton yarn | | | 4 |
| 2 | To study dyeing of different types of reactive dyes (exhaust-HE, HBF) on cotton knit fabric, viscose, jute and linen woven fabric | | | 8 |
| 3 | To study dyeing and after treatments of sulphur black dye on cotton yarn | | | 4 |
| 4 | To study the dyeing of vat dyes on cotton yarn by vatting and pigmentation methods | | | 4 |
| 5 | To study dyeing of azoic colors on cotton fabric by tie and dye method | | | 4 |
| 6 | To study dyeing of acid dyes (Levelling and 1:2 metal complex) on wool and silk | | | 8 |
| 7 | To study dyeing of polyesters and Nylon using disperse dyes by HTHP and carrier method | | | 4 |
| 8 | To study dyeing of Nylon with acid, reactive and direct dyes | | | 4 |
| 9 | To study dyeing of acrylic fabric with modified cationic dyes | | | 4 |
| 10 | Dyeing of cotton fabric with reactive dyes by Cold-pad-batch and vat dye by pad-jig method | | | 4 |
| 11 | Dyeing of Polyester/cotton fabric with disperse + vat dyes and disperse +reactive dyes by Pad-dry-thermosol -pad-steam method | | | 8 |
| 12 | Dyeing of Polyester/cotton fabric with vat dyes by Pad-dry-cure method | | | 4 |

List of Text Books/ Reference Books

Gile's Laboratory Course in Dyeing, D G Duff and R S Sinclair, SDC Publ.

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| Course Code: TXT1106 | Course Title: SPL9 Technology of Fibres and Polymers | Credits = 3 | | |
| | | L | T | P |
| Semester: VI | Total contact hours: 45 | 2 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Understand fibre forming properties with different textile terms as well as their classification (K2). | | | |
| 2 | Acquire deeper understanding and insights in basic chemistry, production processes and physical and chemical properties of Natural and Synthetic fibers. (K2). | | | |
| 3 | Understand different areas of applications of these fibres vis a vis their properties. (K2). | | | |
| 4 | Comprehend fundamental knowledge of polymers, their classifications, as well as techniques and mechanism of polymerization. (K2) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nonwoven and High-Tech Industrial Fibres, Technical textile | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Students will have better understanding of different natural and synthetic fibres, their properties as well as important concept of polymer chemistry which will help in manufacturing as well as designing processing parameters. | | | | |
| Sr. No. | | | | |
| Course Contents (Topics and subtopics) | | | | |
| Reqd. hrs | | | | |
| 1 | Introduction to textile fibre as polymer, Fibre forming characteristics of polymers, Definition of various basic textile terms, Introduction to Fibre, Yarn, Fabric, Classification of fibres based on sources of origin and on chemical constitution. | | | 5 |
| 2 | Natural fibres of plant, animal and mineral origin, chemistry, morphology, physical and chemical properties, structure property relationship with application, commercially important fibres like cotton, jute, linen, bamboo, wool, silk etc., Fibre to fabric conversion steps. | | | 10 |
| 3 | Semi-synthetic fibres such as viscose rayon, cuprammonium rayon, acetate rayon, bamboo rayon and lyocell with respect to chemistry, manufacturing process, morphology, physical and chemical properties and structure property relationship with applications. | | | 6 |
| 4 | Synthetic fibres such as polyester and its variants, polyamides, acrylic, polypropylene, etc with respect to their raw materials, synthesis, manufacturing processes including LOY, FOY, POY, FDY, draw ratio, physical and chemical properties and applications. | | | 10 |

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| 5 | General polymer chemistry; Classification of polymers, synthesis and mechanism, Techniques of polymerization. | 5 |
| 6 | Types of polymeric Molecular weight and its determination. | 4 |
| 7 | Microstructure of polymers, Fibre modification through texturization, TiO ₂ and chemical modification (using co monomer, other monomers and grafting), Brief idea about polymer composites; Polymer waste and techniques of utilization | 5 |
| List of Text Books/ Reference Books | | |
| 1. | Textile Fibres, Shenai V.A., Vol-1, Sevak Publications, Bombay, 3rd edition, 1991. | |
| 2. | Joseph's Introductory Textile Science, Joseph, M.L., Hudson P.B., Clapp A. C., Fortworth: Harcourt Brace Jovanovich College Publication, 6th edition, 1993. | |
| 3. | Microscopy of Textile Fibres, Greaves, P.H., Saville B.P.Oxford : BIOS Scientific Publishers Ltd., 1995. | |
| 4. | Modern Textile Characterization Methods, Raheel, M. Marcel Dekker Inc., New York, 1996. | |
| 5. | Handbook of Fibre Chemistry, Lewin Menachem, Eli M. Pearce, Marcel Dekker Inc., New York, 2nd edition, 1998. | |
| 6. | Mishra, S. P. A Text Book of Fibre Science and Technology. India: New Age International, 2000 | |
| 7. | Ghosh, P. . Fibre Science and Technology. United States: McGraw Hill Education (India) Private Limited, 2004 | |
| 8. | Kothari, V. Manufactured Fibre Technology. Netherlands: Springer Netherland, 2012 | |
| 9. | Natural Polymer man-made Fibres, Carrol and Porczynski C.Z., National Trade Press Ltd., London,1965 | |
| 10. | Visco-Elastic Properties of Polymers, Ferry, J.D., John Wiley and Sons, New York, 3 rd edition, 1980 | |
| 11. | Textbook of Polymer Science, Billmeyer F.W., John Wiley and Sons, New York, 3rd edition, 1984. | |
| 12. | Polymer Science, V R Gowarikar, New Age international (P) Ltd Publications, New Delhi,1986 | |

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| Course Code: TXT1101 | Course Title: SPL10 Manufacturing of Yarn and Fabric | Credits = 3 | | |
| Semester: VI | Total contact hours: 45 | L | T | P |
| | | 2 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Understand different spinning processes and the types of yarns made thereof, fabric manufacture via different routes and their properties (K2) | | | |
| 2 | Calculate yarn and fabric production related numerical. (K3) | | | |
| 3 | Analyze designs of various type of fabrics and different types of defects in fabric. (K4) | | | |
| 4 | Differentiate types of textile substrates and the fabric structures (K4) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nonwoven and High-Tech Fibres, Technical textile | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| This course will help students understand structure of fibres based on which choice material and method for processing can be determined. | | | | |
| Sr No | | | | |
| Course Contents (Topics and subtopics) | | | | |
| Reqd. hrs | | | | |
| 1 | Introduction of spinning, Primary properties of textile fibres, Physical properties of Cotton, Silk, Wool. Fineness measurement of Filament and Yarn. Process comparison of staple spinning and filament spinning. | | | 5 |
| 2 | Cotton spinning system – Ring spinning process | | | 4 |
| 3 | Wool spinning – difference between worsted and common spinning | | | 4 |
| 4 | Testing of yarn, Factors affecting spinning, Types of yarn, Basic defects of yarn, spin-finish chemicals and its usefulness | | | 5 |
| 5 | Introduction to Fabric formation, types of fabric - weaving, knitting, non-woven. | | | 3 |
| 6 | Weaving – steps, details of shuttle loom process, modification of primary motions, Including towel, carpet, tapes and ribbons, blanket | | | 6 |
| 7 | Knitting – Types of knitting, process and machine overview | | | 3 |
| 8 | Non-woven - Types of non-woven, process and machine overview | | | 3 |
| 9 | Fabric design – basic structures, Testing of fabric – basic parameters, cover factor, Basic defects of fabric | | | 6 |
| 10 | Different type of yarn and fabric. Yarn - Slub, core spun, hollow, loop, chenille, etc, Fabric - Poplin, cambric, fleece, etc, Developments – Electrospinning, 3D fabric | | | 3 |

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| 11 | Numerical – Fineness, Moisture percentage, Motion transfer in gears and rollers, Drafting and doubling, Twist, Fabric production, Cover factor, statistical analysis | 3 |
| List of Text Books/ Reference Books | | |
| 1 | Handbook of Textile Fibres - 1st Edition – Elsevier J Gordon Cook, 6th edition, 1983. | |
| 2 | Manual of Textile Technology, Klein, W., The Textile Institute, Manchester, Vol. 1-6, 1987. | |
| 3 | Spun Yarn Technology, Eric Oxtoby, Butterworth-Heinemann, 2013 | |
| 4 | The Practical Spinner's Guide – Wool, Kate Larson, 2015 | |
| 5 | Advances in Yarn Spinning Technology, C A Lawrence, Elsevier Science - 2010 | |
| 6 | Fancy Yarns: Their Manufacture and Application, R H Gong, R M Wright, Elsevier, 2002 | |
| 7 | Weaving: Machines, mechanisms, management, Talukdar, M.K., Sriramulu P.K., Ajgaonkar D.B. Mahajan Publishers Private Ltd., Ahmedabad, 1998 | |
| 8 | Weaving- Conversion of Yarn to Fabric, Peter R. Lord, M H Mohamed, Elsevier, 2014 | |
| 9 | Watson's Textile Design and Colour, Z Grosicki, Elsevier, 2014 | |
| 10 | Knitting Technology, D. Spenser, Elsevier, 2014 | |
| 11 | Knitting technology, D. B. Ajgaonkar, Universal Pub, 1998 | |
| 12 | Nonwovens - Process, Structure, Properties and Applications; T Karthik, 2017 | |
| 13 | A Practical Guide to Textile Testing, Amutha K., Woodhead Publishing India, 2016. | |
| 14 | Statistics for Textile Engineers, J. R. Nagla, Woodhead Publishing, 2015 | |

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| Course Code: TXT1212 | Course Title: SPL11 Technology of Textile Printing | Credits = 4 | | |
| | | L | T | P |
| Semester: VI | Total contact hours: 60 | 3 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Describe and use different types of printing methods and styles, fixation conditions, after treatments used for printing. (K3) | | | |
| 2 | Identify and evaluate thickening agents, chemicals and dyestuffs for printing; Formulation and rheological properties of printing pastes(K4) | | | |
| 3 | Evaluate quality of printed goods and suggest remedial actions to overcome faults in printing (K4) | | | |
| 4 | Comprehend and apply the recent developments in machinery techniques and special printing techniques. (K3) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile Substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Printing Lab | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The course will make student to understand printing as one of the most versatile method of colouration of textiles and its significance in value addition of textiles. | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Sr. No. | Course contents (topics/subtopics) | | | Reqd. hrs. |
| 1 | Introduction to various colouration techniques, Stages in the printing of textiles, History of textile printing. | | | 6 |
| 2 | Preparation of print paste, functions of various ingredients of print paste, Various Natural, modified and synthetic thickeners, classification of thickeners, Preparation of stock thickening, Selection of thickening agents based on dye class, style and method, Rheology of printing pastes | | | 8 |
| 3 | Three Basic styles of printing and various special styles of printing | | | 8 |
| 4 | Methods of Printing, Block, stencil, Screen; hand screen, flatbed, rotary, Roller, Transfer and digital printing, Defects, and remedial actions in various methods of printing, Machines used for printing, Brief idea about the preparation of the block, stencil, flat and rotary screens, rollers for printing. | | | 10 |
| 5 | Various methods of fixation, Selection of fixation method, Machines for fixation and its working; various after treatment of printed materials. | | | 8 |

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| 6 | Printing of Cellulosics, polyamides, polyester and acrylic with different dyes. Printing of blended fibre/fabrics Special printing techniques; Printing of velvet, carpets and knits | 12 |
| 7 | Evaluation of printed fabrics, Ecological aspects in printing of textiles; Recent developments in printing machinery and techniques. | 6 |
| List of Text Books/ Reference Books | | |
| 1 | Dyeing and Printing, Cockett S.R., Hilton K.A., Leonard Hill Books Ltd., London, 1961. | |
| 2 | Introduction to Textile Printing, W. Clarke, Newness Butterworths, London, 4th edition, 1977. | |
| 3 | Guide to Printing Techniques, Naoharu Oyabu, Mahajan Brothers Publish Ltd. Ahmedabad, 1978. | |
| 4 | Technology of Printing, V. A. Shenai, Sevak Publications, Bombay, Vol. 4, 1990. | |
| 5 | Textile Printing by L. W. C. Miles, revised second edition published by SDC, 2003 | |
| 6 | Design and Printing Textiles by June Fish, 2005 | |
| 7 | Digital Printing of Textiles by H. Ujiye, Woodhead Publishing Series in Textiles, 2006 | |
| 8 | Dyeing and Screen-Printing on Textiles by Joanna-Kinnersly Taylor, Revised and Updated, 2012. | |

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| Course Code: TXT1213 | Course Title: PCC Honors Course-II Theory of Dyeing | Credits = 4 | | |
| Semester: VI | Total contact hours: 60 | L 3 | T 1 | P 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1. | Explain the developments in dyes, machinery and processes in tune with constantly changing requirements of the industry. (K2) | | | |
| 2. | Estimate the correct process to be carried out based on type and form of the substrate. (K4) | | | |
| 3. | Analyse the quality of dyeing and suggest corrective measures. (K4) | | | |
| 4. | Design the process for dyeing of novel fibres and blends based on its physico-chemical characteristics. (K4) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile Substrates | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technology of Textile Printing, Technology of Finishing | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Student will understand the importance and relevance of textile coloration, the problems and remedies to solve them, the developments in machinery with respect to growth of industry, the quality of dyed textiles and environmental relevance of dyeing processes | | | | |
| Sr. no. | Course contents (topics/subtopics) | | | Reqd hrs |
| 1. | Perception of colour, Major characteristics of dyes and pigments, Classification of colouring matters according to their application to the textile fibres, Colour Index, Nomenclature of commercial dyes, Molecular structures of dyes, Dye standardisation, Dye Selection, Fastness properties, standard depth concept, evaluation of fastness properties of dyed materials and their acceptability limits, Important properties of dyestuffs and their evaluation, Mechanism of dyeing, Dye fibre interactions | | | 10 |
| 2. | Common terms used in textile wet processing; substantivity and affinity, % shade, % exhaustion, % expression, MLR, standing bath, cross dyeing, reserve dyeing, tailing effect, stripping etc., Dyeing assistants, mechanism for exhausting agents, levelling agents. | | | 4 |
| 3. | Thermodynamics of dyeing process; Kinetics of dyeing; Affinity of dyes towards the fibres; Adsorption isotherms; Equilibrium adsorption and factors influencing the same; Saturation value; Diffusion coefficient; Glass transition temperature and its effect on dyeability; Electro-kinetic properties of dye-fibre systems. | | | 10 |
| 4. | Compatibility of dyes in mixtures; Dyeing of fibre blends and shade matching. Novel dyeing techniques, Theories behind different techniques such as, Rapid dyeing concept solvent dyeing, mass colouration, heat transfer coloration, etc. | | | 8 |

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| 5. | Dyeing of cellulosic fibres with Direct, Reactive, Azoic, Vat, Solubilized Vat, Sulphur, Oxidation colours and OBA's | 8 |
| 6. | Dyeing of polyamide fibres with Acid, Mordant and Metal Complex dyes, Acrylic with Basic and modified cationic dyes, Indigo and Natural dyes, Polyester with Disperse dyes | 8 |
| 7. | Dyeing of blends, Dyeing of union fabrics; Dyeing of micro fibre fabrics | 2 |
| 8. | Batch, semi-continuous and continuous type dyeing machinery for all forms of textiles. Dosing systems for dyeing, automatic colour and chemical dispensing systems, automated inventory management systems for dyes and | 8 |
| 9. | Right First-Time approach, Faults in dyed materials and their correction, Concept of conservation of chemicals and water in dyeing | 2 |

List of Text Books/ Reference Books

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|----|---------------------------------------------------------------------------------------------------------------------|
| 1 | The Theory and Practice of Wool Dyeing, Bird, C.L., SDC Publ., Bradford, 1972 |
| 2 | Chemical Processing of Synthetic Fibres and Blends by K V Datye and A A Vaidya, John Wiley and Sons, New York, 1984 |
| 3 | Wool Dyeing by D M Lewis, SDC Publication, 1992 |
| 4 | Batchwise Dyeing of Woven Cellulose Fabric by John Shore, SDC Publ., 1993 |
| 5 | Colour for Textiles-User's Handbook, W. Ingamells, SDC Publ., 1993 |
| 6 | Technology of Dyeing, Shenai V.A., Vol. 6, Sevak Publication, Bombay, 1994. |
| 7 | Cellulosic Dyeing by John Shore, SDC Publ., 1995 |
| 8 | Blends Dyeing by John Shore, 1998 |
| 9 | Handbook of Synthetic Dyes and Pigments, K.M.Shah, Multitech Publishing, 1998. |
| 10 | Reactive Dyes for Textile Fibres, A. Hunter and M. Renfrew, SDC Publ., 1999. |
| 11 | Basic Principles of Textile Coloration by A D Broadbent, SDC Publ., 2001 |
| 12 | Synthetic Fibre Dyeing by C Hawkyard, SDC Publ., 2004 |

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|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------|-----------------|
| Course Code: TXT1211 | Course Title: SPL12 Technology of Textile Finishing | Credits = 4 | | |
| | | L | T | P |
| Semester: VI | Total contact hours: 60 | 3 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Explain different methods and machineries available for application of finish and calculate finish add on onto fabric. (K2) | | | |
| 2 | Describe different types of softeners, fastness improving agents, antimicrobial, antistatic, flame retardant, their chemistry, application on fabric and evaluation tests. (K2) | | | |
| 3 | Determine use of appropriate machine and process parameters for finishing. (K3) | | | |
| 4 | Compare and choose various mechanical and thermal process control systems to enhance efficiency of drying and heat setting. (K4) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile substrates, Textile Pretreatment, Technology of Textile Dyeing , Technology of Textile Printing | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Testing of Textile materials | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| This course will help students understand effect of various mechanical and chemical finishes in terms of imparting desired functionality to meet the end use application. | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| This course will help students understand effect of various mechanical and chemical finishes in terms of imparting desired functionality to meet the end use application. | | | | |
| Sr. no | Course contents (topics/subtopics) | | | Reqd hrs |
| 1 | Objective of textile Finishing and type of finishing techniques. | | | 2 |
| 2 | Mechanical finishes like Calendaring, raising, sueding, crabbing, potting, compacting, sanforising, pressing, etc and machinery involved. | | | 8 |
| 3 | Heat setting of synthetic fabrics; Machinery used, and principle involved. | | | 4 |
| 4 | Drying equipment; stenters, vertical drying ranges, curing ranges. Process control systems to enhance efficiency of drying. | | | 4 |
| 5 | Evaluation and durability of mechanical finishes | | | 2 |
| 6 | Chemical finishing – conventional softeners, stiffeners, binders, weighting agents, silicone finishes. Machinery involved in finishing of Yarn, Knit, Woven, Denim, Terry towel, Garments | | | 10 |
| 7 | Effect finishes - wrinkle resistance, wash and wear, and durable press properties of fabrics; different technologies for resin finishing- Pad-dry cure and Moist cross-linking, machinery involved. | | | 4 |
| 8 | Functional finishes - antibacterial, flame retarding, water/oil repelling, soil release, antistatic finishes, Moisture management, UV Protection, Bio Polishing etc. | | | 20 |

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| 9 | Performance evaluation of conventional and effect finishes. | 6 |
| List of Text Books/ Reference Books | | |
| 1 | Textile Finishing, Hall A.J., Heywood book, London, 1966. | |
| 2 | An Introduction to Textile Finishing, Marsh J.T., B.I. Publication, Bombay, 1979. | |
| 3 | Technology of Finishing, Shenai V.A., Vol. 10, Sevak Publication, Bombay, 1990. | |
| 4 | Handbook of Fibre Finish Technology, Slade, P.E., Marcel, New York, 1998. | |
| 5 | Encyclopedia of Textile Finishing, Rouette, H.K., Springer Verlag, New York, 2001. | |
| 6 | Chemical Finishing of Textiles, Schindler, W.D and Hauser P.J., Woodhead, 2004 | |
| 7 | Principles of Textile Finishing, Choudhury A. R, Woodhead Publishing, 2017 | |
| 8 | Textile Finishing; Recent Developments and Future Trends, Mittal K.L., Scrivener Publishing, 2017 | |

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| Course Code: | Course Title: VSEC Chemical Engineering Laboratory | | | Credits=2 | | | |
| | | | | L | T | P | |
| Semester: VI | Total contact hours: 60 | | | 0 | 0 | 4 | |
| Course Outcomes (students will be able to.....) | | | | | | | |
| 1 | Learn how to experimentally verify various theoretical principles. (K3) | | | | | | |
| 2 | Visualize practical implementation of chemical engineering equipments. (K4) | | | | | | |
| 3 | Develop experimental skills. (K4) | | | | | | |
| List of Prerequisite Courses | | | | | | | |
| Process | Calculations, Transport Phenomena, Chemical Engineering Operations, | | | | | | |
| | Chemical Reaction Engineering | | | | | | |
| List of Courses where this course will be prerequisite | | | | | | | |
| Other B. Tech. courses | | | | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | | | | |
| Chemical Engineering lab provides students the firsthand experience of verifying various theoretical concepts learnt in theory courses. It also exposes them to practical versions of typical chemical engineering equipments and servers as a bridge between theory and practice. This particular lab focuses on fluid dynamics, distillation, filtration, drying and sedimentation. | | | | | | | |
| Sr no. | | | | | | | |
| Course Contents (Topics and subtopics) | | | | | Reqd. hrs | | |
| 1 | 4 - 6 Experiments on fluid dynamics and heat transfer | | | | | 24 | |
| 2 | 3 - 5 Experiments on Chemical Engineering Operations | | | | | 16 | |
| 3 | 2 – 4 Experiments on Reaction Engineering | | | | | 12 | |
| 4 | 1 – 3 Experiments on process dynamics and control | | | | | 8 | |
| List of Text Books/ Reference Books | | | | | | | |
| 1 | McCabe W.L., Smith J.C., and Harriott P. Unit Operations in Chemical Engineering, 2014 | | | | | | |
| 2 | Bird R.B., Stewart W.E., and Lightfoot, E.N. Transport Phenomena, 2007 | | | | | | |
| 3 | Coulson J.M., Richardson J.F., and Sinnott, R.K. Coulson & Richardson's Chemical Engineering: Chemical engineering design, 1996. | | | | | | |
| 4 | Green D. and Perry R. Perry's Chemical Engineers' Handbook, Eighth Edition, 2007. | | | | | | |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------------|----------|-----------------|
| Course Code: TXP1006 | Course Title: PR6 Printing Lab | Credits = 2 | | |
| | | L | T | P |
| Semester: VI | Total Contact Hours: 60 | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Analyze the effect of various parameters on dyeing and printing of cotton with different class of dyes. (K4) | | | |
| 2 | Carry out different dyeing and printing effects on polyester using disperse dyes. (K6) | | | |
| 3 | Demonstrate colouration of natural and synthetic polyamide fibres using a different class of Acid dyes. (K3) | | | |
| 4 | Achieve different printing effects on varying fibres, application methods and machinery. (K4) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing, Introduction to Textile substrates, Technology of Textile Printing | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Textile process House Management | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The practical will enable students to perform dyeing and printing on different textile substrates using various classes of dyes by different methods of application. | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The practical will enable students to perform dyeing and printing on different textile substrates using various classes of dyes by different methods of application. | | | | |
| Sr. No | Course contents (topics/subtopics) | | | Reqd hrs |
| 1 | Direct style of printing of Direct Dyes on cotton | | | 4 |
| 2 | Direct style of printing of Reactive Dyes on cotton | | | 4 |
| 3 | Direct style of printing of Reactive Dyes on cotton with various types of thickeners | | | 4 |
| 4 | Direct style of printing of Vat Dyes cotton | | | 4 |
| 5 | Direct style of printing of Azoic colors on cotton | | | 4 |
| 6 | Direct style printing on Polyester with Disperse dyes | | | 4 |
| 7 | Direct style printing on Nylon with disperse dyes | | | 4 |
| 8 | Direct style printing on Nylon Acid and Direct dyes | | | 4 |
| 9 | Direct style printing on Wool with Acid and Direct dyes | | | 4 |
| 10 | Direct style of printing on Jute, wool and acrylic with Basic Dyes | | | 4 |
| 11 | Direct style of printing of Pigments on cotton and polyester | | | 4 |
| 12 | Discharge style of printing – white discharge under direct dyed ground | | | 4 |
| 13 | Discharge style of printing – white discharge under Reactive dyed ground | | | 4 |
| 14 | Discharge style of printing – white and yellow discharge under azoic ground | | | 4 |
| 15 | Discharge style of printing – Vat discharge under direct dyed ground | | | 4 |

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| 16 | Discharge style of printing – pigment under reactive dyed ground | 4 |
| 17 | Resist style of printing – White resist under reactive dyed ground | 4 |
| 18 | Resist style of printing – white resist and colour resist under Phthalogen Blue | 4 |
| 19 | Special print effect – Tie and Dye style of printing | 4 |
| 20 | Special print effect – Batik style of printing | 4 |
| 21 | Special print effect – crimp style of printing | 4 |
| 22 | Special print effect – burnt out/brasso style of printing | 4 |
| List of Text Books/ Reference Books | | |
| Gile's Laboratory Course in Dyeing, D G Duff and R S Sinclair, SDC Publ. | | |

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| Course Code: TXP1011 | Course Title: PR7 Finishing and Evaluation of Textiles | Credits = 2 | | |
| | | L | T | P |
| Semester: VI | Total contact hours: 60 | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Carry out the application of conventional textile finishing agents. (K3) | | | |
| 2 | Perform application techniques for specialty functional finishes. (K3) | | | |
| 3 | Evaluate the effect of finishing on the comfort feel properties of textile. (K4) | | | |
| 4 | Formulate compatible mixture recipes for intended end-use application. (K6) | | | |
| List of Prerequisite Courses | | | | |
| Technology of Finishing | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Non-woven and Hi-Tech Fibres, Technical Textile | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| This will help students to understand the properties of textile substrates used in different applications. | | | | |
| Sr No | Course contents (topics/subtopics) | | | Reqd Hrs |
| 1. | Objective and requirement of finishing, machinery used, mechanical operations involved, methods of finish evaluation | | | 4 |
| 2. | Application of softeners of varying ionic nature– Cationic, Anionic, Nonionic, Amphoteric and different physical aspects – flakes, paste, liquid – evaluation of finished fabric for its feel, effect on absorbency, yellowing | | | 4 |
| 3. | Finishing of cotton and Polyester using Silicone softeners of varying particle size – Macro, Micro, Nano (particle size analysis) and performance effect – amino, amido, quaternary to evaluate effect on hand feel and absorbency. | | | 4 |
| 4. | Application of Elastomeric finish on cotton and polyester fabric – evaluation of hand feel, bulk/bounce, stretch and elastic recovery. | | | 2 |
| 5. | Application of stiffener and weight-gain agents on cotton woven– Starch, PVA. Evaluation in terms of hand feel, drape, bending length, tear strength. | | | 2 |
| 6. | Application of antistatic on polyester and hydrophilic on terry towel - testing of finished fabric for static charge, absorbency, wicking property, water retention. | | | 4 |
| 7. | Application of Anti-pilling agent on polyester cotton and polyester Viscose blend - testing of pilling behavior by Martindale. | | | 4 |
| 8. | Application of flame retarding agent and testing of finished fabric by measurement of char length, rate of burning and Limiting Oxygen Index. | | | 4 |
| 9. | Application Resin cross linking agent and testing of finished fabric for crease recovery angle, tear strength, bending length. | | | 4 |

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| 10. | Application of Oil and water repellent and evaluation of fabric for water repellency by spray/shower test and water penetration test and oil repellency by spotting. | 4 |
| 11. | Application of colour enhancer on Navy and Red dyed Cotton and Polyester fabric – evaluate depth enhancement, shade change, hand-feel. | 4 |
| 12. | Application of Rub fastness improver on Navy and Red dyed Cotton and Polyester fabric – evaluate rubbing fastness, shade change, hand feel. | 4 |
| 13. | Application of antibacterial agents and testing of finished fabric for antibacterial property, methylene blue test. | 4 |
| 14. | Application of soil release agent and testing of finished fabric for anti-soiling property, stain spotting and wash off behaviour. | 4 |
| 15. | Application of Aroma and microencapsulated fragrance finish – Mint, Lavender, Rose, Vanilla – evaluation of fragrance release by rubbing. | 4 |
| 16. | One step dyeing and finishing on cotton, polyester and P/C blend fabric by pad-dry-cure method. | 4 |
| List of Text Books/ Reference Books | | |
| 1 | Textile Finishing, Hall A.J., Heywood book, London, 1966. | |
| 2 | An Introduction to Textile Finishing, Marsh J.T., B.I. Publication, Bombay, 1979. | |
| 3 | Technology of Finishing, Shenai V.A., Vol. 10, Sevak Publication, Bombay, 1990. | |
| 4 | Handbook of Fibre Finish Technology, Slade, P.E., Marcel, New York, 1998. | |

**B. Tech. in Fibres & Textile Processing Technology
Syllabus Structure B. Tech. Fourth Year**

Semester VII

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| Course Code: TXT1504 | Course Title: SPL13 Nonwoven and High-tech Fibres | Credits = 3 | | |
| | | L | T | P |
| Semester: VII | Total contact hours: 45 | 2 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Recognize the need, technology, and difference between conventional and High-Tech fibres. (K2) | | | |
| 2 | Describe the manufacturing of Carbon fibres, aramid, PU, Glass, Ultra-high Mol weight PE fibres using different precursors, their applications, and properties. (K2) | | | |
| 3 | Explain the manufacturing of Non-Woven by different web formation and bonding techniques (K2) | | | |
| 4 | Predict end-use applications of hi-tech fibres and Non-woven materials (K3) | | | |
| List of Prerequisite Courses | | | | |
| Technology of Fibres and Polymers | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Technical Textile | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The course will be helpful to understand manufacturing, properties and applications of the most commonly used high tech fibres | | | | |
| Sr No | Course contents (topics/subtopics) | | | Reqd. hrs. |
| 1. | Importance and relevance of Nonwoven textiles, fibres used and various manufacturing techniques. | | | 3 |
| 2. | Different web formation techniques like carding, air laid, wet laid, spun laid, melt blowing, film splitting methods along with process flow machinery and testing of nonwoven used and end use applications. | | | 5 |
| 3. | Introduction to fibres and their manufacturing techniques, terminology, Definition of High-Tech fibres, Differences between conventional and High Tech fibres. | | | 5 |
| 4. | Manufacturing of carbon fibres from PAN precursors, viscose and pitch fibres. Differences between them wrt properties and Application of each type in different | | | 5 |
| 5. | Aramide Fibres, Synthesis of polymer, manufacturing, Discussion on Liquid crystals, Difference between regular aliphatic and aramid fibre, Application in different areas/fields. | | | 5 |
| 6. | Ultra-High Molecular weight Polyethylene Fibres, Synthesis, manufacturing, Special focus on its structure, Discussion on Sheesh Kebab structure, Gel spinning, Super drawing, Difference between regular olefin and UHMW fibre, Application in different areas/fields. | | | 5 |

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| 7. | Polyurethane/Elastomeric Fibres, Synthesis of polymer along with precursors, manufacturing, Discussion on block/segmented structure, comparison with rubber, stretchability, Application in different areas/fields. | 5 |
| 8. | Glass fibres including optical glass fibres, their manufacturing, Rotary jet spinning technique, different types like C, E and S, Sizing and its reasons. Properties vis a vis Aramide and Carbon and other High-Tech fibres, Application in different areas/fields. | 5 |
| 9. | Brief discussion about different biodegradable fibres, monomers used, polymers synthesis, nano fibres, application in medical field. | 5 |

List of Text Books/ Reference Books

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|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. | Natural and man-made Textile fibres, G.E Linton, New York duell, sloan and pearce 1966 |
| 2. | Turbak, A. F., Vigo, T. L. High-tech Fibrous Materials: Composites, Biomedical Materials, Protective Clothing, and Geotextiles. United States: American Chemical Society, 1991 |
| 3. | Bicomponent fibres.,Jeffries, Merrow publishing,1996 |
| 4. | High Performance Fibers, J.W.S. Hearle, Wood head Publishing,2001 |
| 5. | Advanced fiber spinning Technology,T.Nakajima,Wood head publication,2002 |
| 6. | Medical Textiles and biomaterial for healthcare, Anand S.C. Wood head publishing,2006 |
| 7. | High-Performance and Specialty Fibers: Concepts, Technology and Modern Applications of Man-Made Fibers for the Future. (n.d.). Japan: Springer Japan |
| 8. | High Performance Technical Textiles. United Kingdom: Wiley, 2019 |

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| Course Code: TXT1803 | Course Title: SPL14 Effluent Characterisation and Treatment | Credits = 2 | | |
| | | L | T | P |
| Semester: VII | Total contact hours: 30 | 2 | 0 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Comprehend requirements of water and energy conservations during textile processing. (K2) | | | |
| 2 | Explain methods to determine presence of metal or other impurities in the effluent. (K2). | | | |
| 3 | Demonstrate fundamentals about the environment and its characteristics. (K3) | | | |
| 4 | Analyze various effluent treatment procedures and their application to textile processing wastewater. (K4) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Wet Processing | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Process house management | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Understand importance and relevant of environmental aspects related to sustainability in textile wet processing and the effluent parameters | | | | |
| List of Text Books/ Reference Books | | | | |
| Sr No. | Course contents (topics/subtopics) | | | Reqd. Hrs |
| 1. | Water requirement by textile wet processing industry, quality of incoming process water, standard norms for process water, overview of methods used to test incoming water | | | 7 |
| 2. | Methods to treat incoming water such as, screening, filtration, clarification, disinfection etc., | | | 7 |
| 3. | Design of effluent treatment plant, primary, secondary and tertiary treatments | | | 9 |
| 4. | Activated sludge and its modification, trickling filters, rotating biological contractors, suspended and attached growth anaerobic systems. Stabilisation ponds, aerated lagoons, etc. Sludge treatment and disposal. Treated effluent disposal in inland waters and marine environment. | | | 7 |
| List of Text Books/ Reference Books | | | | |
| 1. | Economy Energy & Environment in textile Wet Processing - ACT, Edited by S.S. Trivedi. | | | |
| 2. | Environmental Issues - Technology option for Textile Industry Edited by R. B. Chavan, Indian Journal of Fibre & Textile Research Special Issue - March, 2001. | | | |
| 3. | Eco-friendly Textiles Challenges to Textile Industry - Textile Committee. | | | |
| 4. | Environmental Success - America Textile Industry, AATCC Symposium - 1996. | | | |

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| Course Code: TXP1019 | Course Title: PR8 Shade Matching and Bulk Colouration | Credits = 2 | | |
| | | L | T | P |
| Semester: VII | Total contact hours: 60 | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Perform dyeing of various fabrics and blends using different methods on semi-continuous and continuous dyeing ranges. (K4) | | | |
| 2 | Perform combined and separate Desizing, Scouring, and Bleaching of cotton knit, Cotton/Elastane blends processing on a soft flow machine. (K4) | | | |
| 3 | Process Polyester/Viscose, Polyester/Wool blends on a pilot Jet dyeing machine. (K4) | | | |
| List of Prerequisite Courses | | | | |
| Technology of Textile Dyeing | | | | |
| List of Courses where this course will be pre-requisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The course will help student understand the criticality and importance of accurate colour matching and the lab to bulk reproducibility expectations to achieve optimum productivity | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The course will help student understand the criticality and importance of accurate colour matching and the lab to bulk reproducibility expectations to achieve optimum productivity | | | | |
| Sr. No. | Course contents (topics/subtopics) | Reqd hrs | | |
| 1 | Pretreatment and dyeing of cotton yarn with reactive dyes | 4 | | |
| 2 | Pretreatment and dyeing of polyester yarn with disperse dyes | 4 | | |
| 3 | Pre-treatment and dyeing of cotton knitted fabric using reactive dyes | 4 | | |
| 4 | Pre-treatment and dyeing of cotton woven fabric using reactive dyes | 4 | | |
| 5 | Dyeing of cotton woven fabric using vat dyes with vat pigment method | 4 | | |
| 6 | Dyeing of cotton woven fabric using reactive dyes | 4 | | |
| 7 | Pre-treatment and dyeing of cotton/lycra blended knitted fabric | 4 | | |
| 8 | Pre-treatment and dyeing of polyester woven/knitted fabric | 4 | | |
| 9 | Dyeing of cotton woven fabric with reactive dyes – cold pad batch method | 4 | | |
| 10 | Dyeing of cotton woven fabric with vat dyes – pad jigger method | 4 | | |
| 11 | Dyeing of cotton woven fabric by pad-dry-pad-steam method | 4 | | |
| 12 | Dyeing of polyester cotton blended fabric by one bath process using reactive and disperse dye system | 4 | | |
| 13 | Reactive direct style of printing and development by steaming | 4 | | |
| 14 | Polyester cotton blended fabric printing with pigment dispersions | 4 | | |
| 15 | Pre-treatment and dyeing of garment using reactive dyes | 4 | | |
| 16 | Effect of bio fading enzyme on denim garments | 4 | | |
| 17 | Shade correction of reactive dyed cotton woven fabric | 4 | | |

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| 18 | Shade correction of disperse dyed polyester woven fabric | 4 |
| 19 | Dyeing of cotton woven fabric with three basic reactive dyes – yellow, blue and red for self, binary and tertiary shades starting from 0.1-4% | 4 |
| 20 | Dyeing of polyester woven fabric with three basic disperse dyes – yellow brown, navy blue and red for self, binary and tertiary shades starting from 0.1-4% | 4 |
| 21 | Building data bank on computer colour matching system | 4 |
| 22 | Getting recipe for a give shade from computer colour matching system | 4 |
| 23 | Carry out dyeing using the computer-generated recipe and checking the same on CCM | 4 |
| 24 | Getting exact match by fine tuning recipe derived from computer | 4 |

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| Course Code: TXT1804 | Course Title: Dept Elective 1 Eco Compliance and Certification | | Credits = 3 | | |
| Semester: VII | | | L | T | P |
| Total contact hours: 45 | | | 2 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | | |
| 1 | Understand the concept of Chemical Management and its importance, different global regulations and testing protocols of the hazardous chemicals. (K2) | | | | |
| 2 | Interpret and preparation of safety data sheet of the chemicals. (K3) | | | | |
| 3 | Identify hazardous chemical, RSL and MRSL substances in the Textile value chain. (K4) | | | | |
| 4 | Evaluate different auditing systems used for textile field. (K5) | | | | |
| List of Prerequisite Courses | | | | | |
| Technology of Textile Pretreatment, Technology of Textile Dyeing, Technology of Textile Printing | | | | | |
| List of Courses where this course will be prerequisite | | | | | |
| Nil | | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | | |
| This course is required for the future professional career. The course will help student to understand eco-balance in the textile products and their requirements. | | | | | |
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| Sr no. | Course Contents (Topics and subtopics) | | | | Reqd. hrs |
| 1. | Textile Exchange Certification-GOTS, OCS, RCS, OCS, RAS, RWS, RDS, EU flower, Nordic Swan | | | | 5 |
| 2. | Concept of Chemical Management (CM) and its importance in Textiles Preparation of Safety Data Sheet and its interpretation | | | | 5 |
| 3. | Better cotton initiative (BCI), Fair Trade Cotton, Egyptian cotton | | | | 5 |
| 4. | Oeko tex-Standard 100, Sustainable textile Production (STeP), Made in Green, Clean By Design-Apparel Impact Institute, Other compliance-Bluesign | | | | 5 |
| 5. | Zero Discharge of Hazardous Chemicals (ZDHC)-Supplier to zero, brands to zero, wastewater sampling, Detox to zero, Incheck, Chemchek, ZDHC-MRSL and RSL | | | | 5 |
| 6. | REACH Certification-Registration, Evaluation, Authorization and Restriction of chemicals | | | | 5 |
| 7. | Leadership in energy and environmental design (LEED) | | | | 3 |
| 8. | Fair Wear foundation, Leather Working Group (LWG), Alliance for responsible denim, Sustainable Fibre alliance | | | | 3 |
| 9. | Cradle to cradle certification, ISO certification:9001-QMS,14001-EMS,45001-OHSAS. | | | | 3 |
| 10. | Environment Audit program-Higg Facility Environment Module, Amfori BEPI-Environment & chemical audit, Security Audit-Customs Trade Partnership against Terrorism (CT-PAT), Technical Audits- SQP, Product safety audit programs based on client requirement | | | | 3 |
| 11. | Social Certification-FSLM, WRAP, BSCI, SEDEX-SMETA, SA8000, Client -code of conduct audits, Ethical trading initiative, International Labor organization standard, Forest stewardship council (FSC) certification | | | | 3 |
| List of Text Books/ Reference Books | | | | | |

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| 1. | Textile Exchange: Accreditation and Certification Procedures for Textile Exchange Standards 2.0 |
| 2. | Roadmap to Sustainable Textiles and Clothing, Subramanian Senthilkannan Muthu, Springer Science, 2014. |
| 3. | Ecology and textiles, V. A. Shenai, Sevak publication |
| 4. | Textile effluent, Padma Vankar, Ncute publication |
| 5. | Handbook of chemical and environmental engineering calculations, J.P. Reynolds, John S. Jeris, Louis Theore |
| 6. | Environmental chemistry, John Wright |

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| Course Code: TXT1901 | Course Title: Dept Elective 2 Textile Process House Management | Credits = 2 | | |
| | | L | T | P |
| Semester: VII | Total contact hours: 30 | 1 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1. | Analyze textile practical situations and be able to provide applicable solutions. (K4) | | | |
| 2. | Demonstrate human resource requirements and their management. (K3) | | | |
| 3. | Identify importance and significance of role of management and its function in smooth running of production operations. (K4) | | | |
| 4. | Exercise control over check points and product quality control at various stages of textile processing. (K3) | | | |
| List of Prerequisite Courses | | | | |
| Technology of Textile Pretreatment, Technology of Textile Dyeing, Technology of Textile Printing | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| This course is essential for effective functioning of students in their professional careers. | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| This course is essential for effective functioning of students in their professional careers. | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| This course is essential for effective functioning of students in their professional careers. | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| This course is essential for effective functioning of students in their professional careers. | | | | |
| Sr No | Course Contents (Topics and subtopics) | | | Reqd. Hrs |
| 1 | Responsibilities of management: society and development. Functions of Management: Planning, Motivating, Leading, Controlling; Business organization structures, limitations, relative merits and demerits. | | | 3 |
| 2 | Organisational Process and Behaviour: Span of Control, Authority, Responsibility and Accountability, Delegation of authority, Decentralization of authority. Enhancing Managerial Effectiveness through self and others, Individual Personality and Behaviour, Perception, Attitudes, Values and Aptitude, Frustration, Conflict, Organisational structure, Organisational culture, Organisational transformation, Organisational Effectiveness and Assessment | | | 7 |
| 3 | Technology Management: Strategies and their applications in industry, Business specifications versus technical specifications, Introduction to Strategic Innovation, Introduction to technology transfer. | | | 7 |
| 4 | Marketing Management: Marketing vs sales, advertising, marketing research, supply chain management, Brand Management | | | 7 |
| 5 | Laws: Company Laws, Factory Laws, Labor Laws, and Intellectual Property Rights (IPR) | | | 3 |
| 6 | Communication Skills: Communication process, media channels, written and verbal/ presentation skills, barriers to effective communications. counselling and coaching. | | | 3 |
| List of Text Books/ Reference Books | | | | |

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| 1 | Essentials of Management, Harold Koontz, Heinz Weihrich; Tata McGraw Hill Education Pvt. Ltd., 2012 |
| 2 | Industrial Management, Richard Lansburgh, William Spriegel; J. Wiley, New York, 1947 |
| 3 | Innovation and Entrepreneurship, Peter Drucker; Harper Business, 1993 |
| 4 | Industrial Management– I, Jhamb L. C. and Jhamb S.; Everest Publishing house, 2015 |
| 5 | Essentials of Organizational Behavior, S. Robbins, Timothy Judge; Pearson, 2017 |
| 6 | Organizational Behaviour, Luthans F; McGraw-Hill/Irwin, 2011 |
| 7 | Principles of Marketing, Philip Kotler, Gary Armstrong, Prafulla Agnihotri; Pearson, 2018 |
| 8 | Research and Development Management, Bamfield Peter; Wiely VCH, 1996 |

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| Course Code: TXT 1207 | Course Title: PCC Honors Course-III Emerging Textile Technology | Credits = 4 | | |
| | | L | T | P |
| Semester: VII | Total contact hours: 60 | 3 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Understand the concept of modern IT tools in the textile wet processing like Artificial intelligence, robotics, data analytics etc. (K2) | | | |
| 2 | Grasp the concept of enzyme, their synthesis, and applications in different textile wet processing treatment. (K3) | | | |
| 3 | Recognise the use of modern technology like plasma, e control, super critical carbon dioxide, digital printing in textiles. (K3) | | | |
| 4 | Apply different synthesis routes for nano particles its application on textiles by various techniques to get enhanced performance. (K3) | | | |
| List of Prerequisite Courses | | | | |
| Technology of Textile Pretreatment, Technology of Textile Dyeing, Technology of Textile Printing | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| | | | | |
| Sr. No. | Course contents (topics/subtopics) | | | Reqd hrs |
| 1 | Brief idea about nanotechnology and its importance in Textiles. Different routes/methods used for the synthesis of different nano particles, Nanoclays and their treatments, carbon Nanotubes and its application in textiles, and different methods of application of nanoparticles onto the textile with examples. | | | 12 |
| 2 | Introduction to biotechnology in textiles, enzyme synthesis and characterization, Various biotechnological applications in textile wet processing e.g. Microbial colorants, Enzyme catalyzed dye synthesis. | | | 12 |
| 3 | Plasma technology, E-Control processing; Supercritical carbon dioxide dyeing of textiles; Layer by Layer coloration of textiles, Air Dye technique, Electrochemical dyeing, Digital printing and finishing; Structural colouration. | | | 12 |
| 4 | Water and energy conservation, Application of nonconventional energy and water resources in textile wet processing | | | 12 |
| 5 | Introduction to Industry 4.0 - Internet of Things, Artificial Intelligence, Data Analytics, Robotics | | | 12 |
| List of Text Books/ Reference Books | | | | |
| 1 | Ecotextiles, BTRA,1996 | | | |
| 2 | Digital printing of textiles, Ujiie.H.,Woodhead publishing,2006 | | | |
| 3 | Nano fibers and Nano technology in textiles, Brown P.J,Woodhead publishing,2007 | | | |

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| 4 | Plasma Technologies for Textiles,Woodhead Publishing Ltd.,R. Shishoo, 2007 |
| 5 | Advances in Textile Biotechnology. , United Kingdom: Elsevier Science, 2010 |
| 6 | Plasma Technologies for Textile and Apparel,Dr. S.K. Nema, Prof. P.B. Jhala, Woodhead Publishing Ltd.,2015 |
| 7 | Militky, J., Mishra, R. Nanotechnology in Textiles: Theory and Application. United Kingdom: Elsevier Science, 2018 |
| 8 | Frontiers of Textile Materials: Polymers, Nanomaterials, Enzymes, and Advanced Modification Techniques. ,United States: Wiley, 2020 |
| 9 | Energy Conservation in Textile Industry, S. C. Bhatia, Woodhead Publishing Ltd.2020 |

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| Course Code: TXP1013 | Course Title: Project I | Credits = 4 | | |
| | | L | T | P |
| Semester: VII | Total Contact Hours: 60 | 0 | 0 | 8 |
| Course Outcomes (Students will be able to.....) | | | | |
| 1. | Develop critical thinking to identify the research gap for the project (K5) | | | |
| 2. | Formulate a scientific question and approach to solve it (K6) | | | |
| 3. | Plan the experimental methodology for the project (K5) | | | |
| 4. | Develop skills to communicate the research plan effectively (K6) | | | |
| 5. | Develop skills for writing a scientific document on the research work (K6) | | | |
| List of Prerequisite Courses | | | | |
| NA | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | |
| Teachers will communicate various research project topics to all the students based on interest and facilities available and relevance to the area of Textile Processing Technology and allied areas. | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | Reqd hrs |
| 1 | <ul style="list-style-type: none"> -Teachers will communicate various research project topics to all the students based on interest and facilities available and relevance to the area of Textile Processing Technology and allied areas. - Each student based on his/her interest and merit selects the research topic and is allotted a supervisor. -Review of literature, formulation of research project, hypothesis, objectives, methodology, possible expected outcomes, planning for experimentation, experimental trials, data generation and analysis. -Oral presentation & written report of the seminar will be evaluated. | | | 60 |

Semester VIII

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| Course Code: TXP1017 | Course Title: Project II | | Credits = 3 | | |
| Semester: VIII | | | L | T | P |
| Total Contact Hours: 80 | | 0 | 0 | 6 | |
| Course Outcomes (Students will be able to.....) | | | | | |
| 1. | Perform experiments & troubleshoot to generate reliable data (K5) | | | | |
| 2. | Apply different statistical tools for scientific data analysis (K4) | | | | |
| 3. | Evaluate critically the experimental data and draw meaningful inferences (K5) | | | | |
| 4. | Develop skills to communicate the research outcome effectively and writing a complete document on the project work (K6) | | | | |
| List of Prerequisite Courses | | | | | |
| Technology of Fibres and Polymers, Technology of Textile Dyeing, Technology of Textile Finishing, Technology of Textile Printing | | | | | |
| List of Courses where this course will be prerequisite | | | | | |
| No | | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | | |
| Develop a skill to execute & solve a research problem in textile processing. Develop skills for presenting a research outcome effectively | | | | | |
| Description of relevance of this course in the B. Tech. Program | | | | | |
| Develop a skill to execute & solve a research problem in textile processing. Develop skills for presenting a research outcome effectively | | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | | Reqd Hrs |
| 1 | The topic of the research with defined objectives and hypothesis should be explored by scientifically planned rational experiments. Students should have actual experimental data collected on the chosen research topic. | | | | 60 |
| 2 | -Oral presentation of proposed research work with data generated during actual trial targeted towards the objectives -Submission of report of research proposal | | | | 20 |

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| Course Code: TXT1502 | Course: SPL15 Technical Textiles | Credits = 3 | | |
| | | L | T | P |
| Semester: VIII | Total contact hours: 45 | 2 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Comprehend the difference between woven, knitted, and nonwoven fabrics along with the areas of application depending on the properties desired. (K1) | | | |
| 2 | Explain methods of web formation, web bonding and finishing of nonwovens as per the intended end use. (K3) | | | |
| 3 | Differentiate areas of technical textile and specific fibre properties. (K4) | | | |
| 5 | Apply knowledge of textile processing in areas of technical textiles. (K3) | | | |
| List of Prerequisite Courses | | | | |
| Introduction of Textile Substrates, Technology of Fibres and Polymers, Testing of Textile Materials | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The students will understand various non-apparel applications of textiles and the vast and fast-growing field of technical textiles | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| The students will understand various non-apparel applications of textiles and the vast and fast-growing field of technical textiles | | | | |
| Sr. No. | Course contents (topics/subtopics) | | | Reqd Hrs |
| 1. | Introduction to Technical Textiles, Difference between Technical textiles and other aspects of textiles. Classification of various Technical Textiles and their end use applications | | | 6 |
| 2. | Medical textiles– materials used, classification, extracorporeal (biomedical) – Health care and hygiene products | | | 6 |
| 3. | Geotech, Agrotech, Indutech, Packtech - products and applications | | | 12 |
| 4. | Sports and recreation textiles, Waterproof breathable fabrics –camping and hiking – baseball – tennis –foot ball – golf and hockey – bikes – marine products – textiles in sports surfaces –hot air ballooning | | | 5 |
| 5. | Safety protective textiles and transportation textiles. Introduction, high temp. textiles – flame resistant protective clothing, chemical, protective clothing’s radiation protection, thermal insulation, camouflage textiles | | | 5 |
| 6. | Mobiltech - Transportation textiles – airbags – seat belts – automotive interior and exterior trim – truck and car covers, for aircrafts | | | 5 |
| 7. | Smart Textiles – Concept of phase change materials like temperature sensitive, pH Sensitive, photo sensitive etc., Applications of phase change materials in textiles. Concept of shape memory polymers and their applications in textiles. Use of electronics in clothing. | | | 6 |

List of Text Books/ Reference Books

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| 1. | Hand book of Industrial textiles, Adanur S., CRC Press, 1995 |
| 2. | Automotive Textiles, Mukhopadhyay S.K., Partridge J.F., CRC Press, 1999 |
| 3. | Hand book of Technical Textiles, Horrock A. R.and Anand S.C., Woodhead Publ.,2000 |
| 4. | Coated textiles Principles and applications, Sen A.K., Technomic Publishing, 2001 |
| 5. | Medical textiles, Anand S.C., Woodhead Publishing, 2001 |
| 6. | Handbook of Nonwovens. United Kingdom: Elsevier Science, S. J. Russell, 2007 |
| 7. | Applications of Nonwovens in Technical Textiles. United Kingdom: Elsevier Science, R. Chapman, 2010 |

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| Course Code: TXP1024 | Course: PR 9 Advanced characterization techniques | Credits = 2 | | |
| Semester: VIII | Total contact hours: 60 | L | T | P |
| | | 0 | 0 | 4 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Calibrate instruments required for textile characterizations. (K4) | | | |
| 2 | Measure contact angle, particle size, and zeta potential as a surface characterization technique. (K5) | | | |
| 3 | Demonstrate different experiments for the characterisation of textile materials. (K5) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Substrates, Introduction to Textile Wet Processing, Technology of Fibres and Polymers | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Students will have better understanding of the structure of textile fibres, yarns and fabrics, their properties as well as important concept of textile physics and testing which will help to measure different properties of textile materials. | | | | |
| Sr. no. | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1. | FTIR analysis of natural and synthetic untreated and finished fabrics on FTIR | | | 6 |
| 2. | Structure analysis with respect to crystallinity, orientation and crystal size of neat and modified polyester, Nylon and polypropelene fibres on XRD machine | | | 6 |
| 3. | DSC Analysis of neat and modified polyester, Nylon and polypropelene fibres on Differential Scanning Calorimeter | | | 6 |
| 4. | Analysis of neat and modified polyester, Nylon and polypropelene fibres on TGA and LOI tester | | | 6 |
| 5. | Determination of zeta potential of untreated and surface modified cotton material on Electrokinetic Analyzer | | | 6 |
| 6. | To measure particle size of nano TiO ₂ on nano particle size analyzer | | | 6 |
| 7. | To study the morphology of different treated and untreated fibres using Image Analyzer | | | 6 |
| 8. | To measure static charge decay time, bulk, and surface resistivity of untreated and conducting polyester fabric | | | 6 |
| 9. | Measurement of contact Angle on untreated, finished, and coated fabric on Contact Angle Analyzer | | | 6 |
| 10. | Measurement of surface energy of untreated and finished fabric on Tensiometer | | | 6 |
| List of Text Books/ Reference Books | | | | |
| 1. | Fundamentals of Molecular Spectroscopy - C. Banwell and E. McCash | | | |
| 2. | Instrumental Methods of Analysis - H. H. Willard, 1.1. Merritt and J. A. Dean | | | |
| 3. | Fundamentals of Surface and Thin Film Analysis - L. C. Feldman and J. Mayer | | | |
| 4. | Advances in Electrochemical Science and Engineering -1.1. Gerischer and C. W. Tobnia (eds.) | | | |

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| Course Code: TXT1702 | Course Title: Honors Course-IV Textile Physics | Credits = 3 | | |
| | | L | T | P |
| Semester: VIII | Total contact hours: 45 | 2 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Understand fibre structure and properties as well as their significance in yarn properties. (K2) | | | |
| 2 | Calculate fibre, yarn and fabric properties related numerical. (K3) | | | |
| 3 | Analyze fabric structure and properties. (K4) | | | |
| 4 | Understand the importance of fabric properties and their correlation with yarn structures. (K4) | | | |
| List of Prerequisite Courses | | | | |
| Introduction to Textile Substrates, Manufacturing of Yarn and Fabric | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Students will have a better understanding of the structure of textile fibres, yarns and fabrics, their properties as well as the important concept of textile physics and testing, which will help to measure different properties of textile materials. | | | | |
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| Sr. No. | Course Contents (Topics and subtopics) | | | Reqd. hrs |
| 1 | Fine Structure of fibre; molecular chain properties, crystallinity, the orientation of molecular chains and their effect on fibre properties. Fibre length and its distribution, technical importance of fibre length, methods of measurement of fibre length and associated parameters, Baer-Sorter diagram, HVI, span length and effective length, mean length, uniformity ratio and index and Fibre Quality Index. Definition of fibre fineness, technical significance of fibre fineness, principles of measurement of fibre fineness, maturity of cotton. | | | 10 |
| 2 | Yarn linear density - direct and indirect system, conversion from one system to another measurement of yarn count, linear density of ply and cable structure, yarn diameter and packing density. Definition of twist, twist direction, twist contraction and retraction, measurement of twist, twist factor, effect of twist on strength of yarn (both continuous and staple), effect of twist on yarn diameter and packing density. | | | 9 |
| 3 | Open packing and hexagonal close packing; Fibre migration in yarn. Various types of irregularities in yarn, limit irregularity, irregularity index, causes of irregularity, short- and long-term irregularity, variance - length curves, hairiness index, Classimat faults. | | | 7 |
| 4 | Length, width, thickness, areal density of fabrics, porter, shots, thread density, cover factor - definition and measurement. Fabric stiffness, drape-definitions, measurement, factors affecting these properties. Air permeability, water permeability and thermal transmission property of fabrics, factors affecting those properties. | | | 7 |

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| 5 | Woven cloth setting theories, elements of woven fabric geometry; cover factor, ends and picks, count, crimp and weight relationship of similar fabrics. Pierce simple geometry of plain weave, derivation of basic equations, practical application of cloth geometry crimp interchange. | 7 |
| 6 | Optical properties of textiles; colour, lustre, birefringence, dichroic ratio, fibre friction - its role and measurement; Static Electricity - its generation, measurement, effect in processing. New methods of measurement of fabric hand (KES, FAST etc.). | 5 |
| List of Text Books/ Reference Books | | |
| 1 | Principles of Textile Testing by J.E. Booth,1961 | |
| 2 | Physical Properties of Textile Fibers by W. E. Morton and J. W. S. Hearle, 1962 | |
| 3 | Structural Mechanics of Fibres, Yarns and Fabrics; Vol. 1 by J. W. S. Hearle, P. Grosberg and S. Backer, 1969 | |
| 4 | Textile Yarns (Technology, Structure and Applications) by B. C. Goswami, J. G. Martindale, F. L. Scardino, 1977 | |
| 5 | Textile Fibres, Yarns and Fabrics by E. R. Kaswell, 1953 | |
| 6 | Structural mechanics of woven fabrics by J. Hu, 2004 | |

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| Course Code: TXT1217 | Course Title: Honors Course-V Continuous Processing of Textile | Credits = 3 | | |
| | | L | T | P |
| Semester: VIII | Total contact hours: 45 | 2 | 1 | 0 |
| Course Outcomes (students will be able to.....) | | | | |
| 1 | Elaborate the different scouring and bleaching recipes and machinery for natural and synthetic textiles and their blends. (K3) | | | |
| 2 | Analyze the types of machinery for each type of fibre form, dyeing parameters, and dyeing methods. (K4) | | | |
| 3 | Demonstrate the new developments in textile processing types of machinery with respect to their utility. (K4) | | | |
| 4 | Examine the various parts and segments of textile processing machinery and differentiate them according to their functions. (K3) | | | |
| List of Prerequisite Courses | | | | |
| Technology of Textile Dyeing, Technology of Textile Pretreatment | | | | |
| List of Courses where this course will be prerequisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B.Tech. Program | | | | |
| Students will better understand various stages of textile wet processing, and types of machinery used and gain a basic idea about the wet processing operations. | | | | |
| Sr. No. | | | | |
| Course Contents (Topics and subtopics) | | | | Reqd. hrs |
| 1 | Continuous pretreatment of textiles-Processes & Machinery | | | 10 |
| 2 | Combined pretreatment of different textiles. | | | 8 |
| 3 | Continuous dyeing of natural & synthetic and blended fabrics-various dyeing processes. | | | 12 |
| 4 | Different classes of dyes used, dyeing machinery. | | | 8 |
| 5 | Recent advances in continuous processing. | | | 7 |
| List of Text Books/ Reference Books | | | | |
| 1 | Principles of Textile Testing by J.E. Booth,1961 | | | |
| 2 | Physical Properties of Textile Fibers by W. E. Morton and J. W. S. Hearle, 1962 | | | |
| 3 | Structural Mechanics of Fibres, Yarns and Fabrics; Vol. 1 by J. W. S. Hearle, P. Grosberg and S. Backer, 1969 | | | |
| 4 | Textile Yarns (Technology, Structure and Applications) by B. C. Goswami, J. G. Martindale, F. L. Scardino, 1977 | | | |
| 5 | Textile Fibres, Yarns and Fabrics by E. R. Kaswell, 1953 | | | |
| 6 | Structural mechanics of woven fabrics by J. Hu, 2004 | | | |

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| Course Code: TXP1014 | Course Title: OJT Internship with Industry | Credits = 12 | | |
| | | L | T | P |
| Semester: VIII | Total duration: 15 weeks | 0 | 0 | 0 |
| Course Outcomes (Students will be able to.....) | | | | |
| 1. | Apply the concept of project & production management in further planning. (K3) | | | |
| 2. | Develop critical thinking regarding the various operations involved in textile industry. (K4) | | | |
| 3. | Solve certain industrial challenges in textile processing (K6) | | | |
| 4. | Present and communicate an industrial problem effectively and write a scientific report on the training (K6) | | | |
| List of Prerequisite Courses | | | | |
| Technology of Fibres and Polymers, Technology of Textile Dyeing, Technology of Textile Finishing, Technology of Textile Printing | | | | |
| List of Courses where this course will be Prerequisite | | | | |
| Nil | | | | |
| Description of relevance of this course in the B. Tech. Programme | | | | |
| Develop a systematic thinking about an industrial problem, develop skills for communication, networking, personal grooming & professional conduct within an industrial environment, develop the attitude for individual and teamwork | | | | |
| Description of relevance of this course in the B. Tech. Programme | | | | |
| Develop a systematic thinking about an industrial problem, develop skills for communication, networking, personal grooming & professional conduct within an industrial environment, develop the attitude for individual and teamwork | | | | |
| Sr. No. | Course Contents (Topics and subtopics) | | | Reqd weeks |
| 1 | -Each Student will be involved in R & D/ manufacturing (QA / QC / Plant Engineering /Stores and Purchase)/ marketing / finance/ consultancy/ Technical services/ Engineering / Projects, etc. -Oral presentation & written report of the in-plant training will be evaluated along with industry feedback. | | | 15 |