# GUJARAT TECHNOLOGICAL UNIVERSITY

**Program Name: Master of Engineering**

**Level: PG**

**Branch: Textile Engineering**

**Subject Code : ME02025061**

**Subject Name : Advances in Chemical Processing**

| | |
|---|---|
| w. e. f. Academic Year: | 2024-25 |
| Semester: | 2 |
| Category of the Course: | Professional Elective Course |

| | |
|---|---|
| **Prerequisite:** | Basics of textile chemical processing of undergraduate. |
| **Rationale:** | Subject will cover various advanced techniques used in the field of textile chemical processing's. |

**Course Outcome:**

After Completion of the Course, Student will able to:

| No | Course Outcomes | RBT Level |
|---|---|---|
| 01 | Understand the principles and objectives of various textile finishing techniques. | R,U |
| 02 | Analyze the impact of mechanical and chemical finishing processes on textile properties. | U,A,E |
| 03 | Evaluate advanced finishing techniques and their applications in the textile industry. | U,A,E |
| 04 | Apply sustainable and eco-friendly finishing methods. | U,A,E,C |
| 05 | Characterize and test finished textiles using modern analytical techniques. | U,A,E |

**Revised Bloom's Taxonomy (RBT)*

**Teaching and Examination Scheme:**

| Teaching Scheme (in Hours) | | | Total Credits L+T+ (PR/2) | Assessment Pattern and Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory | | Tutorial / Practical | | |
| L | T | PR | C | ESE (E) | PA / CA (M) | PA/CA (I) | ESE (V) | |
| 3 | 0 | 2 | 4 | 70 | 30 | 20 | 30 | 150 |

**Course Content:**

| Unit No. | Content | No. of Hours | % of Weightage |
|---|---|---|---|
| 1. | Advances in Bleaching and Scouring:- Enzymatic Scouring and | 10 | 24 |

| | | | |
|---|---|---|---|
| | Bleaching, Low-temperature Bleaching, Ozone Treatment, Ultrasonic Treatment, Continuous Bleaching Range (CBR), Ultrasonic Scouring Machines, Ozone Bleaching Equipment. | | |
| 2. | Sustainable Dyeing Techniques, Waterless Dyeing Technologies, Digital Textile Printing, Nanotechnology in Dyeing, Digital Inkjet Printers, Supercritical CO2 Dyeing Machines, Nanoparticle Synthesis Equipment. | 08 | 19 |
| 3. | Digital Textile Printing, 3D Printing on Textiles, Eco-friendly Printing Inks, Smart and Functional Printing. Digital Textile Printers, Eco-friendly Inkjet Printers. | 09 | 19 |
| 4. | Plasma Treatment of Textiles, Antimicrobial Finishes, Flame Retardant Treatments, Hydrophobic and Oleophobic Finishes. Plasma Treatment Equipment, Coating Machines for Functional Finishes. | 10 | 24 |
| 5. | Effluent Treatment and Recycling, Zero Discharge of Hazardous Chemicals (ZDHC), Life Cycle Assessment of Textile Chemicals, Use of Green Chemistry Principles, Effluent Treatment Plants, Recycling Systems for Textile Waste. | 08 | 14 |
| | **Total** | **45** | **100** |

**Suggested Specification Table with Marks (Theory):**

| Distribution of Theory Marks (in %) | | | | | |
|---|---|---|---|---|---|
| **R Level** | **U Level** | **A Level** | **N Level** | **E Level** | **C Level** |
| **20** | **25** | **25** | **15** | **10** | **5** |

*Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)*

**References/Suggested Learning Resources:**

**(a) Books:**

1. Textile Chemical Processing: Theory and Practice by S.R. Karmakar
2. Handbook of Textile and Industrial Dyeing edited by M. Clark
3. Advances in Textile Materials Chemistry by Ana Sutlović and Sanja Ercegović Ražić
4. Chemical Finishing of Textiles edited by W.D. Schindler and P.J. Hauser
5. Sustainable Practices in the Textile Industry by Subramanian Senthilkannan Muthu

**(b) Open source software and website:**

- http://nptel.ac.in

- World Wide Web, Google Search Engine etc.

**Suggested Course Practical List:**

1. Perform enzymatic scouring on cotton fabrics and assess the results.
2. Compare the whiteness index of fabrics bleached using traditional and ozone methods.
3. Experiment with natural dyes on different fabrics and evaluate color fastness.
4. Use digital printing to create intricate patterns on textiles.
5. Create samples using digital textile printing and assess print quality.
6. Experiment with 3D printing on fabric surfaces and analyze the results.
7. Treat fabrics with plasma and test for changes in surface properties.
8. Apply antimicrobial finishes and evaluate their effectiveness.
9. Set up a small-scale effluent treatment plant and analyze the results.
10. Conduct a life cycle assessment of a textile chemical process.

**List of Laboratory/Learning Resources Required:**

Laboratory jigger dyeing machine, Laboratory Winch machine, HTHP Kier boiler, Color matching cabinet, Stenter dryer, Padding mangle, 3D Printer, Digital Printing Machine, Color Fastness Tester, Washing Fastness Tester, Grey scale for washing and rubbing fastness etc.

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