24SC805 COLOUR AND TEXTILE CHEMISTRY 3 1 0 4

Year of Introduction: 2024

Course Description:
This course delves into the integration of color chemistry, fiber chemistry, and medical applications, with a specific focus on natural fibers. It emphasizes eco-friendly and sustainable practices in medical textiles, aiming to equip students for careers in textile innovation, healthcare applications, and sustainable textile development.

Learning Objectives

- Gain substantial knowledge about the chemistry of mordants, dyes, and pigments, including their structures and diverse applications across various industries.
- Develop a foundational understanding of fibers and substrates, focusing on their properties, structures, and classifications.
- Investigate the unique effects of medical textiles and their applications in different areas of healthcare.

Pedagogy:

The color and textile chemistry pedagogy combines the science and art of dyeing and textile manufacturing with effective teaching strategies to ensure learners understand and apply these concepts in the field of textile chemistry. This comprehensive approach ensures that learners are equipped with the skills and insights needed to drive innovation and sustainability in the textile industry. By focusing on both technical and environmental aspects, the course aims to produce well-rounded professionals who can contribute positively to the industry and society.

Syllabus:

Unit 1 Dyes

Natural and Synthetic dyes- their sources and extraction. Synthetic and Natural Mordants, pre-, post, and simultaneous mordanting. Dye classes for principle applications in textile dyeing (acid dyes, direct dyes, reactive dye, disperse dye, vat dye, sulfur dye, basic dye, and solvent dye), Principles of dyeing, Modern methods of dyeing. Food colorants, fluorescent brighteners and optical whitening agents, Environmental issues, Wastewater treatment and dye removal from wastewater.

Unit 2 Chemistry of pigments

Flower pigments: chlorophylls, carotenoids, flavonoids, betalains, Anthocyanins - their structure – Application in the textile industry, paint industry, food industry, plastic industry. Phthalocyanine: Copper Phthalocyanine, applications. Fluorescent brightening agents.

Unit 3 Fibre and their classification

Basic requirements for fibre formation: Intra- and inter-molecular forces, degree of order, degree of orientation of molecular chains, crystalline and amorphous regions – Influence of molecular structure on crystallisation. Similarities and differences amongst the structural features of natural and man-made fibres. Analysis of charts from X-ray diffraction methods.

Unit 4 Properties of fibres

Properties of fibres, Measurement of physical properties i.e. length, denier, strength, elongation, modulus, work of rupture, crimp, spin finish, fibre quality index etc., Hysteresis in moisture absorption. Load elongation, breaking strength, breaking extension, tensile Stress, tensile strain, mass-specific stress, yield point, initial modulus, work of rupture and work factor. Stress-strain curves for various textile fibres and their significance

Reflection of light – specular and diffused reflection, lustre index, factors influencing lustre. Thermal properties – specific heat, thermal conductivity, thermal expansion and contraction, structural changes in fibres on heating, heat setting of various fibres.

Unit 5 Medical applications

Medical textiles- classification of medical textiles- non-implantable material wound dressings, bandages, plasters, etc,.Extra-corporal devices – Artificial kidney, liver lung, implantable material- suture, a soft tissue implant, Orthopedic implants, Cardiovascular implants, Healthcare/ hygiene products, medical cost, surgical gown, face mask etc.

REFERENCES

1. Morton W.E and Hearle., J.W.S., “Physical Properties of Textile Fibres”, The Textile Institute, Manchester, U.K., 4th Edition,2008.

2. Handbook of natural dyes and pigments: Har Bhajan Singh, Kumar, Avinash Bharati, Woodhead Publishing India Pvt Ltd, 2014.

3. Gupta V.B., “Textile Fibres: Developments and Innovations”, Vol. 2, “Progress in Textiles: Science & Technology”. Edited by V.K. Kothari, IAFL Publications, 2000.

4. Meredith R ., “Mechanical Properties of Textile Fibres”, North Holland, Amsterdam 1986.

5. Gohl E.P.G. and Vilensky L.D., “Textile Science”, second edition, CBS Publisher and Distributor, 1983.

6. Mishra, S.P., Fibre Science & Technology, New Age International Publishers, 2000.

7. Gupta V.B. and Kothari V.K., “Manufactured Fibre Technology”, Chapman and Hall, 1997

Course Outcome:

CO1: Acquire an understanding of the sources, chemical properties, and extraction methods of natural and synthetic dyes.

CO2: Understand the environmental impact of dye industry wastewater and apply treatment methods to remove contaminants, ensuring sustainable water management.
CO3: Comprehend the composition, classification, and performance of natural fibers,
CO4: Evaluate the physical, optical, and thermal properties of fibers, and understand factors influencing their performance using techniques like stress-strain testing.
CO3: Explore the potential of natural fibers as agents in medical textile research.

Evaluation Pattern:

Internal – weightage -50

External – weightage - 50

For Internal –

Midterm weightage – 30

Continuous Assessment – 20 – Tutorials/Assignments/Seminars

Employability: The student will get the opportunity to work as a Textile chemist, Quality control manager, product development specialist, sustainability expert, and Textile process specialist.