CHE-341-MN-T: INTERDISCIPLINARY CHEMISTRY

Course Type: Minor Theory **Credits: 2**

A. Course Objectives:

1. To introduce the interdisciplinary role of chemistry in analytical science, healthcare, environment, agriculture, and industry.
2. To develop understanding of basic analytical and spectroscopic techniques used in modern science and technology.
3. To familiarize students with concepts of quality assurance, calibration, data handling, and analytical measurements.
4. To provide knowledge of modern materials such as polymers and nanomaterials and their real-life applications.
5. To create awareness about electrochemical systems, renewable energy resources, and sustainable technologies.
6. To promote scientific thinking and problem-solving skills through application-oriented chemistry concepts.

B. Course Outcomes (COs):

CO No.	Course Outcome Statement (COs) *After learning the course, the students are able to -*
CO-1	Recall basic concepts of analytical chemistry, sampling, and quality assurance.
CO-2	Explain principles and applications of spectroscopic and analytical techniques.
CO-3	Apply statistical and calibration methods in analytical chemistry.
CO-4	Analyze applications of spectroscopy, polymers, nanomaterials, and batteries.
CO-5	Evaluate renewable energy resources and sustainable technologies.
CO-6	Develop interdisciplinary understanding for practical chemical applications.

C. Contents:

Prerequisites	
Students should have a basic understanding of chemistry including fundamental concepts of atoms, molecules, chemical reactions, and states of matter. They should also possess awareness of basic laboratory safety practices, scientific measurements, and elementary mathematical skills related to percentage, mean, and simple numerical calculations.	
Chapter 1: Chemistry in Analysis, Quality and Everyday Applications	**10 Hours**
1. Recapitulation: Introduction to Analytical Chemistry: Meaning, scope, and	

importance of analytical chemistry, Role of chemistry in medicine, food, agriculture, environment, and industries, Classical and instrumental methods, Qualitative and quantitative analysis, Steps in chemical analysis

2. **Sampling and Quality Assurance:** Sampling of solids, liquids, and gases, Sampling errors, Good Laboratory Practices (GLP), Laboratory safety, Quality control (QC)
3. **Errors and Data Handling:** Error and its types, Accuracy and precision, Mean, median, and standard deviation, Confidence limits and reliability of results, related problems
4. **Calibration and Analytical Concepts:** External and internal calibration, Standard addition method, Sensitivity of analytical instruments, Limit of Detection (LOD), Limit of Quantification (LOQ), Applications in water testing, food analysis, and pharmaceuticals

Chapter 2: Spectroscopic Methods	**10 Hours**

1. **Introduction to Spectroscopic Methods:** Interaction of light with matter, Importance of spectroscopy, Applications in medicine, environmental monitoring, and forensic science
2. **UV–Visible Spectroscopy:** Principle of UV–Visible spectroscopyBeer–Lambert law, Electronic transitions, Instrumentation: source, monochromator, detector, Applications in pharmaceutical analysis, food color analysis, and pollution monitoring
3. **Atomic Spectroscopy:** Principle of Atomic Absorption Spectroscopy (AAS), Flame and graphite furnace methods, Basic concept of ICP–OES, Applications in trace metal analysis of water, soil, food, and biological samples

Chapter 3: Materials and Energy	**10 Hours**

1. **Polymers and Plastics:** Introduction to polymers and plastics, Types and properties of polymers, Structure–property relationship, Applications in packaging, healthcare, electronics, and textiles, Biodegradable plastics and environmental concerns
2. **Nanomaterials:** Introduction to nanotechnology and nanomaterials, Properties of nanomaterials, Applications in medicine, cosmetics, sensors, electronics, and water purification
3. **Batteries and Electrochemistry:** Basic redox reactions and electrochemistry, Working principles of common batteries, Lithium-ion batteries and applications, Applications in electric vehicles and renewable energy storage
4. **Solar Energy and Photochemical Conversion:** Solar energy as a renewable resource, Photochemical conversion, Working principle of solar cells, Green and sustainable energy technologies

References:

1. Skoog, D. A., Holler, F. J., and Crouch, S. R., Principles of Instrumental Analysis, 7th Edition, Cengage Learning, 2017.
2. Christian, G. D., Analytical Chemistry, 7th Edition, Wiley India, 2013.
3. Khopkar, S. M., Basic Concepts of Analytical Chemistry, 3rd Edition, New Age International Publishers, 2008.
4. Sharma, B. K., Instrumental Methods of Chemical Analysis, 24th Edition, Goel Publishing House, 2005.
5. Callister, W. D., and Rethwisch, D. G., Materials Science and Engineering: An Introduction, 9th Edition, Wiley, 2014.
6. Poole, C. P., and Owens, F. J., Introduction to Nanotechnology, 1st Edition, Wiley India, 2007.
7. Gowariker, V. R., Viswanathan, N. V., and Sreedhar, J., Polymer Science, 1st Edition, New Age International Publishers, 1986.
8. Twidell, J., and Weir, T., Renewable Energy Resources, 3rd Edition, Routledge, 2015.