



COURSE CONTENT

ENGINEERING CHEMISTRY								
I Semester: CSE								
II Semester: CE / CSD / CSM / ECE / EEE / ME								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
24X0009	Foundation	3	0	0	3	40	60	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: There are no prerequisites to take this course.								

Course Overview:

This course provides on practical relevance, covering water chemistry for industrial use, fuel properties, polymer types, and corrosion control, linking core chemistry to engineering disciplines.

Course Objectives:

1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion, along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering.
4. To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes: After Completion of the Course, Students should be able to

CO1: Understand the fundamental properties of water and its applications in both domestic and industrial purposes.

CO2: Acquire the knowledge of electro chemical processes and their relevance to corrosion and its control methods.

CO3: Determine the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs.

CO4: Understand the basic concepts and properties of polymers and other engineering materials.

CO5: Apply the medicinal values in daily life

UNIT - I: Water and its treatment: [8]

Introduction to hardness of water – Estimation of hardness of water by complexometric method and related numerical problems. Potable water and its specifications - Steps involved in the treatment of potable water-Disinfection of potable water by chlorination and break-point chlorination. Boiler troubles: Sludges, Scales and Caustic embrittlement. Internal treatment of Boiler feed water - Calgon conditioning - Phosphate conditioning - Colloidal conditioning, External treatment methods -

Softening of water by ion- exchange processes. Desalination of Brackish water – Reverse osmosis.

UNIT – II Battery Chemistry & Corrosion [8]

Introduction-Classification of batteries-primary, secondary and reserve batteries with examples. Basic requirements for commercial batteries. Construction, working and applications of: Lithium ion battery, Applications of Li-ion battery to electrical vehicles. Fuel Cells- Differences between battery and a fuel cell. Construction and applications of Hydrogen Oxygen fuel cell. Solar cells - Introduction and applications of Solar cells. Corrosion: Causes and effects of corrosion – theories of chemical and electrochemical corrosion mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current methods. Surface coatings-Metallic Coatings-Hot Dipping-Galvanization, Tinning

UNIT - III: Polymeric materials: [8]

Definition – Classification of polymers with examples – Types of polymerizations–addition (Mechanism of free radical addition) and condensation polymerization with examples – Nylon 6:6. Plastics: Definition and characteristics- thermoplastic and thermosetting plastics, Preparation, Properties and engineering applications of PVC, Teflon, Fiber reinforced plastics (FRP). Rubbers: Natural rubber and its vulcanization. Elastomers: Characteristics –preparation – properties and applications of Buna-S Thiokol rubber. Conducting polymers: Characteristic, Classification and applications of conducting polymers. Biodegradable polymers: Concept and advantages - Poly vinyl alcohol and their applications.

UNIT - IV: Energy Sources: [8]

Introduction, Calorific value of fuel – HCV, LCV- Dulong’s formula. Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, Knocking – octane and cetane rating, synthetic petrol - Fischer Tropsch’s process; Gaseous fuels – composition and uses of natural gas, LPG and CNG.Bio Diesel-Transesterification-advantages.

UNIT - V: Engineering Materials: [8]

Cement: Portland cement, its composition, setting and hardening, special cements-white cement, waterproof cement, high alumina cement.

Smart materials and their applications: - Classification-(piezoelectric materials-quartz, Shape memory material (SMA-Nitinol), Thermo responsive materials, magneto rheological materials- Examples.

Lubricants: Classification of lubricants with examples-characteristics of a good lubricants mechanism of lubrication (thick film, thin film and extreme pressure)- properties of lubricants: viscosity, cloud point, pour point, flash point and fire point.

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi, Dr. P. Aparna and Rath, Cengage learning, 2025.

REFERENCE BOOKS:

1. Engineering Chemistry: by Thirumala Chary Laxminarayana & Shashikala, Pearson Publications (2020)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.
3. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.
4. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
5. Challenges and Opportunities in Green Hydrogen by Editors: Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
6. Raman Spectroscopy in Human Health and Biomedicine, <https://www.worldscientific.com/doi/epdf/10.1142/13094>

ELECTRONIC RESOURCES:

1. <https://libguides.wits.ac.za/chemical>
2. <https://eng.libretexts.org>
3. <https://nptel.ac.in/courses/104105039>
4. https://ftp.idu.ac.id/wp-content/uploads/ebook/tdg/ADVANCED%20MATERIAL%20DESIGN/epdf.pub_advanced-functional-materials.pdf
5. [https://eng.libretexts.org/Bookshelves/Environmental_Engineering_\(Sustainability_and_Conservation\)/Energy_Conservation_for_Environmental_Protection_\(Pisupati\)/01%3A_Energy_and_Society/1.04%3A_New_Page](https://eng.libretexts.org/Bookshelves/Environmental_Engineering_(Sustainability_and_Conservation)/Energy_Conservation_for_Environmental_Protection_(Pisupati)/01%3A_Energy_and_Society/1.04%3A_New_Page)

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos