ENGINEERING CHEMISTRY

Common to ECE, CSE, IT, CSE(AI&ML) & CSE(DS) Branches

21CH102BS/21CH202BS.

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Course Objectives:

1. To bring adaptability to the concepts of electrochemistry and to create awareness on corrosion and its control.
2. To impart knowledge on various aspects of water and its treatment.
3. To acquire the knowledge of engineering materials like polymers, plastics, fibers and rubbers.
4. To impart the knowledge of applications of green chemistry and green fuels.
5. To acquire the knowledge on various spectroscopic techniques and to apply them for medical and other fields.

Course Outcomes: After completion of the course, student would be able to

CO 1: Explain the principles and concepts of electrochemistry. Analyse the problem of corrosion in industry.
CO 2: Explain the hardness of water and its treatment methods.
CO 3: Analyse the knowledge of fundamental principles to make predictions about the general properties of polymeric materials.
CO 4: Explain the concept, applications of green chemistry and green fuels.
CO 5: Apply required skills of various spectroscopic techniques in medical and other fields.

Unit - I: Electrochemistry and corrosion:(10 hours)

Electrochemistry: Electrode-Electrode potential, standard electrode potential electrochemical cells. Nernst Equation- derivation and its applications. Electrochemical series and its applications. Construction and Working of Calomel, Quinhydrone and glass electrode. Determination of pH of a solution by using Quinhydrone electrode. Numerical problems.

Corrosion: Causes and effects of corrosion: Theories of corrosion: Chemical and Electrochemical corrosion- mechanism of electrochemical corrosion. Factors affecting rate of corrosion. Corrosion control methods-Cathodic Protection-Sacrificial anodic and impressed current cathodic protection. Surface coatings: Metallic Coatings-Methods of applying metallic coatings- Hot dipping-Galvanization- Tinning – Cementation-Metal cladding- Electroplating (Copper) and Electroless plating (Nickel).

Unit - II: Water and its treatment:(10 hours)

Hardness of water – Causes of hardness - Types of hardness: Temporary and Permanent – Expression of hardness in terms of equivalents of $CaCO_3$ and units of hardness. Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in the treatment of Potable water – Disinfection of water by Chlorination and Ozonization. Boiler feed water- internal treatment – Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water – Ion exchange process. Desalination of water – Reverse osmosis. Numerical problems.

Unit - III: Polymeric materials: (10 hours)

Polymers: Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples.

Plastics: Definition and characteristics- Thermoplastic and Thermosetting resins, compounding and moulding of plastics -compression and injection moulding. Preparation, properties and engineering applications of PVC and Bakelite.

Fibers: Characteristics of fibers – preparation, properties and applications of Nylon-6, 6 and Dacron.

Fiber reinforced plastics (FRP) – Applications.

Rubbers: Natural rubber and its vulcanization - compounding of rubber.

Elastomers: Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.

Biodegradable polymers: Concept and advantages of biodegradable polymers– preparation, properties and applications of Poly vinyl alcohol.

Unit - IV: Green Chemistry and Green Fuels: (10 hours)

Green Chemistry- Introduction, Principles of green chemistry- Prevention, Atom economy, Less hazardous chemical synthesis, Designing safer chemicals, Use of safer solvents and auxiliaries, Design for energy efficiency, Use of renewable feedstock, Reduce derivatives, Use of catalyst, Design for degradation, Analysis in real time to prevent pollution and Inherently safer chemicals for accident prevention-Applications.

Green Fuels: Biodiesel – Concept, Transesterification and Advantages; Hydrogen- sources, preparation, storage, applications, advantages and limitations- Composition, properties and applications, of LPG and CNG- Alcohol blended fuel concept and advantages

Unit - V: Spectroscopic techniques and applications:(10hours)

Introduction to Spectroscopic techniques-Electronic spectroscopy- Beer lambert's law, Principle of UV- Visible spectroscopy, selection rules, types of electronic transitions and applications of UV visible spectroscopy; Vibrational and rotational spectroscopy-IR (Infra-red) spectroscopy Principle, mode of vibrations, selection rules and applications of IR spectroscopy-Nuclear magnetic resonance Spectroscopy- principle, chemical shift and applications of NMR spectroscopy- Introduction to Magnetic resonance imaging (MRI) and its medical applications.

TEXTBOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company,New Delhi, 17th Edition 2015.
2. Engineering Chemistry by Rama Devi, Prasanta Rath and Ch. VenkataRamanaReddy and Cengage publications, (2018)
3. Fundamentals of Molecular Spectroscopy, by C.N. Banwell, 4th Edition.

REFERENCES:

1. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi(2015)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi(2011)
3. Engineering Chemistry by Thirumala Chary and Laxminarayana, Scitech Publishers, Chennai (2016).
4. Engineering Chemistry (NPTEL Web-book), by B.L. Tembe, Kamaluddin and M.S. Krishnan