

I B. Tech. - II Semester
(19BT1BS04) ENGINEERING CHEMISTRY
(Common to ECE, EEE & EIE)

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
40	60	100	3	-	-	3

PRE-REQUISITES: -

COURSE DESCRIPTION: Atomic Structure and Bonding Theories; Water Treatment; Electrochemistry and Applications; Corrosion; Instrumental Methods and Applications; Fuel chemistry and Lubricants.

COURSE OUTCOMES: After successful completion of the course, students will be able to:

- CO1. Apply the basic knowledge of quantum mechanical approach to atomic structure and bonding theories to identify shapes of different orbitals and molecules.
- CO2. Analyze and solve problems associated with hardness of water, boiler troubles and address the societal, health and safety issues related to quality of water.
- CO3. Apply the basic knowledge of corrosion phenomenon to identify solutions for control of corrosion and demonstrate competency in the basic concepts of electrochemical cells.
- CO4. Demonstrate the basic knowledge of instrumental methods and their applications in the structural analysis of materials.
- CO5. Apply the basic knowledge of fuel chemistry and lubricants to identify the quality of fuels and lubricants.

DETAILED SYLLABUS:

Unit I: Atomic Structure and Bonding Theories (9 Periods)

Quantum-mechanical model of atom, Schrodinger wave equation, significance of Ψ and Ψ^2 , applications to particle in a box and hydrogen atom; Molecular orbital theory – bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of N_2 , O_2 , NO and CO; π -molecular orbitals of butadiene and benzene; VSEPR theory and molecular shapes.

Unit II: Water Treatment**(9 Periods)**

Introduction, types of water, Impurities in water and their consequences. Hardness of water, units of hardness, disadvantages of hardness, measurement of hardness by EDTA method, numerical problems on measurement of hardness of water, boiler troubles-priming & foaming, scales & sludge, caustic embrittlement, boiler corrosion, softening of water– Ion exchange process, zeolite process, desalination of brackish water by reverse osmosis, Drinking water treatment- Ozonisation & chlorination, specifications of potable water as per WHO and BIS standards. Fluoride in ground water: Effects on human health, defluoridation method – Nalgonda method; merits and demerits of various defluoridation methods.

Unit III: Electrochemistry and Applications**(10 Periods)**

Electrode potential, Nernst equation, reference electrodes (Calomel electrode and glass electrode), electrochemical cell, cell potential calculations. Primary cells – dry cell, alkali metal sulphide batteries, Secondary cells – lead acid, lithium ion batteries, Fuel cells - Hydrogen-oxygen fuel cell, Methanol-oxygen fuel cell, Solid-oxide fuel cell.

Corrosion: Introduction, Definition, types of corrosion- wet (galvanic corrosion, concentration cell corrosion) and dry corrosion, Factors influencing corrosion, control of corrosion- sacrificial anodic protection, Impressed current cathodic protection, electroplating method (Nickel).

Unit IV: Instrumental Methods and Applications**(9 Periods)**

Introduction to spectroscopy–types of energy present in molecules, types of spectra, UV-Vis spectroscopy – principle, types of electronic transitions, chromophore, auxochrome, Bathochromic shift, Hypsochromic shift, Instrumentation of UV-Vis spectrophotometer, applications; Infrared spectroscopy – principle, types of vibrational modes, group frequencies, Instrumentation of IR spectrophotometer, applications. principle and applications of physicochemical methods (SEM, TEM, X-ray diffraction).

Unit V: Fuel chemistry and Lubricants**(8 Periods)**

Fuel chemistry: Types of fuels, calorific value, numerical problems based on calorific value; Liquid fuels, cracking of oils (Thermal and Fixed-bed catalytic cracking), knocking and anti-knock agents, Octane and Cetane values, Synthetic petrol: Fischer-Tropsch method and Bergius process.

Lubricants: Definition, functions of lubricants, mechanism of lubrication, classification of lubricants, properties of lubricants – viscosity and viscosity index , flash and fire points, cloud and pour points, Aniline points, neutralization number and mechanical strength.

Total Periods: 45

TEXT BOOKS:

1. P. C. Jain & Monika Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 16th edition, 2013.
2. K. N. Jayaveera, G. V. Subba Reddy and C. Ramachandriah, *Engineering Chemistry*, Mc.Graw Hill Publishers, New Delhi.

REFERENCE BOOKS:

1. J. D. Lee, *Concise Inorganic Chemistry*, Oxford University Press, 5th edition 2010.
2. Skoog and West, *Principles of Instrumental Analysis*, Thomson, 6th edition, 2007.
3. Peter Atkins, Julio de Paula and James Keelar, *Atkins' Physical Chemistry*, Oxford University Press, 10th edition, 2010.