

2018-19 Onwards (MR-18)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech		
Code: 80B03	Engineering Chemistry (Common for CSE, ECE, EEE, IT, CE, ME and Min.E)	L	T	P
Credits: 4		3	1	-

Course objectives:

The purpose of this course is to emphasize the relevance of fundamentals of chemical sciences in the field of engineering and to provide basic knowledge on atomic- molecular orbital's, electrochemistry, batteries, corrosion and the role of water as an engineering material in domestic-industrial use. They will also impart the knowledge of stereochemistry, understanding the chemical reaction pathway mechanisms and synthesis of drugs.

Module I: Water and its treatment

[10 Periods]

Introduction to water, hardness of water, causes of hardness, expression of hardness, units and types of hardness-Numerical Problems. Alkalinity of water, specifications of potable water (BIS); Estimation of temporary & permanent hardness of water by EDTA method. Boiler troubles - Scale & Sludge, Priming and foaming, caustic embrittlement and boiler corrosion; Treatment of boiler feed water - Internal treatment (colloidal, phosphate, carbonate and calgon conditioning). External treatment - Lime Soda process (cold & hot) and ion exchange process, Numerical Problems. Disinfection of water by chlorination and ozonization. Desalination by Reverse osmosis and its significance.

Module II: Molecular structure and Theories of Bonding:

[10 Periods]

Introduction to Molecular orbital Theory. Linear Combination of Atomic Orbital's (LCAO), significance of bonding and anti-bonding molecular orbital, Conditions for the formation of molecular orbital's. Molecular orbital energy level diagrams of diatomic molecules -, N₂, O₂ and F₂. Introduction to coordination compounds-ligand-coordination number (CN) - spectrochemical series. Salient features of crystal field theory, Crystal field splitting of transition metal complexes in octahedral ([CoF₆]³⁻ and [Co(CN)₆]³⁻) and tetrahedral ([NiCl₄]²⁻ and [Ni (CN)₄]²⁻) fields - magnetic properties of complexes. Band structure of solids and effect of doping on conductance.

Module III: Electrochemistry and Corrosion

A. Electrochemistry:

[7 Periods]

Introduction to Electrochemistry-Conductance (Specific and Equivalent) and units. Types of cells-electrolytic & electrochemical cells (Galvanic Cells)-Electrode potential- cell potential (EMF).Electrochemical series and its applications, Nernst equation its applications and numerical problems. Reference electrodes - Calomel Electrode, Quinhydrone electrode and Glass electrode-determination of pH using glass electrode. Batteries: Primary (dry cells) and secondary (Lead-Acid cell, Ni-Cd cell) - applications of batteries. Fuel cells: Hydrogen - Oxygen fuel cell and its applications.

B. Corrosion:**[7 Periods]**

Causes and effects of corrosion: Theories of corrosion - Chemical & Electrochemical corrosion, Pilling-Bedworth rule, Types of corrosion: Galvanic and Water-line corrosion. Factors affecting rate of corrosion-Nature of metal and Nature of Environment, Corrosion control methods - Cathodic protection (Sacrificial anodic and impressed current cathodic methods). Surface coatings: Methods of metallic coatings - hot dipping (Galvanization), Electroplating (Copper) and Electroless plating (Nickel).

Module IV: Stereochemistry & NMR Spectroscopy:**[7 Periods]**

Introduction to Isomers - classification of isomers - structural (chain, positional & functional) and stereoisomerism-geometrical (cis-trans & E-Z system) - characteristics of geometrical isomerism, optical isomerism (chirality - optical activity, specific rotation, enantiomers and diastereomers) of tartaric acid and lactic acid. Conformational isomerism of n-Butane. Introduction to Spectroscopy, Basic concepts of nuclear magnetic resonance spectroscopy, chemical shift, spin-spin splitting, coupling constant in 2-butene.

Module V: Reaction mechanism and synthesis of drug molecules**[10 Periods]**

Introduction to bond cleavage (homo & hetero cleavage) - reaction intermediates and their stability. Types of organic reactions - Mechanism of substitution (SN^1 & SN^2) - addition (Ad_E) - elimination (E_1 & E_2) reactions with suitable example. Ring opening (Beckmann rearrangement-preparation of Nylon-6), oxidation and reduction (Cannizzaro reaction), cyclization (Components of Diels-Alder reaction-Mechanism of Diels-Alder reaction with suitable example) reactions. Synthesis of Paracetamol, Ibuprofen and their applications.

Text Books:

1. P.C.Jain and Monica Jain, "A Text Book of Engineering Chemistry", DhanpatRai Publications, New Delhi, 16th Edition 2014.
2. S.S. Dara and S.S. Umare, "A Text Book of Engineering Chemistry", S Chand Publications, New Delhi, 12th Edition 2010.
3. B.R.Puri, L.R.Sharma and M.S.Pathania, "Principles of Physical Chemistry", S.Nagin Chand & Co., New Delhi, 23rd Edition, 1993.
4. Morrison and Boyd, "Organic chemistry", Pearson Education.Inc. 1992, 6th Edition
5. A.Jaya Shree, "Text book of Engineering Chemistry", Wiley, New Delhi, 2018.

Reference Books:

1. B.Rama Devi, Ch.VenkataRamana Reddy and PrasanthaRath, "Text Book of Engineering chemistry", Cengage Learning India Pvt.Ltd,2016.
2. M.G. Fontana and N. D. Greene, "Corrosion Engineering", McGraw Hill Publications, New York, 3rd Edition, 1996.
3. K. P. C. Volhardt and N. E. Schore, "Organic Chemistry: Structure and Function", 5th Edition, 2006.

e-Resources:**a) Concerned Website links:**

- 1) <https://books.google.co.in/books?isbn=0070669325> (Engineering chemistry by Sivasankar).
- 2) <https://www.youtube.com/watch?v=yQUD2vzfg8> (Hot dipping Galvanization).
- 3) https://archive.org/stream/VollhardtOrganicChemistryStructureFunction6th/Vollhardt_Organic_Chemistry_Structure_Function_6th_djvu.txt.

b) Concerned Journals/Magazines links:

- 1) <http://americanhistory.si.edu/fuelcells/sources.htm> (Fuel Cell Information Sources)
- 2) <https://www.abctlc.com/downloads/courses/WaterChemistry.pdf> (Water Chemistry)

c) NPTEL Videos:

- 1) npTEL.ac.in/courses/113108051/ (corrosion & electrochemistry web course)
- 2) <https://www.youtube.com/watch?v=V7-8EOfZKeE> (Stereochemistry)

Course Outcomes:

After completion of the course students will be able to:

1. Understand water treatment, specifically hardness of water and purification of water by various methods.
2. Acquire knowledge on electrochemical cells, fuel cells, batteries and their applications.
3. Analyze microscopic chemistry in terms of atomic and molecular orbital's splitting and band theory related to conductivity.
4. Acquire basic knowledge on the concepts of stereochemistry.
5. Acquire basic knowledge on chemical reaction mechanisms and that are used in the synthesis of molecules.