With effect from the academic year 2018-2019

CH 102 BS

ENGINEERING CHEMISTRY

Instruction	**:** (3L+1T) Hours/Week
Duration of SEE	**:** 3 Hours
SEE	**:** 70 Marks
CIE	**:** 30 Marks
Credits	**:** 4

COURSE OBJECTIVES:

To provide students with knowledge of engineering chemistry for building technical competence in Industry, Research and Development in the following fields:

- Thermodynamics and Electrochemistry
- Water chemistry and Corrosion
- Molecular Structure and Spectroscopy
- Engineering Materials
- Energy Sources and Nanomaterials

COURSE OUTCOMES:

The concepts developed in this course will help in quantification of several concepts in chemistry that have been introduced at the 10+2 level. Technology is being increasingly based on the Electronic, Atomic and Molecular level modifications. The course will enable the student to:

- Analyze microscopic chemistry in terms of atomic, molecular orbital's and intermolecular forces.
- Rationalize bulk properties and processes using thermodynamic considerations.
- Distinguishes the ranges of electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Gains knowledge in causes of corrosion and its prevention.
- Attains knowledge about the disadvantages of hard water for domestic and industrial purposes. Also learns the techniques of softening of hard water and treatment of water for drinking purpose.

UNIT-I

WATER CHEMISTRY AND CORROSION (10L):

Water chemistry: Hardness of water-Types and units of hardness, estimation of temporary and permanent hardness of water by EDTA method. Alkalinity of water and its determination. Water softening by Ion exchange and Reverse Osmosis methods. Boiler troubles-scales and sludge's formation-causes, effects and prevention. Numerical problems

Specifications of potable water. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization by Chlorination.

Corrosion-causes and its effects. Types of corrosion-Dry or Chemical corrosion and Wet or Electrochemical corrosion and their mechanism. Electrochemical corrosion and its types. Factors influencing rate of corrosion.

Corrosion control methods: Cathodic protection methods- Sacrificial anodic and Impressed current cathodic protection methods. Surface coating methods: Hot dipping-Galvanizing and Tinning.

UNIT-II

THERMODYNAMICS AND ELECTROCHEMISTRY (10L):

Thermodynamics: Definition of thermodynamic functions- Enthalpy, Entropy , Free energy and their significance. Variation of free energy change with temperature and pressure. Concept of spontaneity. Criteria of spontaneity in terms of entropy and free energy. Carnot cycle-efficiency of heat engine. Numericals.

Electrochemistry: Electrochemical cells- Electrolytic and Galvanic cells-notation, cell reaction and cell potentials. Types of electrodes-Calomel, Quinhydrone and Glass electrodes. Determination of P^H of a solution by using Quinhydrone electrode. Thermodynamics of emf of cells- Nernst equation and its derivation. Application of Nernst equation to electrode potential and emf of cells. Numericals. Principles and applications of Potentiometric titrations.

UNIT-III

MOLECULAR STRUCTURE AND SPECTROSCOPY (10L):

Molecular Orbital Theory. Linear Combination of Atomic Orbitals(LCAO).Molecular Orbital energy level diagrams of diatomic molecules-O_2,N_2 and NO. Crystal field theory, Crystal Field Splitting of d-orbitals of transition metal complexes in Octahedral, Tetrahedral and Square planar geometries. Magnetic properties of complexes.

Basic principles of Spectroscopy and selection rules of Vibrational, Rotational and Electronic Spectroscopy and their applications.

UNIT-IV

ENGINEERING MATERIALS: (10L)

Polymers: Introduction. Classification of polymers -Plastics, Fibres and Elastomers.

Preparation, properties and engineering applications of the following polymers:

Plastics: PVC and Bakelite

Fibers: Nylon 6:6, and Dacron.

Elastomers: Buna-S and Butyl Rubber.

Conducting polymers: Introduction. Mechanism of conduction in polymers. Intrinsic conducting polymers: Poly-acetylene and poly-aniline. Aplications of conducting polymers.

Liquid Crystals: Introduction. Classification of liquid crystals. Thermotropic, Lyotropic liquid crystals. Chemical constitution and liquid crystalline behavior. Nematic, Smectic and Cholestric liquid crystals and their applications.

UNIT-V

ENERGY SOURCES AND NANOMATERIALS (8L)

Batteries: Primary batteries-Zn carbon battery. Secondary batteries-Pb- Acid battery and Ni-Cd battery. Lithium-ion batteries- advantages and applications.

Fuel cells: Concept of fuel cells and their advantages. Construction and working of H_2-O_2 and methanol-Oxygen fuel cells.

Solar cells: Concept of solar energy conversion, photovoltaic cells.

Nanomaterials: Introduction. Properties of nanomaterials. Synthesis of nanomaterials-Top down, Bottom up approach and Sol-gel method. Applications of nanomaterials.

Suggested Readings:

1. Jain & Jain, *Engineering chemistry*, Dhanpat Rai publishing Co.,16th Edition.
2. B.L.Tembe,Kamaluddin and M.S.Krishnan, Engineering Chemistry(NPTELWeb-book)
3. Prashanth Rath, Engineering Chemistry, Cengage Learning.
4. M.J.Sienko and R.A.Plane, Chemistry: Principles and Applications, MGH Publishers.
5. B.H.Mahan, University Chemistry, Pearson Publishing Co., 4th Edition.

6. C.N. Banwell, *Fundamentals of Molecular Spectroscopy*, TMH