

# 16HS107 ENGINEERING CHEMISTRY

Hours Per Week :

L	T	P	C
3	-	-	3

## Course Description and Objectives:

This course aims to develop fundamental knowledge on new engineering materials and their significance in science and engineering applications. In addition, characterization of materials using basic and advanced experimental techniques is also offered. Besides, analysis of water sample and treatment method for domestic, commercial and industrial applications are also covered.

## Course Outcomes:

Upon completion of the course, the student will be able to

- CO1: Assess the quality of the water samples and identify suitable water purification methods.
- CO2: Analyze various batteries and fuel cells based on the principles of electrochemistry
- CO3: Analyze various factors affecting corrosion and apply proper corrosion control and prevention methods.
- CO4: Evaluate different synthetic procedures and properties of various polymers and apply them for engineering applications.
- CO5: Apply the principles of electromagnetic radiation to the spectroscopic methods for the analysis of different materials.

## SKILLS:

- ✓ *Analyse the total hardness of water sample.*
- ✓ *Understand the basic principles involved in various batteries.*
- ✓ *Understand the mechanisms of corrosion and various controlling methods.*
- ✓ *Synthesize various polymers.*
- ✓ *Identify the functional groups present in chemical compounds using Infrared and Ultraviolet instruments.*

## UNIT - 1

L-9

WATER TECHNOLOGY : Introduction, WHO, BIS standards of water; Hardness of water-determination of hardness by EDTA (numerical problems), disadvantages of hard water, scales and sludges, caustic embrittlement, boiler corrosion, priming and foaming; Softening methods - zeolite process, ion exchange process; Desalination of brackish water- reverse osmosis and electro dialysis.

## UNIT - 2

L-9

ELECTRO CHEMISTRY: Electrode potential; Electrochemical series; Nernst equation; Reference electrodes - Calomel and standard hydrogen electrode, ion selective electrode and glass electrode; Determination of pH by pH meter, primary cell and secondary cell (lead-acid storage cell and lithium ion battery); Fuel cell - hydrogen oxygen and methanol oxygen.

## UNIT - 3

L-9

SCIENCE OF CORROSION : Introduction, dry corrosion, wet corrosion and mechanisms of wet corrosion; Bimetallic corrosion - concentration cell corrosion; Factors influencing the rate of corrosion; Corrosion control methods - cathodic protection, electroplating, electroless plating and corrosion inhibitors.

## UNIT - 4

L-9

POLYMERS: Introduction; Types of polymerization - preparation, properties and applications of polyethylene, PVC, teflon, bakelite, urea, formaldehyde and silicones; Rubber – vulcanization; Synthetic rubbers - buna-S, buna-N and neoprene; Introduction to conducting polymers - poly thiophene.

## UNIT - 5

L-9

INSTRUMENTAL TECHNIQUES: Interaction of radiation with matter, UV - Visible Spectroscopy, Beer - Lambert's law, qualitative and quantitative analysis; Block diagram of UV-Visible spectrophotometer; IR Spectroscopy - types of vibrations and block diagram of IR spectrophotometer.

## TEXT BOOKS :

1. P.C Jain and M. Jain, "Engineering Chemistry", 17<sup>th</sup> edition, Dhanpat Rai Publications, 2010.
2. S. Chavala, "A Text book of Engineering Chemistry Engineering Materials and Applications", 3<sup>rd</sup> edition, Dhanpat Rai Publications, 2015.

## REFERENCE BOOKS:

1. K.S. Maheswaramma and M. Chugh, "Engineering Chemistry", 1<sup>st</sup> edition, Pearson publication, 2015.
2. M.R. Senapati, "Advanced Engineering Chemistry", 2<sup>nd</sup> edition, Lakshmi Publications, 2006.
3. H. W. Wilard and DeMerit, "Instrumental methods of Analysis", 7<sup>th</sup> edition, CBS Publications, 1986.
4. G. Raj and C. Anand, "Instrumental Methods of Analysis", 5<sup>th</sup> edition, Himalaya Publications, 2007.
5. J.D. Bares, M. Thomas, B. S. Sankar, J. Mendham and R.C Denney, "Vogel's Text book of Qualitative Chemical Analysis", 6<sup>th</sup> edition, Pearson Publications, 2009.
6. Dr.S. Rattan, "Experiments in Applied Chemistry", S.K. Kataria and Sons Publications, 2008.

## ACTIVITIES:

- Collect water samples from different villages near VFSTR University and determine the total hardness, and total alkalinity.
- Present the water analysis report to the villagers and suggest proper measures to be taken.
- Measure the rate of corrosion of iron objects by weight loss method.
- Identify some of the functional groups like carboxylic acid, aldehyde and ketones by I.R. Spectroscopy.
- Collect water sample from different villages and estimate the fluoride present in the raw water and suggest some steps for the removal of fluoride.