

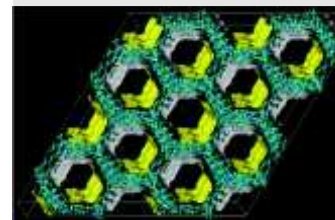
19HS119 ENGINEERING CHEMISTRY (B)

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	-	30	20	10	-	10	-	5



Source: Koya Prabhakara Rao et al., Adv. Funct. Mater. 2013, 23, 3525–3530

COURSE DESCRIPTION AND OBJECTIVES:

The course aims to cover the knowledge about the fundamentals of Chemistry and its applications, which are essential for developing new engineering materials for scientific and engineering applications. Besides these, the students are also expected to acquire knowledge on some contemporary advanced topics such as instrumental techniques, nanomaterials, polymers, batteries and fuel cells etc.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes	POs
1	Analyze the quality of water and design a suitable mechanism for its purification.	2,3
2	Apply various synthetic methods for preparing polymers for engineering applications.	1,2
3	Analyze and apply desirable characteristics in different engineering materials for industrial applications.	1,2,3
4	Apply the principle of electrochemistry for designing various batteries and fuel cells.	3,4
5	Apply the electromagnetic radiation to the spectroscopic methods for the analysis of engineering materials.	3,4,5,6

SKILLS:

- ✓ Analyze the total hardness of water sample.
- ✓ Synthesize various polymers.
- ✓ Identify the properties of different industrially relevant Engineering materials.
- ✓ Characterize chemical compounds by using UV and IR spectroscopic techniques.

UNIT - I**L-9****CHEMICAL BONDING AND WATER TECHNOLOGY:**

Chemical Bonding - Introduction to VBT and VSEPR theory; Crystal field splitting of octahedral and tetrahedral complexes; Molecular orbital theory of diatomic molecules (O_2 and CO), Molecular orbital energy diagram of octahedral complex, Ex: Hexamine Cobalt (II).

Water Technology - Hardness of water, Determination of hardness by EDTA and numerical problems; Softening of water by Ion-exchange process, Desalination of brackish water by electrodi-lysis, Reverse osmosis.

UNIT - II**L-9**

POLYMERS: Introduction-classification, Polymerization - types, Mechanism of addition polymeriza-tion; Preparation, properties and applications of polyethylene, Polymethyl methacrylate, Phenol formaldehyde, Nylon 6,6; Rubber-vulcanization, Synthetic rubbers – Buna-S, neoprene, conducting polymers (Ex: Polythiophene).

UNIT - III**L-9****ENGINEERING MATERIALS:**

Refractories - Classification and properties-refractoriness, refractoriness under load, Thermal stability, Thermal spalling, Porosity, Chemical inertness.

Lubricants - Classification, Properties - viscosity, viscosity index, flash and fire points, Cloud and pour points, Aniline number, Mechanical stability, Carbon residue.

Abrasives – Hardness of abrasive, natural and artificial abrasives - properties and applications

Nanomaterials - Carbon Nanotubes (CNT's) - Synthesis – electric arc discharge method and chemical vapor deposition method, Applications of CNT's in water purification and catalysis

UNIT – IV**L-9****BATTERIES AND CORROSION:**

Batteries - Electrode potential, Primary cell - Leclanche cell, Secondary cell - lead-acid storage cell, Lithium ion battery; Methanol oxygen fuel cell.

Corrosion - Introduction, Dry corrosion, Wet corrosion; Factors influencing the rate of corrosion – temperature, pH and dissolved oxygen; Corrosion prevention by cathodic protection.

UNIT – V**L-9****INSTRUMENTAL TECHNIQUES:**

Introduction to electromagnetic radiation

Electronic Spectroscopy of Organic Molecules - Selection rules, Beer-Lambert's law and its derivation, Numerical problems and applications, Instrumentation of UV-Visible spectrophotometer.

IR Spectroscopy - Selection rules, Types of vibrations, Instrumentation of IR spectrophotometer, Applications of IR Spectroscopy.

LABORATORY EXPERIMENTS

LIST OF EXPERIMENTS

TOTAL HOURS: 30

1. Determination of total alkalinity of water.
2. Determination of total hardness of water.
3. Determination of available Chlorine in bleaching powder.
4. Determination of Fe (II) by dichrometry method.
5. Preparation of phenol - formaldehyde resin.
6. Preparation of Nylon 6,6.
7. Preparation of nanomaterial.
8. Determination of strength of strong acid by pHmetry.
9. Determination of viscosity of lubricating oil.
10. Determination of Mn^{+7} by Colorimetry.
11. Removal of hardness by ion-exchange method.
12. Determination of strength of weak acid by conductometry.
13. Determination of rate of corrosion by weight loss method.

TEXT BOOKS:

1. P.C Jain and Monica Jain, "Engineering Chemistry", 17th edition, DhanpatRai Publications, 2010.
2. Shashi Chawala, "A Text book of Engineering Chemistry Engineering Materials and Applications", 3rd edition, Dhanpat Rai Publications, 2015.
3. K.S. Maheswaramma and Mridula Chugh, "Engineering Chemistry", 1st edition, Pearson publication, 2015.

REFERENCE BOOKS:

1. H. W. Wilard and Demerit, "Instrumental Methods of Analysis", 7th edition, CBS Publications, 1986.
2. Gurudeep Raj and Chatwal Anand, "Instrumental Methods of Analysis", 5th edition, Himalaya Publications, 2007.
3. Shikha Agarwal, "Engineering Chemistry: Fundamentals and Applications", 2nd edition, Cambridge Publications, 2019.

LABORATORY MANUAL:

1. Sunita Rattan "Experiments in Applied Chemistry", S.K. Kataria & Sons Publications, 2008.

Activities:

- o *Electroplating and Electroless plating on different metal surfaces.*
- o *Analysis of water and its purification.*
- o *Battery construction.*
- o *Preparation of soaps and detergents.*