BS 103 CH

ENGINEERING CHEMISTRY-I
(Common to all branches)
Credits: 3

Instruction: (3L) hrs per week   **Duration of SEE: 3 hours**
CIE: 30 marks   **SEE: 70 marks**

Objectives:
- To acquaint a knowledge in thermodynamic principles and their applications
- To explore water softening methods and domestic water treatment
- To study the classification, preparation, properties and uses of polymers.

Outcomes:
- The student able to predict the feasibility of a particular physical or chemical process
- It is possible to establish the conditions for heterogeneous equilibrium between different phases.
- It is possible to assess the quality of water to be used in boilers and for domestic usage.
- From the knowledge of the properties of engineering materials, it is possible to use in different industrial applications**.**

Unit–I:THERMODYNAMICS: Definition of the terms-system and surroundings. Types of thermodynamic systems and processes. State and path function. Extensive and Intensive properties. The concept of reversible and irreversible processes. Work done in isothermal and adiabatic reversible and irreversible processes. First law of thermodynamics and its limitations.

Need for Second law and its statement. Spontaneous and non-spontaneous processes. The Carnot cycle, efficiency of reversible heat engine. Carnot theorem. Concept of entropy – entropy changes in reversible and irreversible processes. Physical significance of entropy. Gibbs and Helmholtz free energy and their significance. Variation of free energy with temperature and pressure. Criteria for spontaneity of a process in terms of entropy and free energy. Numerical problems.

Unit–II: PHASE RULE: Definition of terms phase, component and degrees of freedom. Statement of Phase rule. Phase rule equation and its application to one component system - water system. Condensed phase rule and two components system - Pb-Ag system. Pattinson's process of desilverization of lead. Copper –Nickel(Cu-Ni) system. Safety fuses and Solders.

Unit–III:WATER CHEMISTRY: Hardness of water – Types-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-scale and sludge formation-causes, effects and prevention. Priming and foaming. Specifications of potable water. Water treatment for drinking purpose-coagulation, sedimentation, filtration, sterilization by a) Chlorination b) Ozonolysis. Concept of break point chlorination. Numerical problems.

Unit–IV:POLYMER CHEMISTRY: Definition of the terms-monomer, polymer, homo, co, homo-chain, hetero-chain and graft Co-polymers. Classification - natural and synthetic polymers, Addition and condensation polymers, thermo-plastic and thermosetting polymers, plastics, elastomers and fibers.

Preparation, properties and engineering applications of the following polymers:

a) **Plastics:** PVC and Bakelite
b) **Fibers**: polyesters and polyamides- Nylon-6,6 and Kevlar
c) **Elastomers**: Natural rubber and its chemical structure, vulcanization of rubber and its significance. Buna-S and Butyl rubbers.

Conducting polymers-Introduction, mechanism of conduction in polymers. Intrinsic conducting polymers: Poly-acetylene and poly-aniline. Applications of conducting polymers.

Unit–V:ENGINEERING MATERIALS:-I:Lubricants: Definition, mechanism of lubrication. Hydrodynamic, Boundary and Extreme pressure lubrication. Classification of lubricants –solid, semi-solid and liquid lubricants- properties of lubricants: viscosity, viscosity index, saponification number and acid value.

Refractories: Definition –classification- Requirements of a good refractory material. Properties of Refractories: i) Refractoriness ii) Refractoriness under Load (RUL) iii) Porosity iv) Thermal Spalling.

Clay Products: Whitewares-manufacture, purpose and method of glazing.

Suggested Readings:

1. Puri, Sharma and Pathania, *Principles of Physical Chemistry*, Vishal Publishing Co., 47th Edition (2015).
2. P.C Jain & Monica Jain, *Engineering Chemistry* , Dhanapathi Rai publishing Co. 16th Edition (2015)
3. Shashi Chawla, *Text book of Engineering Chemistry*, Dhanapathi Rai publishing Co. 3rd Edition(2003).
4. Shikha Agarwal, *Engineering Chemistry,* Cambridge university Press,2015.
5. O.G. Palanna, *Engineering Chemistry*, TMH Edition(2009).
6. C. Parameshwara Murthy, CV Agarwal, Andhra Naidu, *Engineering Chemistry*, BS Publcations(2006).

BS 152 CH

ENGINEERING CHEMISTRY LAB -I
(Common to all branches)
Credits: 1

Instruction: 2 hrs per week   **Duration of SEE: 2 hours**
CIE: 25 marks   **SEE: 50 marks**

VOLUMETRIC ANALYSIS

1. Introduction to Volumetric Analysis.
2. Techniques of weighing and usage of analytical balance

PERMANGANOMETRY

3. Preparation of a standard solution of Oxalic acid or Sodium oxalate and standardization of $KMnO_4$ solution
4. Preparation of standard solution of Mohr salt, standardization of $KMnO_4$ solution and estimation of ferrous Iron in the given solution

DICHROMETRY

5. Preparation of a standard solution of potassium dichromate, standardization of Mohr salt solution and estimation of dichromate in the given solution.
6. Estimation of ferrous and ferric ions in the given mixture by using standard $K_2Cr_2O_7$ solution
7. Preparation of a standard solution of Potassium dichromate – Standardization of Mohr salt solution –determination of chemical oxygen demand.

ACIDMETRY

8. Preparation of a standard sodium carbonate solution and standardization of hydrochloric acid and estimation of carbonate and bicarbonate in the given mixture.
9. Estimation of alkalinity of Water.

COMPLEXOMETRY

10. Preparation of standard magnesium sulphate solution and standardization of EDTA solution and estimation of total hardness in the given sample of water.
11. Estimation of temporary and permanent hardness of water by the EDTA method.

Suggested ReadingsS: J. Mendham and Thomas**,** "*Vogel's Text book of quantitative chemical analysis*", Person education Pvt. Ltd, 6th Edition(2002).