PHYSICAL CHEMISTRY

Course Code: 13BC1102

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Course Educational Objectives:

The course attempts to provide the principles and applications of physical chemistry which are essential for a chemical engineering student.

Course Outcomes:

The student can be able to apply

- ✤ The laws and principles of distribution and thermodynamics
- ✤ The rates and mechanism of a catalytic reactions
- ✤ The principles of phase rule to a heterogeneous system whereever necessary

UNIT-I (8 Lectures)

DISTRIBUTION LAW:

Statement-Nernst Distribution law, Explanation and limitations of law, Modification of Distribution law when association or dissociation of the solute occurs, Determination of Equilibrium constant from Distribution coefficient, Extraction of a solute from solution with an immiscible solvent, Applications of Distribution law, partition chromatography .

UNIT-II (12 Lectures)

CHEMICAL KINETICS:

Basic Terms, Methods of determining order of reaction, Theories of reaction rates- Arrhenius, Collision and Absolute reaction rate theories, Influence of ionic strength on the rates of reaction, Simultaneous reactions- Consecutive reactions, Parallel reactions, Reversible or opposing reactions, Chain reactions- Hydrogen and chlorine & Hydrogen and bromine, Fast reactions-stopped flow and relaxation techniques.

UNIT-III (10 Lectures)

CATALYSIS:

Definition - Types- Homogeneous and heterogeneous catalysis, Characteristics of catalytic reactions, Promoters, Catalytic poisoning, Retardation, Autocatalysis, Activation energy and catalysis, Mechanism of Catalysis , Acid-base catalysis- Protolytic and Prototropic mechanism, Enzyme catalysis-Mechanism of enzyme catalysis-Characteristics of enzyme catalysis.

UNIT-IV (15 Lectures)

THERMODYNAMICS :

Thermodynamic terms and Basic concepts, Thermodynamic processes- Reversible and irreversible process, pressure-volume work, Internal energy, First Law of thermodynamics ,Enthalpy, Molar Heat Capacities, Isothermal and Adiabatic expansion of an ideal gas .

Spontaneous process- Entropy- Second Law of thermodynamics, Carnot Cycle- Derivation of entropy from Carnot cycle – Physical significance of entropy, Free energy, Gibbs Helmholtz Equation,Clausius-Clapeyron Equation, Van't hoffs isotherm and isochore,Third law of thermodynamics.

UNIT-V (15 Lectures)

PHASE RULE AND COLLOIDS:

PHASE RULE

Definition and explanation of terms, Thermodynamic derivation of Phase rule, One component system- Water system and Sulphur system, Two component systems –Eutectic point-Lead-silver system-Applications of phase rule

COLLOIDS:

Definition of colloids, Classification of colloids, Solids in liquids (Sols)- Kinetic, optical and electrical properties, Stability of colloids, Protective action, Hardy-Schultz Law, Gold Number, Liquids in liquids (emulsions)- Types of emulsions, Preparation, Emulsifier, Liquid in Solids (gel), Classification, Preparation and properties- General applications of colloids

TEXT BOOKS:

1. Puri, Sharma and Pathania , *"Physical Chemistry"*, 42nd Edition (2008) Vishal publishing company.
2. Arun Bahl, BS Bahl & Tuli , *"Essentials of Physical Chemistry"*, 16th Edition,S.Chand publications.

REFERENCES:

1. Glasston & Lewis, *"Physical Chemistry"*, 2nd Edition, McMillan publishers, 1973.
2. Guru deep Raj, *"Advanced Physical Chemistry"*, 33rd Edition, Goel Publishing House, 2007.
3. Atkins, *"Physical Chemistry"*, 9th Edition W. H. Freeman Publishers, 2010.