PHYSICAL CHEMISTRY

Semester pattern (For Chemical Engineering)

(With effect from admitted batch 2015-16)

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Course objectives

- To understand about the concept of chemical equilibrium and its importance industrial process
- To get an idea about the thermodynamic functions, laws and its applications
- To know about mobility of ions in dilute solutions and its significance in instrumental methods (conductivity meter)
- To inculcate the concept of order and molecularity of various reactions
- To give an idea about phase diagrams of various heterogeneous equilibria

Course Outcomes

By the end of the semester, the student will be able to:	
CO-1	Apply the principles of laws of thermodynamics in various Industrial Processes and Designing.
CO-2	Develop suitable conditions in reaction equilibria of various Chemical Processes.
CO-3	Identify the changes in heterogeneous systems and understand the role of various physical quantities useful in Chemical Engineering Industry.
CO-4	Adopt suitable catalytic mechanisms to determine kinetic parameters applicable in Chemical Reaction & Bioprocess Engineering
CO-5	Predict the nature of substances and their behaviour by applying advanced electrochemical laws.
CO-6	Implement the various principles for solving the challenges in the field of Chemical Engineering.

SYLLABUS

12 periods

UNIT-1

Thermodynamics and Thermo chemistry: First law-Internal Energy, Work and Heat changes, Enthalpy, reversible isothermal expansion of ideal gas, maximum work. Heat capacities at constant pressure and volume, adiabatic expansion of an ideal gas. Heat of Reaction- heat of Formation, Heat of Combustion, Thermo-chemical Laws, effect of temperature on Heat of Reaction. Second law of Thermodynamics, spontaneous processes, Entropy and physical significance of entropy, Entropy change for an ideal gas. Entropy change accompanying phase change, Gibb's Free Energy and applications.

UNIT-II 8 periods

Chemical Equilibrium: Reversible reactions, Law of Mass action, Homogeneous equilibria in gaseous and liquid systems and simple example of Heterogeneous equilibria, Le-Chatlier principle- applications, Effect of temperature on equilibrium-VantHoff's equation.

UNIT-III 10 periods

Liquid state-vapour pressure, effect of temperature, determination of vapour pressure (static and dynamic method) – surface tension, determination by capillary rise method- viscosity, determination (Ostwald's method)

Phase rule: Definition-explanation of terms-Derivation of phases Rule-One component systems (water system)-Two component systems (Ag-Pb & KI-H_2O), Eutectic mixture-its significance.

UNIT-IV 10periods

Chemical Kinetics and Catalysis: Rate of Reaction- Order & Molecularity, determination of order, first order reaction –illustrations, derivation of rate equation Second order reaction – illustrations, derivation of rate equation, pseudo first order and second order reactions-illustrations, Half life period, numerical problems, Catalysis- Types-Homogeneous-Heterogeneous-Enzyme Catalysis-Mechanisms.

UNIT-V 10 periods

Electrochemistry: Electrolytes-Types-Conductance-Specific, Equivalent, Molar conductance – Conductmetric Titrations **,** measurement of electrical conductivity and numerical problems ,variation of conductance with temperature, Migration of ions , relative speed of ions, Hittrof's rule-transport number, Determination-Hittrof method, Kohlarsauch's law and applications.

Prescribed text books-

1. Essentials of Physical chemistry, Arun Bhal, B.S.Bhal and G.D.Thuli, S.Chand and company ltd.

Reference books-

1. Physical Chemistry,7th edition, Peter Atkins & Julio de Paula, oxford university press7th edition.
2. Principles of physical chemistry, 44th edition b B.R.Puri and L.R.Sharma, vishal publishing company, New Delhi.