CHM232(T): Physical Chemistry

Credit – 4, Hours – 60, Marks - 100

Course Outcomes:

After the completion of this course, student will be able to-

CO-1. Gain the conceptual knowledge of thermodynamics, chemical kinetics, colloidal, adsorption, catalysis and electro chemistry.

CO-2. Understand the basic principles of thermochemistry, rate equations, classification of colloidal, types of catalysis and adsorption and conductance measurement.

CO-3. Solve the problems regarding heat, work, internal energy, enthalpy, rate of reaction, velocity constant, adsorption and catalysis.

CO-4. Analyse and correlate the facts regarding thermodynamics, chemical kinetics, colloidal, adsorption, catalysis and electro chemistry.

CO-5. Evaluate and criticize the principles of zeroth and first law of thermodynamics, order of reactions, adsorption and catalysis.

CO-6. Synthesise, create, modify and judge the facts of important branch of physical chemistry like thermodynamics, chemical kinetics.

CO-PSO mapping (connecting COs with PSOs)

CO	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6
CO-1	3	3	2	2	2	3
CO-2	3	3	2	2	2	3
CO-3	2	2	3	2	3	2
CO-4	3	2	3	3	2	3
CO-5	3	2	3	2	3	3
CO-6	3	3	2	2	3	3

Unit – I: Thermodynamics **[25 Marks]**
[15 Hours]

Thermodynamics terms, Intensive and extensive properties, state and path functions, isolated, closed and open systems, Zeroth law of thermodynamics.

First law: Concept of heat *q*, work *w*, internal energy U, and statement of first law, enthalpy H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.
Heats of reactions: standard states, enthalpy of formation of molecules and ions and enthalpy of combustion and its applications, calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions, Adiabatic flame temperature, explosion temperature.

Unit – II: Chemical Kinetics **[25 Marks]**
[15 Hours]

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions (Zeroth, first and second order ($a = b$, $a \neq b$)), experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions. Temperature dependence of reaction rates; Arrhenius equation; activation energy.

Unit – III: Colloidal state **[25 Marks]**
[15 Hours]

Difference between true solution, Colloidal solution and suspension, Phase of colloidal solution, Classification of colloids, Difference between lyophilic and lyophobic colloids, miscelles, preparation of colloids, dialysis, properties of colloidal solution, Tyndall effect, sedimentation, electrophoresis, origin of charge, double layer theory, protective colloids, gold number, emulsions, gels, determination of molecular mass of colloids of colloidal particles, application of colloids.

Unit – IV: (A) Adsorption and catalysis **[13 Marks]**
[8 Hours]

Adsorption and its terms, Factor affecting the adsorption of gases by solids, Factor affecting the adsorption of solids from solution, Types of adsorption, Adsorption isotherms, Freundlich adsorption isotherm, application of adsorption.
Catalysis: Catalyst, types of catalysis, positive and negative catalysis, homogeneous and heterogeneous catalysis, properties of catalytic surface active centers.

(B) Electro chemistry: **[12 Marks]**
[7 Hours]

Transference numbers, Determination of transport number, moving boundary method, result of transport number measurements, Determination of solubility by conductance measurement, Conductometric titrations, activity, activity co-efficient and ionic strength.

REFERENCE BOOKS

1. '**Elements of Physical Chemistry**' by Peter Atkins & Julio De Paula, 5/E, Indian Edition, OxfordUniversity Press.
2. '**Physical Chemistry**' by P. W. Atkins, 7/E, 2002, Indian Edition Oxford University Press.
3. '**Physical Chemistry**' by W. J. Moore, 6/E, 1996, MacGraw Hill Publication.
4. '**Principle of Physical Chemistry'** by Puri, Sharma & Pathania, 41/E, Vishal Publishers.
5. '**Essentials of Physical Chemistry'** by Bahl & Tuli, 22/E, S. Chand publication, New Delhi.
6. '**Advanced Physical Chemistry**' by Gurdeep Raj, 19/E, Goel Publishing House Meerut