

ST.JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

VII SEMESTER

B.Sc. HONOURS CHEMISTRY

Time: 4Hrs/Week

Code CH 7203(3)

Revised Syllabus Under CBCS 2020-21 Marks: 100

Physical Chemistry – I

Thermodynamics, Electrochemistry and Chemical Kinetics

I.

Course Objective: To familiarize students with advanced concepts pertaining to Thermodynamics, Electrochemistry & Chemical Kinetics

Course Outcomes:

- Students can able to understand the classical thermo dynamics, fugacity.
- Students are able to understand the Electrochemical cells, Liquid junction potential.
- Students understand the Butler - Volmer equation and Ilkovic equation
- Understand the complex reactions, chain reactions.
- Students understand the Branching Chain Reactions, Enzyme catalysis and Photochemical equilibrium.

II. Syllabus:

Unit-I: Thermodynamics:

12 Hours

Classical thermodynamics - Brief review of first and second laws of thermodynamics- Entropy change in reversible and irreversible processes - Entropy of mixing of ideal gases - Entropy and disorder – Free energy functions - Gibbs-Helmholtz equation – Maxwell partial relations. Conditions of equilibrium and spontaneity - Free energy changes in chemical reactions, Van't Hoff reaction isotherm - Van't Hoff equation – Classiuss - Clapeyron equation -partial molar quantities - Chemical potential - Gibbs- Duhem equation - partial molar volume -determination of partial molar quantities - Fugacity - Determination of fugacity – Thermo dynamic derivation of Raoult's law.

Unit-II: Electrochemistry-1:

12 Hours

Electrochemical cells - Measurement of EMF - Nernst equation –Equilibrium constant from EMF Data - pH and EMF data -Determination of solubility product from EMF measurements. Concentration cells with and without transference – Liquid junction potential and its determination -Activity and activity coefficients - Debye Huckel limiting law and its verification. Effect of dilution on equivalent conductance of electrolytes - Anomalous

behavior of strong electrolytes. Debye Huckel-Onsagar equation-verification and limitations-Bjerrum treatment of electrolytes.

Unit-III: Electro Chemistry-II:

12 Hours

Reference electrode-Standard hydrogen electrode. Calomel electrode-Indicator electrodes: Metal-metal ion electrodes-Inert electrodes-Membrane electrodes - theory of glass membrane potential, potentiometric titrations, Conductometric titrations. Electrode potentials - Double layer at the interface - rate of charge transfer - Decomposition potential - Overpotential - Tafel plots - Derivation of Butler- Volmer equation for one electron transfer – electro chemical potential.

Unit-IV: Chemical kinetics and Photochemistry:

12 Hours

Branching Chain Reactions-Hydrogen-oxygen reaction - lower and upper explosion limits - Fast reactions - Study of kinetics by flow methods -Relaxation methods - Flash photolysis. Acid base catalysis –protolytic and prototropic mechanism. Enzyme catalysis-Michelis-Menten kinetics.

Photo chemistry: Quantum yield and its determination, Actinometry, Reactions with low and high quantum yields, Photo sensitization, Exciplexes and Excimers, Kinetics of collisional quenching- Stern-Volmer equation.

Unit-V: Chemical kinetics - II:

12 Hours

Methods of deriving rate laws - complex reactions - Rate expressions for opposing, parallel and consecutive reactions involving unimolecular steps. Theories of reaction rates-collision theory-Steric factor-Activated complex theory - Thermodynamic aspects–Uni molecular reactions-Lindemann's theory-Lindemann- Hinshelwood theory. Primary and secondary salt effects. Elementary account of linear free energy relationships-Hammett equation - Chain reactions - Rate laws of H_2 - Br_2 , photochemical reaction of H_2 - Cl_2 . Decomposition of acetaldehyde and ethane-Rice-Hertzfeld mechanism.

III. Suggested Co-Curricular Activities:

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics), collection of relevant videos and material.
3. Visits of industries, firms, research organizations etc.

4. Invited lectures and presentations on related topics by field/industrial experts

IV. Textbooks:

1. Physical Chemistry P.W. Atkins, ELBS.
2. Chemical Kinetics-K.J. Laidler, Mc Graw Hill Pub.
3. Text Book of Physical Chemistry. Samuel Glass tone, Mc millan Pub.
4. Physical Chemistry, G.W. Castellan. Narosa Publishing House

V. Reference books:

1. Thermo dynamic for Chemists. Samuel Glass tone.
2. Electro chemistry, Samuel Glass tone, Affiliated East West
3. Physical Chemistry, W.J.Moore, Prentice Hall
4. Atomic structure and chemical bond. Manaschanda. Tata Mc Graw Hill Company Limited.