St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

According to the Department of Higher Education, Govt. of M.P.
Under Graduate Yearly Syllabus as recommended by
Central Board of Studies and Approved by the Governor of M.P.

Chemistry Syllabus Session 2021-22

Class B.Sc. (II) Year Paper – I (Physical) ***Maximum Marks: 27***
Minimum Marks: 09

Course outcome-

- To enrich the students with the understanding of fundamentals and concepts of physical chemistry viz. thermodynamic parameters with laws of thermodynamics, thermochemistry, phase equilibrium, Solutions, Electrochemistry, adsorption, adsorption Isotherm and its applications.

UNIT - I

Thermodynamics: Basics Concepts of thermodynamics. First Law, Second law of thermodynamics: Need for law, Different statements of the law, Carnot cycle and its efficiency. Carnot theorem. Thermodynamics Scale of temperature. Concepts of entropy: entropy as a state Function entropy as a function of P & T, entropy change in physical change, Clausius inequality, entropy as criteria of spontaneity and equilibrium.Entropy change in ideal gases and mixing of gases. Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs andHelmholtz functions, Gibbs function (G) and Helmholtz function (H) as a thermodynamic quantities, A and G a as a criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change.

B. Thermochemistry: Standard state, standard enthalpy of formation: Hess's Law of heat summation and its application.Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization.

UNIT - II

Phase equilibrium : Statement and the meaning of terms: phase, component and the degree of freedom, thermodynamic derivation of the Gibbs phase rule, one component system: water, CO2 and S system, two component system: solid-liquid equilibria, simple eutectic system: Bi-Cd; Pb-Ag system, Desilverisation of lead.

Solid solution : Systems in which compound formation with congruent melting point (Zn-Mg) and incongruent melting point,(NaCl-H2O) and (CuSO4-H2O) system, Freezing Mixtures: acetone-dry ice.

Liquid–Liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system, azeotrops; HCl-H2O and ethanol water system.

Partial miscible liquids: Phenol-water, trimethylamine – water and nicotine-water system.Lower and upper consolutetemperature. Immiscible Liquids, steam distillation, Nernst distribution law: thermodynamic derivation, applications.

UNIT - III

Electrochemistry

A. Electrical transport, conduction in metals and in electrolyte solutions, specific and equivalent conductance, Measurement of equivalent conductance effect of dilution on conductivity Migration of ions and Kohlrausch-law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel Onsager's equation for strong electrolytes (elementary treatment only). Transport number: Definition and determination by Hittorf method and moving boundary method.Electrode reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode, standard electrode potential, Electrochemical Series and its significance.

UNIT - IV

Electrochemistry

Types of reversible electrodes Gas Metal ions, metal-meal ion, metal-insoluble salt anion and redox electrodes.Electrolyteand galvanic cells, reversible and irreversible cell conventional representation of electrochemical cell.Concentration cell with and without transport, liquid junction potential application of concentration cell valancy of ions, solubility product and activity coefficient. Potentiometric titration.Definition of pH and pK, determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods.

Buffers: Mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts,

Process of electrode, rate of charge transfer , current density, Polarography, Amperometry, Ion selective electrodes and their uses

UNIT - V

Surface Chemistry : Adsorption, adsorption and absorption, types of adsorbtion adsorption of gases and liquids on solid adsorbent, Freundlich and Langmuir adsorption isotherms, Surface area and determination of surface area,

A. Catalysis characteristics of catalyzed reaction, Classification of catalysis application of catalysts, miscellaneous examples.

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Class B.Sc. (II) Year Paper – II (Inorganic Chemistry) ***Maximum Marks: 27***
Minimum Marks: 09

Course outcome-

- To develop fundamentals of the inorganic chemistry through schematic study of transition, inner transition elements, coordination compounds and its preparation, properties and applications.
- To develop an understanding of the concept of acids and bases and their applications.

UNIT - I

Chemistry of Element of First Transition Series:

A. Chemistry of elements of I transition series : Characteristics properties of d-block elements. Properties of the elements of the first transition series, their binary compounds such as carbides, oxides and sulphides.Complexes illustrating relative stability of their oxidation states, coordination number and geometry.

UNIT - II

Chemistry of elements of II and III transition series:

General characteristics comparative treatment with 3d-analogues respect to ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry.

UNIT - III

A. Coordination Compounds

Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature, of effective atomic number concept, Chelates, nomenclature of coordination compounds, Isomerism in coordination compounds, Valance Bond Theory of transition metal complexes.

Oxidation and Reduction

Use of redox patented data analysis of redox cycle, redox stability in water: Frost, Latimer and Pourbaux diagrams. Principle involved in the extraction of elements.

UNIT – IV

General chemistry of f-block elements:

Chemistry of Lanthanides: Electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.

Chemistry of Actinides: General features and chemistry of actinides, chemistry of separation of Np, Puand Am from U, Similarities between the later actinides and later lanthanides.

UNIT - V

Acids and Bases:

Arrhenius, Bronsted Lowry, Lux-Flood,Solvent System, and Lewis concept of acid and bases.

Non Aqueous Solvents:Physical property of solvent, types of solvent and their general characteristics,reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2.

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Class B.Sc. (II) Year Paper – III (Organic Chemistry) ***Maximum Marks: 26***

Minimum Marks: 08

Course outcome-

- To develop an understanding of interaction of EMR with matter, its spectroscopic principles and applications.
- To understand the classification, nomenclature, methods of preparation, characteristic properties and applications of alcohols, phenols, aldehydes and ketones, Carboxylic acids, ethers and organic compounds of Nitrogen.

UNIT - I

Electro Magnetic Spectrum: Absorption Spectra, ultraviolet (UV) absorption spectroscopy, absorption laws (Beer-Lambert's law). Molar absorptivity, Presentation and analysis of UV spectra, types of Electronic transition, Effect of conjugation. Concept of Chromophore and auxochrome, bathochromic, Hypsochromic, Hyperchromic and Hypochromic shifts, UV spectra of conjugated enes and enones. Infrared (IR) absorption spectroscopy- Molecular Vibrations, Hook's law, Selection rules, Intensity and position of IR bands, Measurements of IR spectra, Fingerprint region, characteristics of absorption of various functional group and interpretation of IR spectra of sample organic compound.

UNIT - II

A. Alcohols : Classification and nomenclature.Monohydric alcohols- nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acid, and esters, Hydrogen bonding, nature and reactions of alcohols.

Dihydric Alcohols: Nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$, and HIO_4] and pinacol-pinacolonerearrangement.Trihydric alcohols - nomenclature and methods of formation, chemical reaction of glycerol.

B. Phenols: Nomenclature, structure and bonding.Preparation of phenols, physical property and acidic character.Comparative acidic strength of alcohols and phenols, stabilization of phenoxide ion. Reaction of Phenols-Electrophilic aromatic Substitution, acylation and carboxylation Mechanisms of Fries rearrangements, Claisen rearrangement Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Riemer- Tiemann reaction.

UNIT - III

Aldehydes and Ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes and ketones from acid chlorides, synthesis of aldehydes and ketones using. 1,3 dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on Benzoin, Aldol, Perkin and Knovenagel condensations. Condensation with ammonia and its derivatives.Wittig reaction, Mannich reaction, use of acetals as protecting group.Oxidation of aldehydes, Baeyer-villiger oxidation of ketones, Cannizaro reaction. MeerweinPondroff-Verley, Clemmesen, Wolf Kishner, $LiAlH_4$ and $NaBH_4$reduction.Halogenation of enolizable ketones, An introduction to alfa, beta, unsaturated aldehydes and ketones.

UNIT - IV

Carboxylic acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, Effect of substituent on acid strength. Preparation of carboxylic acid, reaction of carboxylic acids.HellVolhardZelinskyreaction.Synthesis of acid chloridesester and amides reduction of carboxylic acids, mechanism of decarboxylation.Method of formation and chemical reaction of unsaturated monocarboxylic acid method of formation and effect of heat and dehydrating agents.

Ether: Nomenclature of ether and formation of ether Physical Property and chemical reaction, cleavage and auto oxidation, Ziesels method.

UNIT - V

Organic Compounds of Nitrogen: Preparation, properties and chemical reactions of nitroalkanes and nitroarenes. Mechanism of nucleophilic substitution in nitroarenes and their reduction in acidic neutral and alkaline media. Halonitroarenes; structure and nomenclature, and their activity.Amines structure, and nomenclature, physical properties and stereochemistry, separation of mixture of primary, secondary and tertiary amines.Structural features affecting basicity of amines. Amine salts as phase transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles),reductive amination of aldehydic and ketonic compounds, Gabriel phthalamide reaction, Hoffmann bromamide reaction, Reaction of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid synthetic transformation of aryl diazonium salts, azo coupling