MAHARSHI DAYANAND SARASWATI UNIVERSITY

AJMER

पाठ्यक्रम

SYLLABUS

SCHEME OF EXAMINATION AND

COURSES OF STUDY

FACULTY OF SCIENCE

B.Sc. Part-II Examination

बी.एस–सी. पार्ट–**II**

(w.e.f. 2019-20)

(10+2+3 Pattern)

संस्करण

मूल्य = 18 /–

महर्षि दयानन्द सरस्वती विश्वविद्यालय, अजमेर

B.Sc. Part-II CHEMISTRY

Paper	Duration	Max. Marks	Min.Pass Marks
Paper I	3 hrs.	50	18
Paper II	3 hrs.	50	18
Paper III	3 hrs.	50	18
Practical	6 hrs.	75	27
Total Marks		**225**	**81**

Note: Each theory paper is divided into three independent units. The question paper is divided into three parts Part-A, Part-B and Part-C. Part-A (15 marks) is compulsory and contains 10 questions (50 words) at least three questions from each unit] each question is of 1.5 mark. Part-B (15 marks) is compulsory and contains five questions at least one from each unit. Candidate is required to attempt all five questions.Each question is of 3 marks (50 words). Part-C (20 marks) contains six questions two from each unit. Candidate is required to attempt three questions one from each unit. Each question 7+7+6=20 marks (400 words).

PAPER-I

INORGANIC CHEMISTRY

Duration 3 hrs. Max. Marks: 50

Unit-I

A. Chemistry of Elements of First Transition Series

Characteristic properties of d-block elements.

Properties of the elements of the first transition series, their binary compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry

B. Chemistry of Elements of Second and Third Transition series

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

C. Chromatography

Definition, classification, R_f Value, law of differential migration, eluent, elution, paper and thin layer chromatography. chromatographic applications.

Unit-II

A. Coordination Compounds

Werner's coordination theory and is experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complexes.

B. Chemistry of Lanthanide Elements

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

C. Chemistry of Actinides

General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

Unit-III

A. Oxidation and Reduction

Use of redox potential data-analysis of redox cycle, redox stability in water, Frost, Latimer and Pourbaux diagrams. Principles involved in the extraction of the elements.

B. Acids and Bases

Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concepts of acids and bases.

C. Non-aqueous Solvents

Physical properties of a solvent, types of solvents and their general characteristics, reactions in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

PAPER-II

ORGANIC CHEMISTRY

Time: 3 hrs. **Max. Marks: 50**

Unit-I

A. Electromagnetic Spectrum: Absorption Spectra

Ultraviolet (UV) absorption spectroscopy- absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, 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. Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.

B. Ethers and Epoxides

Nomenclature of ethers and methods of their formation, physical properties.Chemical reactions-cleavage and autoxidation, Ziesel's method.

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

C. Alcohols

Classification and nomenclature.

Monohydric alcohols-nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters.Hydrogen bonding.Acidic nature.Reaction of alcohols.

Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol-pinacolone rearrangement.

Trihydric alcohols-nomenclature methods of formation, chemical reactions of glycerol.

Unit-II

A. Phenols

Nomenclature, structure and bonding, preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols-electrophilic aromatic substitution, acylation and carboxylation.Mechanism of Fries rearrangement, claisen rearrangement.Gatterman synthesis.Hauben-Hooesch reaction, Lederer-Manasse reaction and Reimer-Tiemann reaction.

B. Aldehydes and Ketones

Nomenclature and structure of carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using I, 3-dithianes, synthesis of ketones from nitriles and from carboxylic acid. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol.Perkin and knoevenagel condensations. Condensation with ammoniaand its derivatives. Witting reaction.Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-villiger oxidation of ketones. Cannizzaro reaction.MPV.Clemmensen.Wolff-Kishner, $LiAlH_4$, and $NaBH_4$, reductions.Halogenation of enolizable ketones.

An introduction to α, β-unsaturated aldehydes and ketones.

C. Carboxylic Acids

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength, Preparation of carboxylic acids.Reactions of carboxylic acids.Hell-Volhard-Zelinsky reaction.Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids.Mechanism of decarboxylation.

Structure and nomenclature of acid chlorides, esters, amides and acid anhydrides.

Methods of formation and chemical reactions of halo acids.Hydroxy acids: malic, tartaric, and citric acids.

Methods of formation and chemical reactions of unsaturated monocarboxylic acids.

Dicarboxylic acids: methods of formation and effect of heat and dehydrating agents.

Unit-III

A. Carboxylic Acid Derivatives

Relative stability of acyl derivatives.Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution.

Chemical reactions.Mechanisms of esterification and hydrolysis (acidic and basic).

B. Organic Compounds of Nitrogen

Preparation of nitroalkanes and nitroarenes.Chemical reactions of nitroalkanes.

Mechanisms ofnucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media.Picric acid.Halonitroarenes; reactivity.Structure and nomenclature of amines, physical properties.Stereochemistry of amines.Separation of a mixture of primary, secondary and tertiary amines.Structural features affecting basicity of amines. Amines salts as phase-transfer catalysis.

C. Amines

Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive aminationof aldehydic and ketonic compounds. Gabriel-

phthalimide reaction, Hofmann 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.

PAPER-III

PHYSICAL CHEMISTRY

Time: 3 hrs. **Max. Marks: 50**

Unit-I

A. Thermodynamics-I

Definition of thermodynamic terms: system. surroundings etc. Types of systems, intensive and extensive properties.State and path functions and their differentials.Thermodynamic process.Concept of heat and work.

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.Joule's law-Joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU&dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry: standard state, standard enthalpy of formation-Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume.Enthalpy of neutralization.Bond dissociation energy and its calculation from thermo-chemical data, temperature dependence of enthalpy.Kirchhoff's equation.

B. Thermodynamics-II

Second law of thermodynamics: need for law, different statements of the law. Carnot cycle and its efficiency.Carnot theorem.Thermodynamic scale of temperature.

Concept of entropy: entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change in physical change-clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy. Evaluation of absolute entropy from heat capacity data. Gibbs and Helmholtz functions: Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities. A &G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

Unit-II

A. Chemical Equilibrium

Equilibrium constant and free energy.Thermodynamic derivation of law of mass action.Le Chatelier's principle.

Reaction isotherm and reaction isochore-clapeyron equation and Clausius- Clapeyron equation, applications.

B. Phase Equilibrium

Statement and meaning of the terms- phase, component and degree of freedom, thermodynamic derivation of Gibbs phase rule, phase equilibria of one component system- water, CO_2 and S systems.

Phase equilibriaof two component system- solid-liquid equilibria, simple eutectic-Bi-Cd, Pb-Ag systems, desilverisation of lead.

Liquid- liquid mixtures-ideal liquid mixtures.Raoult's and Henry's law, Non-ideal system-azeotropes-HCI-H_2O and ethanol-water systems.

Partially miscible liquids- Phenol-water, trimethylamine, nicotine-water systems.

Lower and upper consolute temperature.Effect of impurity on consolute temperature.

Nernst distribution law-thermodynamic derivation, applications.

Unit-III

A. Electrochemistry-I

pH

Determination of pH using hydrogen quinhydrone and glass electrodes, by potentiometric methods.

Types of reversible electrodes-gas-metal ion, metal-insoluble salt anion and redox electrodes.Electrode reaction, Nernst equation, derivation of cell E.M.F. and single electrode potential.standard hydrogen electrode-reference electrodes-

standard electrode potential, sign conventions, electrochemical series and its significance.

Conduction in electrolytic solutions, specific conductance and equivalent conductance.Measurement of equivalent conductance, variation of equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Ostwald's dilution law, its uses and limitations.

Debye-Huckel-Onsagar'sequation for strong electrolytes (elementary treatment only).

Transport number, definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, definition & determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

B. Electrochemistry-II

Electrolytic and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements.Computation of cell EMF.Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH, and K), polarization, over potential and hydrogen over voltage.

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

PAPER-IV

PRACTICALS

Time: 6hrs. **Msx. Marks: 75**

1. Inorganic Chemistry

(A) Preparation of standard solutions and dilution of solutions.

(B) Quantitative Analysis

Volumetric Analysis (Any Four)

(i) Determination of acetic acid in commercial vinegar using acid base titrimetry.

(ii) Determination of alkali content-antacid tablet using acid base titration

(iii) Estimation of calcium content in chalk as calcium oxalate by redox titration

(iv) Estimation of hardness of water by complexometric method.

(v) Estimation of ferrous and ferric ions by redox titrimetry.

(vi) Estimation of copper by iodometry.

(C) Gravimetric Analysis

(i) Analysis of Cu as CuSCN

(ii) Ni as Ni-dimethylglyoxime

(iii) Ba as $BaSO_4$

(iv) Pb as $PbCrO_4$

2. Organic Chemistry

(A) Chromatography

(i) Separation values of mixture of two organic Compounds by Paper Chromatography.

(ii) Separation of a mixture of two dyes by TLC.

(iii) Separation of mixture of two aminoacids by paper chromatography.

(iv) Separation of mixture of aminoacids by TLC.

(v) Separation of monosachharides and D-fructose by paper chromatography.

(B) Qualitative Analysis

Identification of one organic compound and preparation of suitable derivative

3. Physical Chemistry (Any Four)

(i) Determination of the transition temperature of the given substance by thermometric/dialometric method (e.g. $MnCI_2$, $4H_2O$, $SrBr_2$, $2H_2O$ etc.)

(ii) To study the effect of a solute (e.g. NaCl, Succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol-water system) and to determine the concentration of that solute in the given phenol-water system.

(iv) To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.

(v) To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.

Scheme of Examination (B.Sc. Part-II) **Max. Marks: 75**

1. Inorganic

A-	Preparation of standard solution	05
B-	Volumetric Analysis-One Exercise	10
C-	Gravimetric Analysis-One Exercise	10

2.	**Organic**	
A-	Chromatography-One Exercise	10
B-	Qualitative Analysis-One Organic Compound	10
3.	**Physical**	
	One experiment isto be performed	20
4.	**Viva**	05
5.	**Record**	05